APEC Human Capital Policies for Green Growth and Employment Project Report

APEC Human Resources Development Working Group

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Executive Summary

The APEC Human Resources Development Working Group (HRDWG) implemented the Human Capital Policies for Green Growth and Employment Project, the subject of this report. The objectives of the APEC Human Capital Policies for Green Growth and Employment Project were to: 1) enhance understanding of human resource development policies within APEC economies related to sustainable, "green," energy efficient growth and employment, 2) share promising practices and experiences among APEC economies in "green" human resource development policies and programs, and 3) develop recommendations for APEC economies, with special emphasis on developing economies, to build capacity in training and education for a green and energy efficient economy. To accomplish these objectives, an APEC-wide survey on green growth and employment was conducted in early spring of 2012 and an APEC Symposium was convened on March 20-21, 2012 in Washington DC, USA.

The project conducted the **Human Capital Policies and Practices for Green Growth and Employment survey**, with 9 APEC economies responding to the survey. The survey findings revealed that almost all APEC economies have green TVET strategies and initiatives that support and promote the transition to a sustainable, clean energy future and through these strategies, provided opportunities for vulnerable populations. To ensure that green education and training programs are relevant to the labor market and provide opportunity for family-sustaining wages, almost all member economies reported that TVET systems work directly with industry to define the appropriate credentials and qualifications needed to adapt to technological changes in the emerging green economy. Further, many APEC economies developed students' interest, skills, and knowledge on sustainability literacy and practices, integrated through STEM education and standards, at the primary and secondary school levels. The survey also highlighted that most APEC economies have teacher professional development programs in place to ensure teachers at all levels have the requisite skills and knowledge to prepare students for the emerging green economy.

The APEC Symposium on Human Capital Policies for Green Growth and Employment offered informative presentations and discussions on strategies to help establish sustainable approaches to economic development in APEC economies. Symposium participants examined the policies, programs, and promising practices for the preparation of skilled workers in the emerging green economy, and considered implications for developing APEC economies. The APEC Symposium centered on four topic areas: (1) Science, Technology, Engineering, and Math (STEM) for Sustainable Development, (2) The Technical and Vocational Education and Training (TVET) System's Role in Green Growth and Employment, (3) Role of Intermediaries and Strategic Partnerships in Green

Growth and Employment, and (4) Employer Engagement, Economic Development, and Job Creation. Common themes emerged from the two days, including the need to build the capacity of technical vocational education and training systems for the green economy by providing access labor market information and resources, and developing credentials and career pathways to ensure inclusive growth and pathways out of poverty. Common elements to implementing effective and innovative green strategies and programs were discussed, including partnering with enterprises, targeting skills development with the existing workforce, and providing foundation skills for students through education for sustainability at the primary and secondary school levels.

Introduction

Due to urgent concerns about the environment, climate change and unemployment in the Asia-Pacific region, the transition to a sustainable "green" and clean energy economy has never been more vital. APEC has been tackling these economic and environmental challenges through its sustainable growth agenda established in its 2010 Leaders' Growth Strategy. APEC's priority and commitment to help regional economies make a successful transition to a clean energy future and green economy is demonstrated through several projects implemented by various working groups. Examples of these projects and initiatives are creating environmentally sustainable economic growth and development, promoting the development and adoption of green technologies, and highlighting effective human capital development policies and practices that produce a highly productive and skilled green workforce, focused on vulnerable populations.

APEC's commitment to green growth is important since the 21 economies that make up APEC account for 40 percent of the world's population, more than half (54%) of the world's gross domestic product, and a large share of the world's energy consumption (60%) (Tradeology, official blog of U.S. International Trade Administration, September 19, 2011). Based on projections of future growth, particularly the movement of millions of rural dwellers going into urban areas, it is expected that APEC economies will continue to increase their energy consumption and most likely, be disproportionately affected by the adverse effects of climate change (Tradeology, official blog of U.S. International Trade Administration, September 19, 2011). Despite these challenges, pursuing a green growth strategy allows these economies, with their diversity of natural resources and human capital, along side diverse levels of development, the ability to simultaneously move towards economic prosperity and ecological sustainability. Accordingly, more APEC economies, particularly developed economies, are laying out the policy framework and making resource commitments to provide the enabling conditions and pathways towards a vibrant green economy. As these APEC economies move forward, skills will be pivotal to help enable the transition to a green economy.

The transition to a green economy also holds the promise of new employment opportunities in both existing industries and occupations as well as in newer ones, especially in response to drivers of change effectively take hold, such as supportive government policies and incentives, the adoption of improved technologies, support for innovation, and market demand for greener products and services. A highly skilled and qualified workforce is a critical need common to all economies that are seeking sustainable economic growth. Meeting this requires APEC economies to prepare workers with the skills and competencies needed for the greening of industries to ensure that employers, including small and medium

enterprises, do not face a shortage of adequately trained workers as new industrial technologies are adopted.

The technical and vocational education and training (TVET) sector is seen as core to addressing these skill and competency requirements of industry in the emerging green economy, particularly those with a strong orientation to regional and global labor markets. Further, because of the TVET sector's accessibility and affordability across the APEC region, it can support human resource development that is inclusive, reduce disparities to opportunities across the region, and promote green pathways out of poverty for vulnerable populations. Some TVET systems and individual institutions are already taking action as highlighted in the survey results. Their actions include: modifying existing certificate and degree programs and courses to integrate green skills for a variety of sectors, creating new and expanded career-qualification pathways to upskill workers, working with employers to redefine skills and competencies, helping to implement regional sustainable development plans, and supporting teacher professional development at all levels of education. In addition, many developing economies are increasingly realizing the potential role that TVET can play in green skills development and are creating economy wide TVET strategies to enhance international competitiveness, improve socio-economic conditions, and achieve greater workforce participation for women and other vulnerable populations.

The road to a successful green growth strategy requires a paradigm shift. Because there is no blueprint for APEC economies to follow, it becomes more important to gain a full understanding of green policies, practices, partnerships, and systems. The APEC Human Resources Development Working Group (HRDWG) Human Capital Policies for Green Growth and Employment Project is aimed squarely at furthering and enhancing current knowledge, specifically focused on the TVET system's role in green growth and employment in each economy, and employer engagement and other strategic partnerships that will help promote and enhance green economic development and job creation for all. To contribute to the collective knowledge and wisdom, the project promoted interactions between economies across the region to facilitate promising ideas, policies, and labor market realities to help the transition to a new era of green growth.

About the Human Capital Policies for Green Growth and Employment Project

The three key objectives of the Human Capital Policies for Green Growth and Employment project were to: 1) enhance understanding human resource development policies within APEC economies related to sustainable, "green," energy efficient growth and employment, 2) share promising practices and experiences among APEC economies in "green" human resource development policies and programs, and 3) develop recommendations for APEC economies, with special emphasis on developing economies, to build capacity in training and education for a green and energy efficient economy. To accomplish these

objectives, an APEC-wide survey on green growth was conducted and an APEC Symposium was convened on March 20-21, 2012 in Washington DC (USA).

Project Report

The purpose of this report is to summarize the HRDWG's Human Capital Policies for Green Growth and Employment Project. This report is divided into three sections: (1) findings from an APEC survey conducted focused on Human Capital Policies and Practices for Green Growth and Employment, (2) a summary and overview of the APEC symposium that took place in Washington, DC on March 20-21, 2012, highlighting implications for developing APEC economies, and (3) appendices.

Chapter 1: APEC SURVEY: Human Capital Policies and Practices for Green Growth and Employment

As part of the Human Capital Policies and Practices for Green Growth and Employment project, APEC member economies were surveyed in 2012. The purpose of the survey was twofold. First, the survey helps to understand each APEC economy's policies, programs, promising practices, and partnerships they have undertaken that support TVET systems in the preparation and education of skilled workers in emerging green sectors. Second, the survey provides an opportunity to learn about policies and practices that appear effective, or are innovative, in building strong coordinated systems for the development of needed human capital. The survey results helped inform the topics for the APEC Symposium conducted in March 2012.

The following APEC economies responded to the survey:

- **Australia**
- **Canada**
- **Chile**
- **Japan**
- **Mexico**
- **The Russian Federation**
- **Chinese Taipei**
- **Thailand**
- **United States**

This report provides an overall summary of survey findings, indicates trends and patterns, and records the synopsis of APEC economies' responses by each survey question. Appendix I of this report contains a copy of the survey questions submitted to APEC economies and Appendix II shows survey responses by each economy.

1.1 - Summary of Survey Findings

The following summarizes findings from the nine APEC economies that responded to the survey. Please note that responding economies did not always provide responses to every question. Additional detail regarding responses to specific questions follows this summary.

- *Almost all of the responding APEC economies have green TVET strategies and initiatives -- originating at the national or state/province/territory level -- that support and promote the transition to a sustainable, clean energy future. In addition to broader sustainable development and climate change plans and policies, many member economies align and coordinate green strategies and initiatives with economic development, education and training, labor market*

research, innovation technologies, and trade activities in their economies.

- *All responding APEC economies stated that they promote access to education, training and employment through incentives, scholarships, and targeted programs for vulnerable populations. In addition, many reported that they targeted resources to green growth and training opportunities for vulnerable populations.*

- *Almost all responding APEC economies reported that they engage primary and secondary students in rigorous STEM learning, including developing and enhancing the science and mathematics curriculum and providing professional development opportunities for teachers. Most responding APEC economies indicated that primary and secondary school levels integrate environmental sustainability into STEM education curricula and standards.*

- *Most responding APEC economies did not indicate significant policies and initiatives to promote alignment between secondary and tertiary education, with the exception of the United States. A few respondents stated that changes in policies and laws designed to encourage demand for workers by greening businesses would also incentivize students to attain TVET degrees or other credentials.*

- *Most responding APEC economies stated that TVET systems work closely with industry and business in the design and delivery of green programs -- including defining the skills and competencies needed for the labor market.*

- *Almost all of responding APEC economies reported that TVET systems work with industry to define the appropriate credentials and qualifications needed to adapt to technological changes in the emerging green economy. APEC economies reported the following activities to synchronize credentialing requirements with the needs of industry: mapping or defining key skills and competencies in greening sectors at the national level, awarding grants to provinces and localities to enhance labor exchange information, and identifying curriculum and course requirements to align and address new skill requirements.*

- *Most responses indicated teacher professional development trainings and programs were in place in APEC economies to ensure teachers have the requisite skills and knowledge to prepare students for the emerging green economy. A wide range of teacher professional development opportunities were reported including: industry internships, short courses and face-to-face workshops, action research on innovations and technology, and virtual communities of practice.*

- *Many respondents identified numerous challenges for the TVET system in upskilling or reskilling the existing workforce for employment in the energy efficiency and renewable energy sectors. Among the challenges cited are: uncertain regulatory environment, impact of financial crisis and budgetary constraints, skills set that are not well-defined in the greening of sectors, slow expansion of innovations, no system of credentialing, and skills mismatch with industry and workers. Several reported innovative approaches to training the existing workforce, such as dedicating funds for innovation and training and a grant program targeting dislocated workers that align with a variety of green industries and provide accelerated paths to industry-recognized credentials.*

- *Many APEC economies reported taking a regional economic development approach to green growth; several are working with industry and NGOs to identify and promote green skills and sustainable development within functional economic regions.*

- *All responding APEC economies provided specific examples of strategies and practices that help align and coordinate green growth efforts with business, industry, training and education sectors as well as the economic development sector. Strategies cited were wide ranging and included: developing a campaign to reduce water usage; reviewing apprenticeship program standards through the lens of green processes and technologies to change practices; developing a region-wide green school curriculum; and developing new competencies, working with the automotive industry to speed the growth and development of skills in emerging green vehicle design technologies.*

1.2 - Synopsis of Responses to Survey Questions

Section II: General Questions

Question 2.1 - ***Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.***

Summary of Responses: *Almost all of the APEC economies have green TVET strategies and initiatives -- originating at the national or state/province/territory level -- that support and promote the transition to a sustainable, clean energy future.*

Synopsis of APEC Economies' Responses:

- **Australia** has three complementary TVET strategies for a clean energy future. The first is the Clean Energy and Other Skills Package (CEOSP), an investment up to $32 million over four years that enables both tradespeople and professionals in key industries to develop the skills needed to deliver clean energy services, products and advice to Australian communities and businesses. The second strategy is the Green Skills Agreement (GSA), which ensures that training in skills for sustainability remains an integral part of all TVET programs and is relevant to the needs of industry. The GSA does this by developing national standards, upskilling TVET practitioners, conducting strategic reviews of training packages and implementing a transition strategy to reskill vulnerable workers. The third strategy, the Skills for the Carbon Challenge (SCC), provides national leadership to build capacity in the tertiary education sector to supply the skills needed for workers and businesses to prosper in a low-carbon economy.

- **In Canada,** almost all provinces and territories have government-wide or ministerial/departmental-specific legislation governing green economic measures including: ongoing reviews of education, training, and apprenticeship programs, sustainable development and renewable energy strategies, publicly funded research and development, and commissioned studies on the green economy and green labor market. Provinces and territories offer training for the developing green economy through university, college, vocational, and private training. As a part of the Government of Canada's Sector Council initiative -- Environment Careers Organization (ECO) -- Canada has identified three core areas of specialization: Environmental Protection; Conservation and Preservation of Natural Resources; and Environmental Sustainability.

- In **Chile,** secondary school students have to complete a period of 480–960 hours of workplace training to obtain a TVET certificate, typically taking place after graduation. Advances in education have been in process and include the following: the dual model of education; a national certification system for vocational skills; and a closer connection between academic fields and the labor market.

- **Japan** does not have exclusive TVET strategies to support and promote a sustainable, clean energy future, however, a general career and vocational education report on the "Future Vision of Career Education/Vocational Education in Schools," is a response to new challenges on education, employment, and labor in a globalized, knowledge-based society and changes in structure and practices.

- Within the **Mexican economy**, there are three main systems of TVET that support the transition to a sustainable and clean energy future: upper secondary

education, higher education and vocational training. All secondary students take a new compulsory course called Ecology and Environment.

- In **The Russian Federation**, business communities and educational centers develop their own green growth initiatives and technologies and organize competitive bidding for their further application.

- In **Chinese Taipei**, the Bureau of Employment and Vocational Training has strengthened policies and practices under each of its branches as they relate to green energy and VETs. These include on-the-job training opportunities in LED application, carbon footprint supervision, and curriculum development in numerous areas -- including energy savings, energy management, and low-carbon energy and environmental technology.

- **Thailand** uses four key strategies to increase the quality and quantity of TVET occupational competencies and skill needs related to sustainable development: 1) increase TVET participation; 2) social services; 3) research innovation; and 4) entrepreneurship development and quality improvement.

- The **United States** Government has articulated strategies in a number of public policy areas to transition towards a sustainable clean energy future. Large investments in recent years have been made into technologies to improve energy efficiency and develop alternative energy sources and training and research in green jobs through the American Recovery and Reinvestment Act of 2009. A number of sustainability strategies have been developed by education and industry -- including the American College and University Presidents' Climate Commitment (ACUPCC). Many institutions of post-secondary (tertiary) education across the economy have signed on the ACUPCC, committing to a zero-carbon future, aggressive recycling programs, and the adoption of curricula that support a broad economic shift towards sustainable energies.

Question 2.2 - *Are the above skills strategies aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?*

Summary of Responses: *In addition to broader sustainable development and climate change plans and policies, many APEC economies align and coordinate green strategies and initiatives with economic development, education and training, labor market research, innovation technologies, and trade activities in their economies.*

Synopsis of APEC Economies' Responses:

- **Australia's** development of a skilled and qualified workforce is aligned with and will support The *Securing Australia's Clean Energy Future Plan: Australian Government's Climate Change Plan*, which will price carbon and drive investment in new clean energy sources like solar, gas and wind. Australia's National Strategy on Energy Efficiency (NSEE) is an agreement among the Council of Australian Governments, which seeks to accelerate energy efficiency efforts by streamlining roles and responsibilities across all levels of government and by helping households and businesses prepare for a price on carbon. Under this strategy, The National Energy Efficiency Skills Initiative (NEESI) was developed identifying actions to build workforce knowledge and develop skills for a low carbon economy and implementation of sustainability strategies.

- Almost all of **Canada's** provinces and territories have either government-wide or departmental-specific legislation governing green economic strategies in the following areas: sustainable development, climate change and emissions reduction, water management, green building, education and training/apprenticeship programs.

- **Chile** has been implementing environmental policies using innovative instruments, regulatory reforms and pioneering tradable permit mechanisms for water rights, fishing quotas, and emissions permits. Chile recognizes a need for integration of environmental objectives in a wide range of key economic sectors such as mining, forestry, energy, agriculture, and transport to achieve green growth.

- **Mexico** aligns and coordinates their career and training programs in TVET education with requirements by the Secretariat of Environment and Natural Resources and offers economic support to initiatives by the education and social sector institutions such as formal environment education and training to promote sustainable development. In addition, the Secretariat of Economy and the National Council for Science and Technology provide a special Fund for Technological Innovation that includes investments that promote the usage of clean technologies.

- **The Russian Federation** mainly focuses on aligning their TVET skills strategies with international businesses.

- **Chinese Taipei** utilizes on-the-job training for talent development in the field of green energy and coordinates between private and public sectors in order to expand sustainable economic and green energy development. The VET courses align with environmental protection and energy department regulations.

- In **Thailand**, the TVET colleges work actively to help to conserve energy and implement clean energy policy, including working with the Ministry of Energy on clean energy projects and the automotive industry to provide workers green skills training and upskilling. The Fix-It Center sends vocational students to various villages across the economy to help repair machines and appliances for local farmers and homeowners and offers technical know-how on the maintenance of engines, tools, and other machinery to save energy and clean energy.

- **The United States** has made an unprecedented effort to coordinate strategies for economic development, education and training investment, trade support, and, in one significant case, research investment, to move towards a sustainable future. The US Government has begun rapidly expanding the number of investments that are made through "regional innovation cluster" approaches – a strategy for coordinating investments across multiple Federal agencies -- in support of a broad range of partners seeking to develop the economy of each region. In 2010, an interagency Taskforce for the Advancement of Regional Innovation Clusters, led by the Economic Development Administration of the U.S. Department of Commerce, began to develop and administer interagency grant competitions to promote Regional Innovation Clusters, including one focused on energy efficient buildings, and an ongoing series of Jobs and Innovation Accelerator Challenge grant competitions.

Question 2.3 - ***How do you ensure inclusive access to green growth education, training and employment for vulnerable populations?***

Summary of Responses: *All responding APEC economies stated that they promote access to education, training and employment through incentives, scholarships, and targeted programs for vulnerable populations. In addition, many reported that they targeted resources to green growth and training opportunities for vulnerable populations.*

Synopsis of APEC Economies' Responses:

- **Australia's** 11 Industry Councils revised Training Packages to integrate skills for sustainability. These Training Packages provide Registered Training Organizations (RTOs) the opportunity to deliver training through multiple qualifications -- including entry-level qualifications that are made available to vulnerable groups such as the long-term unemployed and disengaged youth. One objective of the Green Skills Agreement is developing a transition strategy to re-skill vulnerable workers. The Australian Government's Department of Education, Employment and Workplace Relations (DEEWR) commissioned a project to identify future green employment and training opportunities for Indigenous Australians in the Murdi Paaki region of New South Whales.

DEEWR funded a project to map employment opportunities in low-carbon sectors for at-risk workers in Victoria's La Trobe Valley, an area with a number of high-emission brown coal power plants.

- In **Canada,** the federally-supported Environment Careers Organization has gathered some limited data on the participation of vulnerable groups within the environmental sector. Among the ECO findings: forty percent of all environmental employees are women; less than 3% are Aboriginal; less than 6% are immigrants; 24% are below 30 years of age; and 14% are 55 or older. Every effort is made to provide equal access for all to the labor market, education and skills development opportunities.

- In **Chile,** there has been an important effort to provide more opportunities for students to participate in TVET programs that have the talent and interest in pursuing a career on TVET but do not have the resources to pay for tuition or other expenses during the course of their studies. The new Millennium scholarships sponsored by the government to those students who want to attend a higher education institution for a technical career and need financial support. In addition, the Technicians for Chile Program has been implemented; generating new competencies for those who already have been granted a technical degree from a higher education institution.

- In **Japan** vulnerable populations have the constitutional right to receive equal education. The government recently put in place the official Course of Study for high schools and schools with special needs to expand employment opportunities, particularly for students with disabilities.

- **Mexico** provides scholarships to vulnerable students from primary and secondary levels to ensure completion of their compulsory education levels. The National Program of Scholarships for Higher Education provides vulnerable and high performance students with financial aid to attend post-secondary institutions.

- **The Russian Federation** offers equal access to programs for all groups of people without restrictions.

- **Chinese Taipei's** TVET branch offices fully subsidized TVET relating to green energy for all applicants who are categorized as a vulnerable group. Chinese Taipei also conducts employment consultation, promotions, and training and encourages industries to employ vulnerable groups by providing employment rehabilitation, individual case management, demand-oriented programs, employment adaptation and short-term employment with subsidies.

- **Thailand** has created a National Economic and Social Development Plan focused on skill development and the greening of the Thai Government. Under the Plan, the Ministry of Industry provides and facilitates pre-employment and workplace trainings, provides incentives to provide workplace trainings, establishes a National Green Skills Office at the Ministry of Labor, creates a campaign for green process and products in the agricultural sector; and initiates various pilot projects.

- In the **United States,** a number of investments by the government provide under-represented U.S. populations with access to a variety of education, training, and employment opportunities, including those related to green jobs. The U.S. Department of Education (ED) makes many targeted investments to improve education for students from ethnic minority groups, from low-income families, or who have disabilities. Public school systems throughout the United States are required to offer free, compulsory education through the secondary level (12th grade). In addition, ED promotes greater access to post-secondary (tertiary) education through its funding for need-based student financial aid. ED has also focused technical assistance on education and training promoting growth in sectors that would help green the economy.

  Many U.S. Department of Labor (USDOL) programs target or serve disadvantaged or underserved populations. In 2009-2010, USDOL invested nearly $500 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds in a series of grant competitions to support training for careers in the renewable energy and energy efficiency industries and research on green jobs. Priority was given to applicants serving low-income workers, unemployed youth and adults, high school dropouts, ethnic minority communities, areas of high poverty, and other underserved sectors and vulnerable members of the workforce, as well as communities most impacted by global restructuring of the automotive industry. ARRA "Pathways Out of Poverty" grants targeted residents of high-poverty geographic areas designated by the U.S. Census Bureau--ranging from neighborhoods in urban areas to several counties in rural areas. ARRA Green Capacity Building Grants focused on enabling existing USDOL grantees, many of which target the vulnerable populations to train for entry-level jobs in green industries.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

Question 3.1 - ***How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?***

Summary of Responses: *Almost all APEC economies reported that they engage primary and secondary students in rigorous STEM learning, including developing and enhancing the science and mathematics curriculum and providing professional development opportunities for teachers.*

Synopsis of APEC Economies' Responses:

- The Government of **Australia** is providing more than $639 million from 2009–2013 for specific science and math education initiatives to provide the future workforce with core STEM skills that will be essential to the green economy, including a number of school-focused professional development, resource development and assessment projects. The Government is also investing billions in a range of other initiatives that contribute to the advancement of science and math education. These include: 1) Science and Language Centres for 21st Century Secondary Schools, enabling 179 new language learning centres, 280 science laboratories and 78 dual facility (science and language) laboratories to be built in schools; 2) Smarter Schools: Improving Teacher Quality National Partnership, to attract, train, place, develop and retain quality teachers, 3) Smarter Schools: Improving Teacher Quality National Partnership, to promote the effective use of student performance information to deliver sustained improvement in literacy and numeracy outcomes for all students, 4) Digital Education Revolution online curriculum resources project to develop online resources to support the Australian Curriculum and the development of Australian Science and Mathematics inquiry-based learning models and curriculum; and 5) Promotion of financial literacy in schools that provides practical opportunities to apply mathematical concepts in a range of financial and consumer contexts.

- In **Chile,** the Ministry of Education has incorporated STEM education for all educational levels within each subject related to sustainable development. No special programs are being implemented at the national or regional level.

- In **Japan**, several projects have been implemented to support science and mathematics education to train students in problem-solving skills needed in the green economy. These include the Super Science High schools (SSH) for advanced science and mathematics education and the Science Partnership Program to support experimental and problem-solving activities conducted in collaboration between universities, research institutes, and junior and senior high schools. A nationwide scientific competition for high school students has also been established.

- In **Mexico,** from 2004 to 2010, the Secretariat of Public Education has reformed the curricula of three compulsory education levels, primary, lower secondary,

and upper secondary, so that STEM competency-based learning models now play a relevant role in the student's education.

- In **The Russian Federation,** companies drive the development of sustainability-oriented curriculum for primary and secondary schools by implementing new innovative ecology technologies with government support.

- **Chinese Taipei** government has treated environmental education for primary and secondary education as a key issue. Environmental education has been incorporated into the Grade 1-9 Curriculum Guidelines and 7 learning areas. The goal is to cultivate the right environmental values in students through various kinds of learning activities designed to make them environmentally aware and sensitive and to develop knowledge of environmental sustainability. For senior high school education, the Senior High School Curriculum Guidelines implemented in 2010 contains the following goals: enhance the competencies in the humanities, society and technology; improve logical thinking ability, judgment, aesthetic appreciation as well as creativity; strengthen teamwork skills, develop a spirit of democracy and law, and strengthen a sense of duty; enhance self-study skills and cultivate an attitude of life-long learning; improve self-understanding and career development; and nurture the idea of respect for life and globally sustainable development.

- **Thailand** has been supporting primary and secondary students in STEM learning. Science camps and clubs are well accepted in schools. A recent robotics camp called Interactive Technologies for the Inventive Mind (I-Tim), was introduced at Chiang Mai University for secondary school students to produce creative robots or machines for home appliances, agriculture, industry, environmental, and energy efficiency purposes.

- In the **United States**, the federal government has a limited role in primary and secondary education, however, it has targeted investments to promote STEM education. For example, the National Science Foundation has made large investments in school programs that promote interest in science and, to some extent, sustainable technologies. Further, new awards were made recently to colleges seeking to improve minority participation in STEM-related study at the college and graduate level. The National Oceanographic and Atmospheric Administration (NOAA), part of the U.S. Department of Commerce, has invested in science education programs with a focus on preserving the biosphere. The U.S. Department of Education has also initiated a recognition program, the Green Ribbon Schools program, which recognizes and highlights schools that have sought to comprehensively promote sustainability through the school culture, student activities, and the curriculum. Large philanthropic foundations such as the Bill and Melinda Gates Foundation, the Carnegie Corporation of

New York, and others are building private support to make STEM education a larger priority in the United States.

Question 3.2 - *How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?*

Summary of Responses: *Most APEC economies indicated that primary and secondary school levels integrate environmental sustainability into STEM education curricula and standards.*

Synopsis of APEC Economies' Responses:

- **Australia** has incorporated sustainability as a cross-curriculum priority in the new National Australian Curriculum, allowing students to learn knowledge, skills, and understanding about sustainable patterns of living and how humans interact with the environment. Environmental sustainability is contained in content descriptions within Science, Mathematics, Geography, and English. In Geography, for example, sustainability is one of the seven concepts for geographical understanding and is included throughout all year levels. In addition, the Australian Sustainable Schools Initiative (AuSSI) is an initiative of the Federal Department of Sustainability, Environment, Water, Population and Communities. AuSSI provides practical support to schools and their communities to live and work more sustainably and fosters a whole school approach with measurable environmental, educational, social and financial benefits.

- **Chile** has sustainability and STEM contents covered in each subject area, though some schools have chosen to lead in environmental involvement. The National System of Environmental Certification of Educational institutions (Sistema Nacional de Certificación Ambiental de Establecimientos Educacionales, SNCAE) is a program coordinated by CONAMA (National Agency for the Environment), the Ministry of Education, CONAF (National Forestry Corporation), the ACHM (Chilean Association of Municipalities, UNESCO and the DGA, Directorate of Water. The purpose of this program is to promote a culture of sustainability and to promote the values of environmental preservation within the school population.

- **Japan** integrates the perspective of environmental sustainability into the general Course of Study at the primary and secondary level and into specialized courses, such as Agriculture and Engineering. The Course of Study for the upper secondary level includes geography, history, civics, science and home economics -- all have topics and lessons about a sustainable society contextualized to the subject area. For example, in Civics, students research

problems of modern society where a sustainable society is required and problems related to the environment, resource use, and energy in domestic and international affairs. In Science, students explore the conversion and conservation of energy, the reuse of plastic and metals, balancing of the ecosystem, the importance of biodiversity, global warming, ozone layer destruction, and the relationship between nature and human lives.

- **Mexico's** primary, lower, and secondary level academic programs incorporate competency-based curriculum design methodology, which ensures that environmental sustainability is incorporated, where appropriate.

- In **The Russian Federation**, educational institutions develop their own training and educational programs on the basis of standards, recommendations, and economic data, developed by the Ministry of Education and Science.

- For primary and secondary education in **Chinese Taipei**, environmental education teaching programs can be incorporated into 7 learning areas or the school integrated curriculum. By integrating these programs into the regular curriculum, schools avoid burdening teachers and students with additional material or "crowding out" other topics. One of the goals of the Senior High School Curriculum Guidelines implemented in 2010 was to implement the idea of respect for life and globally sustainable development. Related themes -- such as global warming, alternative energy, nuclear energy, recourse recycling, conservation of biological diversity, and pollution control -- are introduced within the five mandatory subjects. To enhance civic environmental awareness, Civics and Society is one of the mandatory subjects and includes the theme of societies of diverse cultures and issues of awareness of global citizenship and globalization. The theme of a global village deals with the issue of economic globalization and environmental and biological problems by addressing the issue of Chinese Taipei environmental pollution and biological destruction and compliance of related international conventions and civil environmental protection movements.

- **Thailand's** Ministry of Education has a long-established school science curriculum. A good example of STEM education at the secondary level is the establishment of Mahidol Wittayanusron School, the economy's first school specifically designed to accommodate gifted students in science and mathematics.

- In the **United States**, many examples abound that illustrate activities by school districts to integrate sustainability into STEM curricula and standards. One example is the public school board for the city of Virginia Beach, Virginia, which selected sustainability as one of eleven 21st century skills required of all K-12 students. The Department of Curriculum and Instruction developed a

continuum of skill level expectation at each grade level. Additionally, beginning in April 2012, interested Career and Technical Education (TVET) students, many of whom are in STEM-related programs, have been piloting a Green Education Foundation Sustainability 101 online course that carries a first of a kind sustainability certification and is also eligible for one college credit. At the Wisconsin Department of Public Instruction, environmental education has been identified as a discipline of study and is most often taught at the secondary level. Environmental science is integrated into many elementary level curricula. Examples of environmental science projects in Wisconsin include: gardens for students to work in on the school grounds; a sustainability camp where students learn about solar, wind and gardening; and a high school environmental science club with tours of the energy labs at Gateway Technical College.

Question 3.3 – ***How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?***

Summary of Responses: *Most APEC economies did not indicate significant policies and initiatives to promote alignment between secondary and tertiary education, with the exception of the United States. A few respondents stated that changes in policies and laws designed to encourage demand for workers by greening businesses would also incentivize students to attain TVET degrees or other credentials.*

Synopsis of APEC Economies' Responses:

- **Chile's** National Policy of Education for Sustainable Development has a component that encourages business to adapt to green technologies. The national policy promotes sustainable development in the labor market and schools at the same time, connecting and incentivizing the links between students with skills and certification in some TVET-related programs to sustainable development and businesses with similar policies.

- **Mexico** makes information regarding the general requirements of professional careers available via the internet in order to inform secondary school students of environmental education opportunities within each profession. Information describing the types of employment available in sustainable development and required job qualifications is also available on the internet.

- **The Russian Federation's** demand for human resources/relevant staff by large companies that use innovative and ecological-oriented technologies is the best

motivation for students to obtain TVET degrees, certificates, or other credentials.

- In **Chinese Taipei**, the enforcement of environmental laws can encourage students to acquire a TVET degree, certificate, or other credential. For example, “The Environmental Education Act” mandates that environmental protection curriculum be implemented in government agencies and at all levels of primary and secondary schools, which creates demand for qualified teachers with specialty areas. By law, Chinese Taipei’s environmental education institutions must designate those professionals of environmental education, which will stimulate demand for credentials needed in the labor market.

- **Thailand’s** Department of Skill Development (Ministry of Industry) offers skills training courses and skills assessment for all trainees and new TVET graduates who attend the pre-employment training courses. Students can contact the Office of Vocational Education Commission to find out about TVE Colleges and TVET degrees. The Office of Industrial Economics, also part of the Ministry of Industry, maintains the “Labor Economic and Education Data Exchange Plus (LEED-X Plus), which provides up-to-date labor market information about the number of workers in different industries, as well as qualifications needed to meet employers' demands.

- In the **United States**, technical fields as a whole use a complex patchwork of credentials that vary by technical specialty, and by geography. Given the extent and variety of credentials and occupational licenses, the United States government has been active in trying to compile, provide access, and disseminate information in searchable online databases on industry-recognized credentials so that consumers are better informed about higher education and job training options.

  The U.S. Department of Education has been supporting state governments for years to articulate, on the basis of industry input, a set of career pathways that show students what they need to learn and be able to do in order to enter into particular career fields. The large numbers of potential career paths across the entire economy have been clustered into 16 groupings under a National Career Clusters™ Framework. These “career clusters” are regularly reviewed, revalidated, and updated in extensive consultation with panels of subject matter experts that include business representatives. The end result is a suggested sequence of study from the ninth grade (beginning secondary) into the first two years of tertiary education, which for many students takes place at community colleges.

  The U.S**.** Department of Labor (USDOL), with industry partners, has developed competency models that provide a detailed understanding of the foundational

and technical skills and competencies required for workplace success in a particular industry. Components related to green skills, sustainability, or environmental concerns are included in number of the industry competency models that have been developed. USDOL has also developed several on-line tools for students and job seekers to learn about the skill requirements of various career fields, including those in the green economy. Further, USDOL's Registered Apprenticeship system is integrating green skills via new green occupations, by "greening" existing occupations, and by "greening" pre-apprenticeship programs, which are designed to reach out to youth.

Section IV: The TVET System's Role in Green Growth

Question 4.1 - *How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?*

Summary of Responses: *Most APEC economies stated that TVET systems work closely with industry and business in the design and delivery of green programs -- including defining the skills and competencies needed for the labor market.*

Synopsis of APEC Economies' Responses:

- **Australia's** *Green Skills Agreement* (GSA) is overseen by the GSA Implementation Group (GSAIG), with representatives from a wide range of business, government, community, and educational organizations including the following peak organizations: the Australian Chamber of Commerce and Industry, the Australian Council of Trade Unions and the Australian Industry Group. Industry Skills Councils (ISCs) are key stakeholders in the Australian VET system and provide advice to Australia, state and territory governments on the training that is required by industry. ISCs provide comprehensive representation of industry in the managing and planning of VET, and advice and participation in the development of training products and services to meet industry needs. ISCs are responsible for collecting information on industry training needs from employers, unions and professional industry associations, thereby ensuring an industry-led VET system that is flexible and responsive. ISCs advise government on how public funds should be spent within each industry, and have primary responsibility for the development and maintenance of Training Packages. There are eleven ISCs: Agri-food, Community Services and Health, Construction and Property Services, ElectroComms and Energy Utilities, Government Skills, Innovation and Business, Manufacturing Skills, SkillsDMC, Service Skills, Transport and Logistics and ForestWorks. The ISCs undertook the strategic review of Training Packages to embed skills for sustainability and have a key role to play in implementation of other projects and policies under the GSA and the Clean Energy and Other Skills Package.

- **Canada's** Environment Careers Organization (ECO) services reach all participants of the environmental sector including employers, practitioners, educators and students and works directly with industry stakeholders to develop programs to respond to emerging labor market. The industries with the highest concentrations of environmental employees include agriculture, forestry, fishing, hunting, construction, administration and support, waste management, remediation, professional, scientific and technical services. Over the next decade, retirements of Canadian environmental workers will create over 100,000 vacancies or 14-percent of the environmental workforce. A recent survey conducted among Canadian industry employers shows strong growth in demand for environmental skills in the construction, manufacturing, and agricultural sectors.

- **Chile's** government is the primary funder of Research and Development (R&D), carried out in universities and public research organizations. Only around 46% of R&D is financed by industry as compared to an OECD average of more than 60%. The links between universities, public research institutes, and the private sector are weak. An important step happened in 2008 with an R&D tax credit, along with other measures. In addition, one important component that Chile has tried to reinforce is the concept of "competencies", as the basis for the curricular development within academic institutions. There is a special fund created inside the program MECESUP (Program for the Improvement of the Quality of Higher Education) that provides funding for different institutions that apply to foster and enhance competencies in their curricula. The work with business has been mainly informational although there is a component that promoted on-the-job training for the use of green technologies.

- In **Mexico,** the TVET education requires that a panel, in which half represent industry and business, meet prior to any new career program. The general and specific skills and competencies that students are expected to acquire are developed by the panel and become part of the curriculum design of each profession.

- In **Chinese Taipei,** the green environment protection regulations are aligned with workplace demands and are connected to the VETs implementing human capital programs.

- **In Thailand,** all TVET institutions or providers, both public and private, are required to involve industrial groups and local agencies in the development of policies, guidelines, and curriculum. The main objectives of the partnership and networking with business and industry is not only looking for a training place for students or direction in producing manpower but also identifying competency required by enterprises. Main industrial groups partnering are: Petrochemical,

Gems and Jewelry, Textile and Garments, Automobile, Tourism and Hospitality, and Food. Through these partnerships, teacher training, curriculum development, and competency-based training are organized and implemented.

- In the **United States,** there has been continuous and consistent consultation with business and industry to articulate the skill needs of the workforce in a myriad of technical fields of relevance to the green economy, the products of these consultations include the *career clusters* supported by the U.S. Department of Education and *industry competency models* supported by the U.S. Department of Labor (USDOL). As part of USDOL's Registered Apprenticeship program, requests for USDOL to recognize new apprenticeable occupations are industry-driven, and as such are generally submitted for consideration by industry associations or labor organizations. In determining whether an occupation satisfactorily meets the criteria of being apprenticeable, USDOL's Office of Apprenticeship solicits input from industry subject matter experts. The national Registered Apprenticeship system recognizes more than 900 occupations, which are listed at: http://www.doleta.gov/oa/guidance.cfm. Several green occupations recently gained DOL recognition as being apprenticeable. Many Registered Apprenticeship program sponsors have updated their program standards to include training elements emphasizing the use of green technologies and/or processes. Further, more and more Registered Apprenticeship sponsors are partnering with organizations that offer pre-apprenticeship training in green occupational skills and awareness, for individuals from traditionally vulnerable populations.

Question 4.2 - ***How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?***

Summary of Responses: *Almost all of APEC economies reported that TVET systems work with industry to define the appropriate credentials and qualifications needed to adapt to technological changes in the emerging green economy. APEC economies reported the following activities to synchronize credentialing requirements with the needs of industry: mapping or defining key skills and competencies in greening sectors at the national level, awarding grants to provinces and localities to enhance labor exchange information, and identifying curriculum and course requirements to align and address new skill requirements.*

Synopsis of APEC Economies' Responses:

- **Australia's** Industry Skills Councils are responsible for the strategic review of Training Packages (sets of nationally endorsed standards and qualifications for recognizing and assessing people's skills) to embed skills for sustainability.

ISCs are responsible for ensuring that competencies and qualifications are included in National Training Packages and that they meet the technological needs of industry, as Australia moves to a sustainable, low-carbon economy. In addition, Australia's Clean Energy and Other Skills Package (CEOSP) includes a baseline and the curriculum-mapping project that will be undertaken in 2012 will: 1) map the key occupations and industries responsible for the delivery of energy efficiency products and services; 2) determine the key skill requirements in each of these industries; 3) assess the availability of nationally accredited VET courses and university courses to address these skill requirements; 4) review energy efficiency policies and programs established by Australian governments and organizations to ensure the CEOSP complements existing programs; and 5) identify the most effective mechanisms for delivering skills to the existing workforce.

- **Canada** has thirteen provinces and territories, each with their own regulatory environments. At the federal level, the Environment Careers Organization (ECO) has a set of National Occupational Standards (NOS), which are competencies required to perform successfully in a particular environmental occupation. NOS are considered benchmarks against which people of a particular profession measure their level of performance and competency. Using a bottom-up approach, all of ECO Canada's NOS are compiled using a methodology that relies heavily on broad-based input from professionals in the field.

- **Chile** had a program called Chilecalifica (Chile qualifies) from 2002, a joint effort from the Ministries of Education, Work and Social Protection, and SENCE (National Service of Training) and Economy. The purpose of the program was improving general training and competencies for the job market for the active population with low levels of literacy, offering opportunities to finish their elementary and secondary studies and providing specific training. The purpose of the program was to improve the quality and articulation of technical education at all levels and to increase the coverage of the training of high-level technical people. The program also provided the National Qualification System of Competencies for the job market. The idea was to create a system of lifelong education and training so people could acquire different competencies and new knowledge throughout their lives, along with the social and professional recognition for the skills they incorporated to their work environment. Major accomplishments of this program included: the design and implementation of a flexible model of studies for elementary and secondary as well a special evaluation system; curricular reform of adult education and the incorporation of different choices of training for different job positions, and a stronger link between the academic world and job market.

- **Japan** has no specific quality assurance system exclusively for the green

economy, however, students are required to earn enough credits in certain subjects specified in the official Course of Study in order to graduate. This system ensures qualification.

- In **Mexico**, each TVET institution has established a linkage with an Industry Committee that meets at least twice a year, where all aspects regarding technological changes are discussed and recommendations are made to incorporate these changes either within the curriculum or by developing special programs to meet the challenges. Also each University has an area of focus that brings the orientation both to students and workers. There are cooperative programs between higher education and industry, involving main industry and business associations, higher education institutions, entrepreneur and incubators programs, foundations, and social organizations.

- **Chinese Taipei** promotes cooperation between industry-academia-government to assure that appropriate credentials and qualifications are defined.

- **Thailand** has joint committees comprised of the Office of Vocational Education Commission (OVEC) and industrial clusters that are organized under cooperative projects to identify competencies required by each industrial cluster and career path in the emerging green economy. This cooperation fosters a sense of ownership in TVE of industrial clusters and encourages them to work closely with OVEC in developing and producing qualified TVE graduates.

- In the **United States**, U.S. Department of Labor has issued administrative guidance to state and local operators of the public workforce system that clarifies its terminology regarding credentials. The guidance stated, among other items, that a credential is awarded in recognition of an individual's attainment of measurable technical or occupational skills necessary to obtain employment or advance within an occupation. These technical or occupational skills are generally based on standards developed or endorsed by employers. USDOL has also supported several research projects to better understand the impact of green economic activity on occupations and their associated skill requirements, as well as to identify and count green jobs. This research was conducted through USDOL's Bureau of Labor Statistics, through the Employment and Training Administration (ETA) funded Occupational Information Network (O*NET) database and through ETA's State Labor Market Information Improvement grants, funded by the Recovery Act.

4.3 - *What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?*

Summary of Responses: *Most responses indicated teacher professional development trainings and programs were in place in APEC economies to ensure teachers have the requisite skills and knowledge to prepare students for the emerging green economy. A wide range of teacher professional development opportunities were reported including: industry internships, short courses and face-to-face workshops, action research on innovations and technology, and virtual communities of practice.*

Synopsis of APEC Economies' Responses:

- In **Australia**, one of the four objectives of the *Green Skills Agreement* is the upskilling of VET practitioners to provide effective training and facilitation in skills for sustainability. A number of projects have been completed under this objective including the creation of a training unit within the Innovation and Business Skills Industry Skills Council to assist the Australian VET sector and the VET workforce to deliver and assess training for sustainability, and the completion of an evaluation of professional development programs focused on skills for sustainability. Following on from this project, the Australian Government will fund delivery of a $1 million national Skills for Sustainability Professional Development program for VET practitioners in 2012, designed to provide the Australian VET sector with the capability to deliver skills for sustainability training and continuous professional development for practitioners. The program will comprise two streams: 1) delivery of an accredited short course program incorporating face-to-face workshops and blended learning/online options to provide the maximum number of VET practitioners with the skills, knowledge, and base accreditation to deliver skills for sustainability training, and 2) delivery of a Sustainability Champions Scholarship Program for selected VET practitioners who will undertake high-level training to become sustainability champions in their organizations.

- **Chile** does not have massive or general interventions for teachers, however, some individual or specific efforts have been put in place. One such effort, is a 2010 manual developed called "The Energy Efficiency at the School Curriculum for Technical Education," an inter-ministerial initiative, with a main role from the Ministry of Energy.

- **Japan** has the following systems in which teachers, including those in TVET, undertake coursework based on individual's experience, ability and area of specialty: 1) beginning teachers' training 2) ten-year mark teachers' training, 3) long-term internship; and 4) sabbatical to attend graduate school. In addition, to help teachers update their knowledge and skills, Japan has implemented in April 2009 a system to renew educational personnel certificates that requires educators to take and complete specified courses every 10 years. The courses are given at universities and include the most advanced knowledge based on

the current social and economic situation, with objectives such as “considering myself as an educator and understanding changes in children, education policies, and cooperation between those inside and outside of schools” and “the strengthening capacity of education in each subject.”

- In **Mexico**, the TVET schools have developed industry internships for teachers to ensure academic staff skills are updated in addition to specific training programs developed by each school tailored to the teacher’s background and course requirements.

- **Chinese Taipei** has a variety of categories of VET teachers, however, there is no qualification verification system nor related regulations.

- **Thailand’s** Office of Vocational Education Commission (Ministry of Education) has encouraged TVE teachers to carry out research work for new knowledge and innovation/technology for sustainable development. An example is “One Page Research” and “Classroom Action Research,” which has inspired TVE teachers to continue to improve their performance through data collection. Students are also supported through project-based learning to create technology/innovation related to their areas of specialty including those related to the green economy.

- **The Russian Federation** uses advanced training techniques with their TVET practitioners to fully qualify to prepare future workers for the emerging green economy.

- In the **United States**, The National Research Center for Career and Technical Education (www.nrccte.org), funded by the U.S. Department of Education, is developing an evidence-based model for preparing new secondary TVET teachers. Research has shown that up to 75 percent of new secondary TVET teachers are selected for their subject-matter expertise in TVET fields, with little or no preparation in how to teach. Research also shows that those TVET teachers who are well-trained and supported in entering the teaching profession are more likely to remain in the field and build their teaching skills over time, thus improving both the quantity and quality of TVET teachers. The evidence-based teacher induction model, now being studied, aims to equip new TVET teachers with the skills they need to intellectually and emotionally engage students in rich, academically rigorous activities, enabling students to succeed in higher study and careers. New TVET teachers will participate in the induction model, through both professional development and support services, which emphasizes four areas of knowledge and skill that teachers need to improve student achievement: 1) planning standards-based instruction, 2) using research-based instructional strategies, 3) assessing students to promote learning, and 4) effectively managing classrooms. The teacher support element

of the model includes mentoring by an experienced educator in the teacher's school, coaching from an experienced instructional coach, guidance of a school principal, and peer support via electronic "communities of practice."

4.4 - *What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.*

Summary of Responses: *Many respondents identified numerous challenges for the TVET system in upskilling or reskilling the existing workforce for employment in the energy efficiency and renewable energy sectors. Among the challenges cited are: uncertain regulatory environment, impact of financial crisis and budgetary constraints, skills set that are not well-defined in the greening of sectors, slow expansion of innovations, no system of credentialing, and skills mismatch with industry and workers. Several reported innovative approaches to training the existing workforce, such as dedicating funds for innovation and training and a grant program targeting dislocated workers that align with a variety of green industries and provide accelerated paths to industry-recognized credentials.*

Synopsis of APEC Economies' Responses:

- The **Australian** Government is committed to building the capacity of the vocational education and training system to provide skills for sustainability to existing workers so they can participate in and benefit from the shift to a clean energy, resource efficient economy. As a part of this effort, the Australian Government established the Upskilling Workers in Skills for Sustainability Pilot Project in June 2009. This project supported existing workers in the manufacturing, electro-technology and construction and property services industries to access industry-relevant skills for sustainability training, with a deliberate focus on small and medium enterprises (SMEs). While a significant number of workers were upskilled through this pilot project, a number of challenges were also identified, including the effects of an uncertain regulatory environment, the impact of the Global Financial Crisis and a difficulty in convincing SMEs of productivity benefits. It is expected, however, the imminent introduction of a carbon price in Australia to further increase demand for the upskilling of existing workers in sustainability skills. In addition, under Round 1 of the Critical Skills Investment Fund (CSIF), two projects are being funded which focus on upskilling workers in sustainable practices. The Sunshine Coast Region Solar & Waste Water Training Project will upskill existing workers and train new potential workers in a range of qualifications for the renewable energy and domestic waste water management sectors in the Sunshine Coast region. In addition, the Electrotechnology Worker Upskilling project will train existing

workers and new workers in instrumentation, sustainable energy, air conditioning installations and hazardous areas in Western Australia.

- In **Canada**, the largest influence of the green economy on employment are with the jobs that being adapted or reallocated, with existing workers having to learn new skills and/or broaden their existing skill sets. The movement towards greening the economy has resulted in a need for increased economic integration and increased demand for a more holistic economic approach. ECO Canada has been conducting additional research to define the skills required for new emerging sectors and the 2007 survey of environmental employers, showed strong growth in environmental skills required in the construction sector. Growth is most likely in occupations such as trades workers and site managers/supervisors, and also involves the emergence of a few specialist occupations (energy auditors, blower door testers, etc.). A challenge is that the skill sets required in the emerging green construction sector are not well defined and a relatively low percentage (18%) of the construction workforce uses at least some environmental skills in their work. In addition, ECO Canada helps to prepare employers to transition to a highly skilled workforce to increase productivity in some industries, such as the agricultural and manufacturing industry. Strong growth in demand for environmental skills was observed in these two sectors, even during a period in which the total number of workers employed in these sectors declined since 2007. These opposing trends suggest that employers are transitioning to a more highly skilled workforce that plays a value added role in increasing the productivity of these two sectors.

- **Chile** sees benefit from greater sector and geographic diversification, while continuing at the same time to add value to established sectors to make them more competitive. Chile's lack of economic diversification and overdependence on primary commodities make the economy vulnerable to sudden changes in international commodity prices and secular shifts in demand, despite the stabilizing role of the structural fiscal rule. This overdependence may also constrain long-term growth potential. At the same time, resource dependence raises environmental concerns: intensive agriculture in the centre and south, and forestry and salmon platforms in the south and north, lead to soil erosion, loss of native forests, a rise in the presence of pesticides and fertilizers in rivers, and contamination of water from the salmon industry and in the north, intensive copper production results in emissions of arsenic and carbon monoxide. Chilean regions need to transform static advantages into dynamic ones by producing more complex and higher value added goods in the sectors of specialization. Science, technology and innovation policy can play a key role by exploring new products in emerging sectors and by making existing sectors more productive and efficient. The technological upgrading of traditional industries for innovation-led growth can be a spur for regions such as Valparaiso and Bio-Bio, and for the northern regions in which manufacturing is underdeveloped. The mining

industry could be the nexus of a broad set of diversified and interrelated services and manufacturing activities. Furthermore, as Chile develops higher skills and technology in resource-based sectors, it can transfer knowledge and productivity gains to other sectors.

One interesting initiative has been the Regional Allocation of the Innovation for Competitiveness Fund (FIC, *Fondo para la innovación y la competitividad*). It was created in 2006 as an instrument to channel financial resources from the royalties in the mining sector towards innovation. Starting in 2008, 25% of the Fund's resources were allocated on a regional basis, taking into consideration the national innovation strategy, regional development strategy, and strategic innovation agenda and plans for improving competitiveness of the regional development agencies. The Competitiveness Fund projects must focus on science, applied research, innovative entrepreneurship, specialized human resources formation and development, or the transfer and diffusion of technology. Finally, the resources must be transferred, through agreements, to CORFO, Innova Chile, CONICYT, state universities or those recognized by the state, and/or technological scientific centers of excellence.

- **Mexico** established the System of Technological Universities (SUT) that has developed a training program to update teachers, promoting the study of a Masters Degree in renewable energy. This Masters Degree program is offered to teachers in a blended approach: online courses and on-site evaluation and assessment. By the end of 2011, 80 teachers completed their Masters Degree focused and 120 are currently enrolled in this program.

- **The Russian Federation** experiences challenges like slow expansion of innovations, less coordinated information between authorities and business companies, and a weak focus on ecological problems.

- **Chinese Taipei** takes into consideration local green industries when developing VET programs, in order to ensure that the workforce can gain the necessary skills for the local labor market.

- In **Thailand**, a special challenge is that there is no integrated plan for the upskilling of the existing workforce in energy efficiency and renewable energy sectors and only some solutions. As a result, the Ministry of Energy had to train people on energy efficiency in establishments, buildings and within production processes. Trainees included technicians working in major industries and in small enterprises, and instructors from training institutions and teachers from vocational schools.

- In the **United States,** special challenges to the TVET system's efforts to "upskill" or "reskill" the existing workforce for the energy efficiency and renewable energy sectors include:

  - *Defining credentials* with no national system for creating or issuing them. Credentials are generally based on standards developed or endorsed by employers and issued through a variety of public and private entities.
  - *Skills mismatch* between declining and growing occupations and industries in a labor market that increasingly requires post-secondary education or apprenticeship training, which many of the long-term unemployed lack.

  - *Government budgetary constraints* worsened by the recent recession.

  United States Government (USG) solutions for upskilling or reskilling the U.S. workforce for high-growth and emerging industries include: increasing credential attainment, promoting and supporting comprehensive partnership networks, expanding Registered Apprenticeships, and developing career pathways. Registered Apprenticeships and career pathways are described in the responses to Questions 3.3 and 2.3, respectively.

  For increasing credential attainment, U.S. Department of Labor (USDOL) plays a vital role in partnership with community colleges, businesses and labor unions and ensuring that credentials are industry-recognized, "portable" across the economy, and "stackable" over time to help workers move along career pathways to different or potentially higher-paying jobs, while giving employers access to the skilled workers they need to compete globally. USDOL has set a high-priority performance goal to increase credential attainment by 10 percent among customers of the public workforce system by September 30, 2013. Further, USDOL launched its Credentials Forum in May 2012 and invited businesses and industry associations from four high-growth sectors to share information on their preferred credentials,

  An example of an innovative USG approach to reskilling the U.S. workforce are the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grants, administered by USDOL, in close coordination with the U.S. Department of Education. These grants enable community colleges, in partnership with employers in high-growth and emerging industries, to develop targeted training programs for economically dislocated workers, especially those affected by globalization. Every grantee institution has at least one employer partner that has jobs available for trained workers. Grantees must also demonstrate strategic alignment of industry, public workforce system, and educational institution partners and also provided accelerated paths to industry-recognized credentials. A number of TAACCCT grants support training for a variety of green industries.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 - *How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?*

Summary of Responses: *Many APEC economies reported taking a regional economic development approach to green growth; several are working with industry and NGOs to identify and promote green skills and sustainable development within functional economic regions.*

Synopsis of APEC Economies' Responses:

- In **Australia**, the *Green Skills Agreement* under objective number 4 is to develop a transition strategy to reskill vulnerable workers and also support regions to take advantage of economic development opportunities that will emerge as Australia moves towards green growth. For instance, the Murdi Paaki Green Skills Project Final Report maps current and potential employment opportunities in the emerging green economy and relevant training pathways for the 16 Indigenous communities across the Murdi Paaki region of NSW. It also makes recommendations to the Murdi Paaki Regional Assembly (MPRA) to strengthen its role as the first point of contact for public and private sector and community stakeholders. MPRA's role would be to identify and promote green employment and enterprise opportunities in the region and further develop a targeted regional approach to green skills and sustainable development for the region. In the transition to a green economy, the Murdi Paaki region will benefit from public and private investment in sustainable agricultural practices, clean and renewable energy generation, housing and infrastructure retrofitting, natural resource management, and the water and waste management industries. These investments offer jobs and enterprise opportunities for Indigenous Australians in the region.

  The Australian Government has also commissioned the National Centre for Sustainability (Swinburne) to conduct Stage 1 of the Skills Transition for the Latrobe Valley – Implementing the Low Carbon Road Map Project. The project will build on a Climate Works Australia study of the lowest cost carbon abatement opportunities for the Gippsland region, through concurrent research into the skills and jobs profiles of local workers in carbon-intensive industries. The research program will identify the skills sets of workers and the jobs that may be in transition in carbon intensive industries, and map these to the employment opportunities and skills that can contribute to the delivery of the cost abatement opportunities in the Gippsland region. The findings of the project will assist government in developing appropriate training and employment

program response strategies to ensure a just transition to a low carbon economy for workers in the Latrobe Valley and Gippsland region. As a complement to these projects, the Australian Government's Department of Education, Employment, and Workplace Relations will be deploying 34 Regional Education, Skills and Jobs Coordinators (RESJs) to work with regional communities and local stakeholders to help deliver regional solutions to skills and employment issues. Part of the role of RESJs will be to provide information and advice on the potential green growth job opportunities in their area, and identify training and skills development pathways for community members to access these opportunities.

- In **Canada**, almost all provinces and territories have either government-wide or ministerial/departmental-specific legislation governing green economic measures, including: sustainable development strategies; climate change and emissions reduction targets and action plans; water strategies; green building policies; ongoing reviews of education, training, and apprenticeship programs; green elements in innovation plans; renewable energy strategies; some publicly-funded research and development; and commissioned studies on the green economy and green labour market. Provinces and territories are working on offering training for the developing green economy through university, college, vocational, and private training programs such as:
- "Explicitly Green Programs" have emerged to meet the needs of the green economy in sustainable or conservation-oriented areas. These include programs in areas such as: renewable energy development and support, energy assessment programs, and green-focused building design programs.
- "Traditional Green Programs" including environmental studies programs, environmental protection fields, and environmental engineering-related studies.
- "Programs with Green Elements" that promote green elements in an otherwise traditional field of study (e.g. commerce, MBAs, etc.), in the form of courses, job options, or fieldwork.

  Canada's environment industry is characterized by growth, diversity and on-going developments within the fields of science and technology. In order to help define this dynamic sector, ECO Canada has identified three core areas of specialization: 1) Environmental Protection, 2) Conservation and Preservation of Natural Resources, and 3) Environmental Sustainability. Within these categories of the environmental sector there are a broad spectrum of employment opportunities including (but not limited to) Air Quality, Water Quality, Waste Management, Fisheries and Wildlife, Mining, Energy, Research and Development, and Communication and Public Awareness.

- In **Chile**, the National Policy of Education for Sustainable Development, supports initiatives coming from the private sector and NGOs that are aligned with plans that help move towards a green economy. One important nonprofit private institution that deals with the TVET sector and job market is *Fundación Chile*. Through its the *Human Capital Project*, Fundación Chile has innovated its management and development by transferring labor competence standards and management and learning technologies that has raised the organizations' competitiveness. This impact aims at providing 15 production sectors, 394 companies, and 82 workers and students with more job skill certifications, training in employability, and digital literacy. Large strategic guidelines include developing of a National System of Labor Competences, employability and the labor market, and upgrading of education and training, human capital and innovation management in companies, company networks, and clusters. Fundacion is also strong on environmental and sustainability issues, developing different workshops with diverse audiences. For example, they developed the workshop "Measuring Sustainability" joined with ProChile and Walmart Chile. Fundación Chile was also selected among 100 sustainable initiatives worldwide by the United Nations and the Euro-Brazilian Sustainable Council–EUBRA Initiative, and was included in the "Bright Green Book" or "Green Book for the 21st Century" because of its contributions to promoting a green economy.

- **Mexico's** Secretariat of Environment and Natural Resources recognizes and aids 17 NGOs that deal with energy savings programs, usage of solar energy and clean technologies, promotion of sustainable development, scientific collaboration, climate change, eco-agro-industry, forest preservation and other sustainability-oriented programs. The web page http://ong.tupatrocinio.com/medio- ambiente- mexico- c16- p12.html reports 27 NGOs that deal with environmental issues, with bases in 13 States (out of 32 States). These NGOs have developed formal financial programs based on social cooperation and some work towards preservation of natural resources, particularly with indigenous populations, and tutoring and cultural programs to educate children and young people on the need to preserve the ecology.

- At the end of 2009, **Chinese Taipei** organized an Energy Savings and Carbon Reduction Promotion Committee. One of the roles of the committee was to connect Chinese Taipei with the United Nations Framework Convention on Climate Change (UNFCCC). Chinese Taipei has also been working through its economic ties in various economies in their region to promote green growth, including co-organizing the 22nd Joint Economic Cooperation Meeting between the Federation of Thai Industries and Chinese International Economic Cooperation Association.

- In **Thailand,** a number of green manufacturing companies – such as the Fujikura (Thailand) Ltd., Canon Hi-Tech (Thailand) Ltd., and Daikin Thailand –

are providing upgrading in specific emerging new greens skills for their employees through training courses designed by the parent companies and designing job descriptions for employees whose work in occupations being transforming by greening.

- Since the mid-2000s the **United States** Government has implemented initiatives to promote coordinated economic and workforce development at the regional/metropolitan level, including the President's Interagency Taskforce for the Advancement of Regional Innovation Clusters, discussed in a previous question (2.2).

Question 5.2 - ***How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?***

Summary of Responses: *Slightly more than half of respondents reported that "intermediary" organizations help to coordinate green growth efforts with TVET and other education systems. A majority of economies reported businesses and industry as the primary contributors to the development of TVET systems.*

Synopsis of APEC Economies' Responses:

- **Australia's** Green Skills Agreement is overseen by a high level representational body: the Green Skills Agreement Implementation Group (GSAIG). Members include Adult Learning Australia; Australian Chamber of Commerce and Industry; Australian Council of Private Education and Training; Australian Council of Trade Unions; Australian Industry Group; Australian Commonwealth, state and territory governments; The Australian Technical and Further Education (TAFE) Directors; and Universities Australia. The make-up of the GSAIG ensures that a wide range of groups from government to community, business, union and educational organizations are involved and have input in the implementation of a key government strategy aimed at ensuring the development of appropriate training as Australia moves to a sustainable, low-carbon future.

- **Chile's** government encourages internships and other initiatives coming from firms, NGOs and unions that will offer students on-the-job experiences related to supporting a sustainable economy. As mentioned in a previous response, the dual training system provides a way of involving organizations outside the Ministry of Education. Also some companies own and fund schools. Nonetheless, coordination is still a challenge for the TVET educational system at the secondary and higher education levels.

- In **Mexico**, the National Academy for Environment Education (ANEA) has taken several actions to promote public recognition of the need to preserve the environment. One such action has been to publish third-party research results relating to a sustainable environment.

- **Chinese Taipei's** BEVT's branch offices coordinate and intensively integrate the resources of local NGOs, institutes, associations, trade associations, colleges and universities by means of seminars and workshops to acknowledge the demand for green industries. Chinese Taipei also promotes the "Industrial Talent Investment Program" and the "Assist Enterprises to Upskill Workforce Program," to provide green energy skills of existing workers. As a way to involve youth in the green areas and integrate industries, campuses and training VETs, a subsidized collegiate and university employment program invites green-related private sector experts to teach in courses such as energy-saving motor integration, green energy industries, energy management, soil environment manager, and environment quality and green product monitoring. There is also a Student Trainee Program provided by BEVT for teenagers to participate the professional skill cultivation programs (e.g., Solar energy application), providing trainees with instruction in theory and hands-on practice.

- **Thailand** encourages its private TVET enterprises to propose training programs that the branch offices then sponsor or subsidize to cultivate the skills in demand. The Ministry of Industry has organized various training courses for industries and establishments using a "green" curriculum. One such project involves the Thailand Automotive Institute and the Electric and the Refrigeration and Air Condition Association working closely with universities and training institutes to provide upgrading courses to achieve green jobs. Some examples are the training of Department of Skill Development's instructors and teachers of vocational schools on green substance for air-conditioning refrigeration, modifying auto machines for LPG, NGV. Another example of a green project is the Youth Camp organized by Public Company Limited (PTT), which enhances informal education and skill development for youths. This includes the Generation P Energy Conservation Youth Camp, now in its 11th consecutive year, which provides 80 children from various schools the opportunity to attend camp with instructors and green learning activities. Students attending this camp are required to make use of the knowledge received from the camp for the development of 20 projects under the concept of 'New Energy, Sufficiency Energy from School to the Community' during a six-month period. This year's winning project was "Changing the wind into alternative energy," belonging to Muang Phon Phittayakhom School and earning team members scholarships and entitlement to further their studies at the Faculty of Engineering of Khon Kaen University.

- In the **United States**, U.S. Department of Labor's (USDOL) green jobs training grants involve partnerships between numerous stakeholders, including the public workforce system, educational institutions, employers, labor unions, and community-based NGOs. For example, in June 2011, USDOL awarded a total of $38 million in Green Jobs Innovation Fund (GJIF) grants to organizations such as a labor union sponsored training center, a state workforce agency, an industry sponsored training center, and several NGOs, in 19 states and the District of Columbia. The GJIF funds are helping organizations with existing career training programs to build sustainable green career pathways that include attainment of industry-recognized skill credentials, forge linkages between Registered Apprenticeship and pre-apprenticeship programs that prepare underrepresented populations to enter apprenticeships, and/or deliver integrated basic skills (e.g. literacy, numeracy and job readiness) and occupational training through community-based NGOs.

Question 5.3 - ***Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?***

Summary of Responses: *All APEC economies provided specific examples of strategies and practices that help align and coordinate green growth efforts with business, industry, training and education sectors as well as the economic development sector. Strategies cited were wide ranging and included: developing a campaign to reduce water usage; reviewing apprenticeship program standards through the lens of green processes and technologies to change practices; developing a region-wide green school curriculum; and developing new competencies, working with the automotive industry to speed the growth and development of skills in emerging green vehicle design technologies.*

Synopsis of APEC Economies' Responses:

- **Chile's** government promoted a grant project where female entrepreneurs presented their business ideas that were aligned with a sustainable economy vision. The project that presented the best combination of profitability and green growth was the winner. "Know Your Water Footprint" Initiative, which promotes the sustainable and efficient use of water, is another example of good practice, which came about in the midst of an energy crisis resulting from the drought that battered several regions in the economy. This initiative aims to foster discussion and decisionmaking among all interested parties by sharing information about water resources and its footprint, including news, experiences, projects, and best practices in water management. The Municipality of Vitacura and Fundación Chile began their "Know your Water

Footprint" campaign and presented the results of the first phase publicly by engaging eight well-known public figures. As part of this first stage, Fundación Chile measured the Water Footprint of the community's Civic Center and its Bicentenary Park, making Vitacura one of the first municipalities internationally to undergo this measurement. The goal is to encourage all citizens to measure their own water footprint.

- **Canada's** Manitoba Province is a prime example of working on linking TVET with the green economy and green jobs on multiple fronts. The Manitoba Education department is currently conducting a survey that is designed to gather information on Education for Sustainable Development (ESD) in technical and vocational institutions. The information collected will be used as a directory of best practices that can be replicated or developed for new sustainable development initiatives within their TVET system. At the provincial and territorial level, Manitoba is working on the links between TVET and Green Economy/Green Jobs. Manitoba Education has also created a Guide to Green Jobs and Sustainable Careers (still in draft form), which provides available definitions of a green economy and green jobs. Manitoba Education, in partnership with the International Institute for Sustainable Development, hosted an intergovernmental workshop on Green Jobs/Green Economy. The purpose of this meeting was to open a discussion on how to begin to prepare young people to help build a green economy in Manitoba.

  Apprenticeship Manitoba in the Department of Entrepreneurship, Training and Trade, has also committed to review changes to program standards through the lens of green processes and technologies. This review occurs through the Apprenticeship Board and the Program Standards Standing Committee. As a part of its Strategic Plan, the Board has also identified the designation of new trades as a primary priority. The Community Liaison Standing Committee will continue to expedite the review of potential trades, including those occupations that support the green economy or include green practices, as they are brought forward through formal requests by industry. Further, Manitoba Education's Technical Vocational Initiative (TVI) received funding in March 2011 to develop a new sustainability focus including green technologies, and alternative and renewable energy sources that will focus on programming in energy-efficient and sustainable technologies with emphasis on geothermal, biomass, solar and wind. TVI`s curriculum is undergoing review and revisions so as to reflect the increasing importance of sustainability and "green" issues relative to skills development.

- **Japan's** Education for Sustainable Development (ESD) program has been implemented in society as a whole including industry and schools, to promote

green growth. Through cooperative projects between industries and schools, ESD has promoted activities based on Corporate Social Responsibility.

- **In Mexico,** the annual Award for Environmental Merit, which is bestowed by the President of Mexico, has examined 1,453 initiatives presented by social, education, government and non-government institutions since 1993. This award covers 6 categories: research, individual initiatives, social proposals, formal environment education, non-formal environment education, and environment communication. In addition, in 2007, the institution "ProMéxico" was created as an agency of the federal government whose mission is: the coordination of strategies directed to strengthen the participation of Mexico in the global economy; aiding export business and coordinating foreign investment; and helping to promote the usage of clean technologies and of renewable energy sources. In 2010, Mexico produced 13,210 megawatts (24.2% of the overall energy generated in the economy) of clean electrical energy based on renewable energy sources, including hydroelectric (84.6% of the total), geothermic (7.3%), biomass (4.2%), and wind (3.9%).

- **Chinese Taipei** promotes courses relating to the environment and green energy, encourages the workforce to initiate the learning to acquire green skills and knowledge, and supports enterprises to sponsor courses to upskill the workforce for the emerging green economy.

- **Thailand** has implemented "The Green Project" in local schools on Samui Island in the south of Thailand. As a result, in 2008, two of the Thai Hotel Association's member-resorts combined to sponsor a local school on Samui Island. The two resorts pooled their resources to create "The Green Programs" which organized trips to see working examples of conservation and recycling as part of the school's curriculum. It was hugely successful and more schools were included, and similarly paired with nearby resorts. This "green" program of school fieldtrips and activities has been refined and expanded. Student projects were extended to include their local communities and school curricula. Before the end of 2010, all of Samui's 18,000 students were participating in "The Green Programs." In just two years, by working together, resorts across the island and local officials succeeded in making the Regional Green School Curriculum a part of all 26 government managed schools. In addition, the Office of Vocational Education Commission (Ministry of Education) has successfully promoted cooperation with the private sector in dual vocational training (DVT), by providing training allowances for the trainees or the private sector, or the training curriculum developed to be targeted at the job in the workplace.

- In the **United States**, a successful initiative to support the "greening" of the automotive industry was recently highlighted in an U.S. Government

Accountability Office report about collaboration between the business and industry sector with the training and education sectors to support workforce needs in critical U.S. industries. The Michigan Department of Career Development, the state-level public workforce agency, created the Michigan Academy for Green Mobility Alliance (MAGMA) to speed the growth and development of skills in emerging green vehicle design technologies. The academy classes are offered to incumbent and displaced engineers and technicians. The state workforce agency's partners, in addition to six Local Workforce Investment Boards, include multiple automotive manufacturers and suppliers (including the "Big Three" firms—General Motors, Ford, and Chrysler) and multiple education providers. Major contributing factors in the project's success included employer input into the training curriculum and MAGMA staff becoming knowledgeable about the engineering competencies needed in the automotive industry.

Chapter 2: APEC Symposium on Human Capital Policies for Green Growth and Employment – Summary of Proceedings

2.1 - Introduction and Symposium Themes

The APEC Symposium on Human Capital Policies for Green Growth and Employment was held on March 20-21, 2012, in Washington, DC, USA, with 44 representatives from 16 APEC economies in attendance. The project Symposium offered informative presentations and discussions on strategies to help establish sustainable approaches to economic development in APEC economies, examined the policies, programs, and promising practices in the preparation of skilled workers for an emerging green economy, and provided considerations on implications for developing APEC economies. Recognizing that the transition toward a sustainable economy is urgent to address both high unemployment for vulnerable populations, especially in developing economies, and the increasing environmental costs of current patterns of resource utilization, the APEC Symposium centered on four topics: (1) Science, Technology, Engineering, and Math (STEM) Education for Sustainable Development, (2) The Vocational Education and Training System's (TVET) Role in Green Growth and Employment, (3) Role of Intermediaries and Strategic Partnerships in Green Growth and Employment, and (4)Employer Engagement, Economic Development, and Job Creation.

APEC economies at all levels of development were represented at the symposium. Common themes emerged from the two days, even though economies are implementing different green growth strategies and are facing different challenges and opportunities. The common themes included:

- Building the Capacity of Technical Vocational Education and Training Systems for the Green Economy
- Ensuring Inclusive Growth and Pathways Out of Poverty
- Innovative Strategies and Partnerships for Promoting Green Growth and Employment

❖ 2.1.1 Building the Capacity of Technical and Vocational Education and Training Systems for the Green Economy

A theme throughout the symposium was the importance of building the capacity of the TVET systems to meet the growing demand of skilled workers in a vibrant, inclusive green economy. Significant success can be achieved if these systems educate and prepare a quality workforce with the right skills to enter into family-sustaining green employment opportunities, particularly if they include vulnerable populations that are usually left behind by economic growth and technology. Several of these challenges and opportunities identified during the course of presentations and discussions, include:

- Understanding and Accessing Labor Market Information to Identify Current and Future Green Skills and Competencies Needs
- Creating Skill Standards, Credentials, and Career Pathways

- Leveraging Resources to Create and Enhance Green TVET Programs
- Closing the Skills Gap
- Creating Professional Development Opportunities for Teachers/Faculty/Trainers

Understanding and Accessing Labor Market Information to Identify Current and Future Skills and Competencies Needs

Many participants in the symposium spoke of the ability to access and understand labor market information on "greening occupations and industries as an essential component for the design and delivery of effective TVET programs, while recognizing the difficulties of gaining and organizing this information. By accessing and analyzing labor market information on green sectors, APEC economies could: identify and anticipate current and future skill needs and gaps, design and implement new or enhanced training programs,, and measure impact and value of training for industry. Several APEC economies discussed political, cultural, and business environments that were not conducive to growth in the green economy and where advocates for sustainable development struggle to explain the relevance of training programs to the labor market. Some economies such as the United States have invested in the last few years in enhancing national, state, and local market systems and conducting research studies on the definition of green jobs to help ensure that education and training programs are aligned to real jobs and credentials. The need to develop public-private partnerships and skill sector councils with TVET programs and to link labor market information with green growth strategies were also highlighted.

Implications for Developing Economies: For many developing economies, accessing and organizing labor market information is extremely difficult because there is no formal process or coordinated system. Developing economies will need to gain this information through partnerships with industry and/or conduct research at the local and regional level. A dialogue with other APEC economies to share promising practices working with public-private partnerships and conducting research could prove useful.

Creating Skill Standards, Credentials, and Career Pathways

Panelists at the symposium noted that while the formal level of education completed by potential employees is easy to identify, it is often difficult to document the competencies possessed by graduates of schools and training programs. Even if TVET programs are equipping students with the tools that are needed to succeed in the sustainable economy, without credentials that are validated by employers and are portable in the labor market, progress will be hampered. Credentials that are measurable and give workers specific skills along a pathway to advancement, while meeting employers' skill needs are critical,, particularly with vulnerable populations. There has been some success in APEC economies to achieve this goal, but there is still much work to be done.

Representatives from member economies recognized the difficulty in achieving industry recognition and deciding which credentials are the most important for employers. Most programs mentioned during the symposium that have succeeded in developing standards aligned with industry-recognized credentials possessed strong partnerships with industry and labor unions, such as apprenticeships. Developing and validating skills standards and create career pathways requires intensive and extensive work that can include research, focus groups, expert analysis, mapping out all occupations, development of a competency model, and industry-wide review and requires collaboration between many involved parties. Marcy Drummond (USA) spoke about energy efficiency career pathways created by Los Angeles Trade Technical College, which was defined as a sequence of postsecondary training and education programs, with supportive services, designed to enable individuals living in communities of poverty to access a college education, gain postsecondary and industry-recognized credentials, and attain an occupation that pays family-supporting wages and offers opportunities for advancement and growth in the emerging green economy. During the symposium, several APEC economies noted the importance of linking policy and resources to TVET institutions that offer these types of programs with industry-recognized credentials.

Leveraging Resources

Leveraging resources to create new and enhanced TVET programs for the green economy may be difficult without public-private partnerships and even more difficult, for developing economies with limited access to resources. The uncertainty of the global economy and the reluctance of many potential supporters to invest in the green economy can make resources difficult for both new and existing TVET programs to obtain. Symposium participants recognized that one way to overcome this difficulty is to improve the ways in which training providers measure their progress. If the methods programs use to track and measure their progress are improved, securing both financial and institutional support can be made easier. Bruce Pearce (Canada) suggested that better methods and models for tracking programs' progress could open doors to more diverse providers of funding and resources. Government grants were recognized as the primary source of funding for sustainable development; however, the need for diversification was also identified. Olga Strietska-Ilina (ILO) noted that while government funding has provided an initial stimulus for sustainable development, future growth would depend on support from other sources. An example of an alternate form of resources mentioned at the symposium was social impact bonds. Support from social impact bonds and other sources, however, will require data to show the relevance and improved outcomes of training programs.

Implications for Developing Economies: Utilizing innovative financial mechanisms to develop, adopt, and scale green TVET programs such as social impact bonds were suggested by several symposium participants .

With limited resources and infrastructure, one recommendation that came out of the symposium was the need to increase green commitments of developed APEC economies and multilateral organizations to support developing economies to encourage technology transfer, investment, and skills to strengthen the green economy.

Closing the Skills Gap

At the symposium, participants agreed that without an adequate supply of skilled workers, the green economy would not be able to reach its full potential. Although the green economy is still emerging, several symposium participants reported a current skills gap that businesses are facing in certain sectors such as energy efficiency and the importance of TVET programs and systems to help fill the shortage of skilled workers. To overcome this challenge, symposium participants acknowledged that more efforts must be made in designing and executing of high quality, education and training programs that respond to industry's need, improving access to apprenticeships programs, building partnerships with NGOs to develop the "worker" pipeline, by making these programs more accessible to workers at all skill levels, and developing more effective curricula and customized programs for new and incumbent workers.

Implications for Developing Economies: Some participants acknowledged that these solutions may be more difficult for developing economies to increase capacity of formal education and training systems and institutions because of the lack of infrastructure and human and financial resources that will be needed to facilitate the closing of the skills gaps. Participants suggested that the promotion between different interests and institutions across the APEC region to share ideas, practices, policies and market realities could help the progress of green growth for developing economies.

Preparing and Training Teachers

A major concern addressed throughout the symposium was teacher preparation for the emerging green economy. While much of the discussion about common challenges was devoted to the identification of necessary skills and closing the skills gap for employers and workers, it was recognized that without properly trained teachers all efforts to overcome other challenges would be marginalized. Even if training programs possess the best curricula and customized solutions, participants acknowledged that they would fail to achieve goals, if instructors are not properly trained. The skills required of competent workers in the green economy change rapidly. As a result, teachers must undergo continuous training and professional development to keep up with industry demands and the latest technologies. Examples were presented by APEC economies of opportunities for teachers including industry internships, research, learning communities, and virtual courses and workshops.

Implications for Developing Economies: Symposium participants stated the importance of using low-cost and no-cost materials, including Open Education Resources, to train teachers in developing economies for green skills and competencies and that sharing and exchanging curriculum, teachers guides and other materials from more developed APEC economies would help reduce cost and duplication of effort.

❖ 2.1.2 Ensuring Inclusive Growth and Pathways out of Poverty

The impact of APEC economies' different rates of economic growth in the transition to a green economy remains unclear. However, most symposium participants recognized that reducing the environmental costs of current patterns of resource utilization in conjunction with intentional poverty reduction efforts, could potentially benefit vulnerable populations and developing economies in multiple ways. Many of the second day symposium discussions were devoted to discussing inclusive growth and the role of vulnerable populations in the green economy. APEC economies are working with all involved parties, including communities, education and training providers, businesses, labor unions, government, and NGOs, to design and deliver training programs and green pathways that provide the skills necessary for new and expanding green jobs, including pathways for vulnerable populations to enter these jobs.

Symposium participants described several ways through which inclusive growth can be achieved. The Philippine model described by Lynette Yu-Bautista is based on a two-pronged strategy. The first part of the strategy focuses on the deliberate targeting and prioritization of vulnerable populations in selection for green training programs. Initially, the government identified the poorest localities and then selected residents of these areas to receive assistance and training for sustainable employment. The Philippine government also took steps to modify and improve training programs. The second part of the Philippine strategy was aimed at corporate social responsibility. Although the interpretations of corporate social responsibility vary across member economies, all believe that corporations possess some level of obligation to their employees and the communities they operate in. The Philippine model is based on the belief that the greening of the economy and the uplifting of the poor are closely connected. This belief drives government efforts to convince corporations that their investments should not be strictly defined by profits, but that resources and funding should also be set aside for sustainable development.

In Canada, a somewhat different model for inclusive growth is being embraced. Programs have been implemented which employ homeless youth on green construction projects. These programs not only provide vulnerable youth with hands-on experience in the sustainable economy, but also help to pull them out of poverty. Symposium participants acknowledged that there is no cookie cutter model for inclusive growth and that the methods used by member economies will

likely vary. Currently, there is much progress being made throughout the APEC community in the effort to foster inclusive growth. Participants agreed that further discussion would be beneficial.

❖ 2.1.3 Innovative Strategies and Partnerships to Promote Green Growth and Employment

Strong commitments and policies that prioritize investments in green growth from APEC economies will be crucial to maximize the implementation of green economic development and employment strategies. Symposium participants articulated and highlighted these commitments and policies. Although many APEC economies are at different stages in the process of implementing green growth strategies, several overarching strategies were identified:

- Education for Sustainability/Environmental Literacy
- Partnering with Small and Medium Enterprises
- Upskilling the Workforce

Education for Sustainability (ESD)/Environmental Literacy

Participants from multiple APEC economies discussed the importance of helping multi-generations acquire the knowledge, skills, motivation, and attitudes to act as environmental stewards who will protect and preserve the environment. By creating environmentally literate populations that act and influence others, APEC economies will have a greater ability to achieve a sustainable world and green economy. Masa Goto (Japan) discussed the central investment to building the economy around sustainable approaches lies in primary and middle school education that teaches about sustainable systems and through upper secondary and postsecondary education to give people the skills and competencies they need to become workers in the emerging green economy. In Japan, the government has begun to integrate education for sustainable development into primary and secondary school curricula and ESD became an official course offering throughout Japanese schools in March of 2008. The Japanese model recognizes the importance of effectively preparing both students and teachers. Other APEC member economies have made similar efforts to introduce environmental education into the classrooms. In the United States, the State of Maryland was the first to mandate environmental literacy as a requirement to graduate high school. Martin Riordan of Australia discussed that the principles of sustainability, sustainable growth, and sustainable well-being have now become a fundamental tenet in Australian education policy. Further, Australia created the Green Skills Agreement (GSA) that ensures that governments work collaboratively with employer and employee representatives, the TVET sector, and community organizations to ensure that training in, and the delivery of, skills for sustainability is an integral part of all vocational education and training and is relevant to the needs of industry.

Partnering with Small and Medium Enterprises

Many participants from different APEC economies discussed partnerships between governments and small and medium enterprises (SMEs) to strengthen the sustainable economy. Because SMEs provide the backbone for much of the economic development throughout the APEC region, their support is necessary to sustain green economic development. Several symposium participants stated that demand for green skills is mixed, among SMEs, because they may either be unaware of practices in green skills or have not prioritized green skills in a competitive business environment. Several participants stated that in order to overcome this challenge, TVET systems could help educate SMEs and communities about the value of the green economy and governments should develop public policies that can build a market framework that encourages the development and adoption of greener products, services, and technologies. While developing economies may lack the infrastructure and resources to develop new green technologies, they could still benefit if these technologies are rapidly deployed to these economies at a reduced cost. In addition, the role of social enterprises and entrepreneurship was discussed, with several APEC economies including Mexico, Republic of Korea, and the United States, having very active participation in this area. Several participants also highlighted examples of partnerships with enterprises, including incentives and subsidies to build relationships and promote new markets.

Upskilling the Workforce

The expected structural changes in the transition to a green economy will most likely result in the need to enhance and redefine workforce skills and competencies. With an increased demand for skilled workers and limited transferability of skills among sectors, workers will need to be retrained. APEC member economies recognized that retraining workers and creating lifelong learners will play a major role in sustainable economic development. While many TVET programs target new workforce entrants, the green economy has the potential to create jobs for individuals at various stages in their lives and careers. In order for members of today's workforce to take advantage of green employment opportunities, significant efforts must be taken to develop upskilling programs, since most of the employment opportunities will be in existing occupations and industries, as stated throughout the symposium. Further, if these workers are not retrained they will mostly likely end up unemployed or be forced into low-wage employment, creating a cycle of poverty that will difficult to escape. It was noted in the symposium that unionized employers more often offer continuing training opportunities. Multiple examples were highlighted on retraining workers for green occupations and industries.

2.2 - Summary of Symposium Events

Thirteen presentations were delivered during the symposium. The topics covered by presenters and panelists ranged from environmental literacy programs to green job creation. This section contains a summary of the presentations offered during the symposium and some of the specific topics addressed. Full summaries of all presentations can be found on the APEC HRDWG Wiki.

March 20, 2012

Symposium participants were welcomed by Education Network (EDNET) Coordinator, Adrianna de Kanter (USA). After providing a brief description of APEC and the organization's goals, de Kanter outlined the purpose of EDNET and the themes that drive the group's future efforts. Following de Kanter, remarks were made by U.S. Department of Education Under Secretary Dr. Martha Kanter. During her presentation, Kanter addressed several overarching education topics including the need to increase the number of students with a college education, promote policies for a sustainable future, rebuild the crumbling infrastructure of underserved schools, and prepare a skilled green workforce. After the welcome and opening remarks, the STEM themed session was held. The session was chaired by Kimberly Green (USA). Ms. Green gave an overview of the U.S. federal government's efforts to guide innovation through the development of career clusters. These clusters help to link secondary and tertiary education with industry in order to better prepare students for the green economy. The members of the panel were San Gee (CT), Masakuza Goto (JPN), Steve Barry (USA), and Dr. Jackrit Suthakorn (THA). San Gee addressed efforts being made in Chinese Taipei to infuse environmental education into the curricula of primary and secondary schools. Emphasis was placed on the use of both top-down and bottom-up policies by the central government to promote environmental education. Examples of methods described during Gee's presentation were the establishment of a support team mechanism (top-down) and the creation of activities to promote environmental education (bottom-up).

Masakazu Goto spoke next on the Japanese model for building a framework of quality education for sustainable development. Key points of Mr. Goto's presentation were the importance of the development of teacher training programs and the creation of linkages between teaching materials, people, and societies. Stephen Barry completed the panel by presenting on the measures to improve environmental literacy being taken in the State of Maryland. The Maryland program utilizes an integrated instructional approach to provide over the course of a student's academic career to ensure that graduates possess not only the knowledge and skills, but also the motivation to practice sustainability. Points emphasized by Mr. Barry were the benefits of effectively motivating students' interest in environmental education and a systemic and systematic approach to curriculum alignment. The presentation portion of the STEM session was concluded by Jackrit Suthakorn. Mr. Suthakorn presented on the use of robotics

competitions to engage Thai students and encourage them to enter into STEM fields. The Robocamp at Mahidol University allows youth to engage in a variety of robotics competitions at both the local and international level. The program is designed to not only inspire participants to further pursue STEM field but also provide some skills, which can be used upon entry into several high demand industries.

The first day's lunch session was accompanied by a presentation from Martin Riordan, CEO of the Technical and Further Education (TAFE) Directors Australia. During his presentation Mr. Riordan provided an overview of the Australian Green Skills Agreement, focusing on the policy context, industry perspectives, and the challenges and opportunities of the TAFE Institutes created by the Agreement. Some of the challenges mentioned by Mr. Riordan were the training and recruitment of competent teachers and the designation of leaders from different sectors. Although there were challenges associated with the Australian model, during both the presentation and question and answer period, its was proposed as a foundation for future discussions.

The lunch period was followed by a session on the TVET system and green growth, chaired by Sarah White (USA). During her opening remarks, Ms. White addressed the work being done at the Center on Wisconsin Strategy to advance green workforce development. Ms. White emphasized the need to build a more coherent, skill development system, to establish a national qualifications framework, and build industry partnerships in greening sectors. The remaining members of the panel were: Wang Wenjin (PRC), Dr. Young Saing Kim (ROK), and Gustavo Flores Fernandez (MEX). Wang Wenjin presented on the green employment and government sustainability policies in the People's Republic of China. During the presentation, Mr. Wenjin described some of the methods used by the government to foster sustainable growth, which include accelerating transformation by adjusting industry structure, reducing reliance on non-renewable energies, and promoting economic development while also preserving the environment. The presentation also detailed the challenges that capital investment and technology bottlenecks have created for the system. Dr. Young Saing Kim's presentation focused on efforts in the Republic of Korea to further promote sustainable growth. He discussed the overall strategy for green growth, which includes changing people's behavior, greening the current system of standards and qualifications, and partnering with small and medium enterprises. Dr. Gustavo Flores-Fernandez brought the session to a close with a presentation of Mexico's strategy for sustainable growth. Dr. Fernandez discussed general strategies for economic development and clean energy promotion while also explaining how the nation's education agenda aligned with such policies. Many participants in the session described the common challenges to creating, sustaining and measuring effective TVET programs that could link workers to jobs in the green economy. There was widespread recognition of the need for

governments, NGOs, labor, and industry to partner together to ensure that curricula and education and training programs meet industry's needs.

The first day of the symposium was concluded with a session focused on the role of intermediaries and strategic partnerships in green growth and employment. The session was chaired by Olga Strietska-Ilina, a representative of the United Nations International Labor Oragnization (ILO). During her opening remarks Ms. Illina addressed some of the adverse effects that a systemic transition towards a sustainable economy will create. The predictions put forward during her presentation were supported by a 21-country study recently conducted by the ILO. Some points focused on were the many uncertainties associated with sustainable development, including the restructuring that will most likely result in the creation of new employment opportunities as well as the elimination of some jobs. The remaining members of the panel were: Eduardo Cuevas Rosselot (CHL), Bruce Pearce (CDA), and Marcy Drummond (USA).

Mr. Cuevas' presentation discussed the effects of green growth on vulnerable populations, particularly youth between the ages of 20 and 24. The Chilean model uses three steps: a classroom phase, tutoring or internships, and effective work placement, to prepare youth with the necessary tools to participate in the green economy. Mr. Cuevas also discussed the important role that partnerships between different sectors would play to ensure that equitable, sustainable growth. Mr. Pearce addressed the use of youth initiatives in Canada to further encourage green growth. The two programs he highlighted, Choices for Youth and Warm Up Winnipeg, engage youth in green building employment and provide affordable retrofits for-low income communities. Ms. Drummond presented on green pathways being developed by Los Angeles Trade Tech College, which relies heavily on partnerships with industry, to establish industry-recognized credentials and family-sustaining jobs. The question and answer segment of the session raised three common themes:

- Need for data and intermediary funding models that show a return on investment
- Need for strong partnerships to build pathways
- Importance of government investments/subsidies until markets for green goods and services are thriving

March 21, 2012

The Symposium's second day began with a welcome and keynote address from Jane Oates, Assistant Secretary Jane Oates for the U.S. Department of Labor, Employment and Training Administration, who stated, "There should be no wrong door for young people and veteran workers who are looking to enter a new sector or retool to stay competitive in their existing sector." The Assistant Secretary emphasized the need to break down cultural behaviors and institutional barriers, that delay sustainable growth. Following the welcome and keynote address, Mitch

Horowitz (USA) led a discussion on advancing green economic development strategies and leveraging collaborations. He presented research being done on sustainable development at Battelle, the world's largest non-profit research and development laboratory. Mr. Horowitz identified four crucial steps to green growth in the education sector: understanding your assets,, conducting cluster analyses, mapping clusters to industry strengths, and identifying core competencies. Beyond the scope of education programs, he identified necessary measures for achieving green economic growth, which include the need to communicate effectively with industry, provide incentives, and accurately measure progress. Strategies for promoting green economic development and leveraging industry-education collaborations were discussed during this session and throughout the symposium.

The final themed session of the symposium focused on employer engagement, economic development and job creation, chaired by Graham Larcombe of the Organization for Economic Development (LEED) project. Mr. Larcombe identified six major challenges to sustainable development: 1) strengthening the green growth paradigm, 2) increasing APEC economies' green commitments, 3) promoting institutional interaction, 4) finding cost-effective solutions, 5) integrating the APEC globalization agenda with sustainability, and 6) increasing investment in knowledge and skills. The remaining members of the panel were: Kevin Allen (USA), Alwine Woischnik (CHL), and Grant Shmelzer (USA). Mr. Allen addressed the efforts being made by the District of Columbia Property Assessed Clean Energy (PACE) to make the financing of energy efficient retrofitting easier. The program to create a commercial retrofitting market for energy-efficient building retrofits in Washington, DC with funds generated from local property taxes.

Ms. Woischnik discussed the Chilean model for sustainable development and the challenges and opportunities associated with it. Points of emphasis were the distinction between green and sustainable jobs, the roles of civil society, government institutions, and competitiveness in the green economy. Mr. Shmelzer's presentation described how apprenticeship programs help to upskill the workforce and prepare vulnerable populations for entry into the green economy.

The second day's lunch period was accompanied by presentations from Michelle Fox, Chief Workforce and Education Strategist at the U.S. Department of Energy and Neil Butcher, an Education Impact Fellow. Ms. Fox addressed the National Training and Education Resource Center (NTER), an open source platform used as an e-learning repository with advanced capabilities. The highly customizable system allows learners from various locations to conveniently acquire new skills. During her presentation, Ms. Fox discussed the next steps for NTER: use of energy-focused training tools, duplication of efforts in other economies, and the use of central repositories for best practices. Mr. Butcher discussed the Open

Education Resources (OER) APEC project and stated that green growth and employment is an ideal vehicle to harnessing the potential of OER to transform educational practice, introduce significant cost efficiencies into TVET in this area, and facilitate rapid, open sharing of knowledge in a swiftly changing field. The next session included a discussion of Rio +20, led by Lawrence J. Gumbier (USA) and Kathy Schalch (USA). Rio +20 is a gathering of world leaders, held in June 2012, with the goal of identifying pathways towards a greener economy. The event was intended to provide leaders with venue to share best practices, create partnerships, and develop strategies for eradicating poverty while preserving natural resources. A key focus was the position of vulnerable populations in sustainable development plans.

The Green Growth Symposium concluded with a wrap up session, moderated by Jee-Peng Tan of The World Bank. She began the session with a presentation on The World Bank's efforts to assist governments in the identification of gaps and creation of strategies and pathways. The panel was comprised of: Anastasia Filichkina (RUS), Pham Kim Thanh (VN), and Lynette Yu-Bautista (RP). Ms. Filichkina addressed the need to better connect training to needs, create mechanisms and develop ways to fill gaps in training programs. Phan Kim Thanh presented on the ESD in Viet Nam. The Vietnamese model aims to provide students in both the primary and secondary levels with the knowledge, attitude, and life skills to be active participants in the sustainability movement. Some methods mentioned during the presentation were solidifying the legal framework for ESD, raising awareness in communities and improving teacher training programs. Ms. Bautista presented some of the ecological constraints the Philippines faces and strategies being used by the government to overcome them. The conversation was initiated by the panel and provided an opportunity for symposium participants to identify common challenges, implications and recommendations for green growth and employment in APEC economies.

As part of the wrap up session, participants were asked about recommendations, outstanding questions, and lessons learned to move the green growth agenda forward. Answers included the need to: clarify and define the differences between education for sustainable development and green growth terms and create a framework for green growth or sustainability, continue to promote more information sharing and integration of best practices across economies, increase focus on cost-benefit analysis of creating a green economy, mobilize resources and financing mechanisms for developing economies to propel green growth and green jobs, increase teacher training opportunities in education for sustainability, reduce impediments for business to invest in green skill development, transform qualification standards for green jobs training, embrace open licensing environments to share and pool resources across economies, integrate APEC's globalization agenda with its sustainability agenda, and increase incentives for developing economies to participate, including diffusing new technologies and

skills to SMEs, and supporting access to clean energy projects and emerging programs.

2.3 - Conclusion

During the APEC Human Capital Policies for Green Growth and Employment Symposium, several pressing issues associated with the transition to a sustainable economy were discussed. Participants identified common challenges member economies face and potential innovative strategies to promote green growth. Many areas were touched on, including: closing the skills gap, developing systems of standards and credentials, employer engagement, upskilling the workforce and creating green education and employment opportunities for vulnerable populations. Symposium participants recognized that if the transition towards a sustainable economy is to be successful, adjustments must be made in all areas of life ranging from the classroom, to the workplace, to the home. APEC economies also agreed on the critical importance of building the capacity of the TVET systems to meet the growing demand of skilled workers in a vibrant, inclusive green economy. Project participants acknowledged that there is no single model of success for all member economies. As was discovered during the presentations and panel discussions, members of the APEC community are very diverse and as a result, will require customized solutions to address challenges. Although the same model may not be successful in all cases, important information can be learned from the study and discussion of each economy's work. The varying circumstances of member economies should not be seen as a hindrance for the promotion of green growth and employment, but instead as an opportunity to maximize opportunities for sustainable growth within the APEC region.

Appendix I: COPY OF APEC SURVEY

Section I: Contact Information

1.1 Contact Person (name and organization):
1.2 Contact Information (e-mail and telephone):
1.3 APEC Economy:

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response:

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response:

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response:

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response:

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response:

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-

recognized certificate, or other credential demanded by the emerging green economy?

Response:

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response:

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response:

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response:

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response:

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response:

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other “intermediaries” helping coordinate green growth efforts with TVET and education systems?

Response:

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Appendix II: APEC Economies' Survey Responses

❖ Australia

Section II: General Questions

2.1 Does **your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.**

Response:

Yes, Australia has three complementary TVET strategies.

Clean Energy and Other Skills Package (CEOSP):
Announced on 12 July 2011, the CEOSP will invest up to $32 million over 4 years to enable tradespeople and professionals in key industries to develop the skills needed to deliver clean energy services, products and advice to Australian communities and businesses. Key occupations targeted include builders and workers in: electrocomms (to promote low-cost energy efficiency design); facility managers (to support better management of existing buildings to ensure maximum performance); engineers (to support whole-process redesign of industrial applications); and financial managers (to ensure good understanding of the business advantages of energy efficiency investments). The CEOSP has four elements:

1. Baseline mapping project - to determine key skills requirements in targeted industries.
2. Trades training - based on the development of priority skills sets for the delivery of energy efficiency training to existing workers in the built environment industry.
3. Professional training - based on the development of an energy efficiency teaching module to provide undergraduate engineering students with the technical skills required to deliver and promote energy efficiency solutions.
4. Integrating energy efficiency skills – funding of projects that enhance workers' energy efficiency skills in the building and construction sectors in 2011 and 2012.

***Green Skills Agreement* (GSA):**
The GSA, endorsed by the Council of Australian Governments on 7 December 2009, is a statement of the commitment of the Australian and state and territory governments to work collaboratively with employer and employee representatives, the VET sector and community organizations to ensure that training in, and the

delivery of, skills for sustainability is an integral part of all VET and is relevant to the needs of industry. The GSA has four objectives:

1. Developing national standards in skills for sustainability within the requirements of the national regulatory framework.

2. Upskilling VET practitioners so they can provide effective training and facilitation in skills for sustainability.

3. Strategic review of Training Packages (sets of nationally endorsed standards and qualifications for recognizing and assessing people's skills) to embed sustainability knowledge, skills and principles.

4. Implementing a transition strategy to re-skill vulnerable workers.
   Work on objective 3 is complete. Work on the other three objectives is progressing.

Skills for the Carbon Challenge (SCC):
The SCC initiative, announced on 23 April 2009, provides national leadership in building the capacity of the tertiary education sector to supply the skills needed for workers and businesses to prosper in a sustainable, low-carbon economy. The initiative supports investment in research to develop a better understanding of the underlying skills issues associated with the transition to a low-carbon economy and appropriate responses. The initiative also supports the Skills for Sustainability – Educational Institution Award, as part of the Australian National Training Awards, to encourage excellence in the delivery of education and training for sustainability.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response:

Together, the above policies and initiatives will help underpin the development of the skilled and qualified workforce required to support the *Securing Australia's Clean Energy Future Plan: The Australian Government's Climate Change Plan*, which will price carbon and drive investment in new clean energy sources (such as solar, gas and wind), energy efficiency and improved land management practices to reduce Australia's carbon emissions. The CEOSP is one element of the plan and targets development of the skills needed to deliver clean energy services, products and advice to Australian communities and businesses.

The policies and initiatives also support implementation of the National Strategy on Energy Efficiency (NSEE), a Council of Australian Governments agreement which

seeks to accelerate energy efficiency efforts, streamline roles and responsibilities across levels of government and help households and business prepare for a price on carbon. The National Energy Efficiency Skills Initiative (NEESI) was developed under the strategy. The NEESI identifies actions to build requisite workforce knowledge and skills for a low carbon economy and implementation of sustainability strategies.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response:
Under Objective 3 of the *Green Skills Agreement*, Australia's 11 Industry Skills Councils reviewed and revised Training Packages to integrate skills for sustainability. This provides Australia's Registered Training Organizations (RTOs) with the opportunity to deliver skills for sustainability training through multiple qualifications, including entry-level qualifications made available to vulnerable groups such as the long-term unemployed and disengaged youth. In addition, Australia's VET system provides a wide range of training services for vulnerable populations to support their entry to and participation in the workforce and community life.

The fourth objective of the *Green Skills Agreement* (GSA) targets development of a transition strategy to re-skill vulnerable workers. To inform the development of the transition strategy, the Australian Government's Department of Education, Employment and Workplace Relations (DEEWR) commissioned a project to identify future green employment and training opportunities and pathways for Indigenous Australians in the Murdi Paaki region of New South Wales as Australia transitions to a sustainable, low-carbon economy. The research, funded through the Skills for the Carbon Challenge initiative, was completed in April 2011. DEEWR also is funding a project to identify map employment opportunities in low-carbon sectors for potentially at-risk workers in Victoria's La Trobe Valley, home to a number of high-emissions brown coal power plants.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response:

The Australian Government is providing more than $639 million from 2009–2013 for specific science and math education initiatives, which will provide the future workforce with core STEM skills that will be essential to green economy. These include a number of school-focused professional development, resource development and assessment projects totaling over $14.1 million for that period and $625 million for reduced student contributions for math, science and statistics units and HECS-HELP remissions for those taking up relevant occupations.

The Australian Government is funding of over $1.97 billion is being applied to a range of other initiatives that are also contributing to the advancement of science and math education. These include:

- The Government's $0.81 billion investment in Science and Language Centres for 21st Century Secondary Schools is enabling 179 new language learning centres, 280 science laboratories and 78 dual facility (science and language) laboratories to be built in schools.
- Smarter Schools: Improving Teacher Quality National Partnership ($550m) is implementing measures that target the teacher 'lifecycle' to attract, train, place, develop and retain quality teachers.
- Smarter Schools National Partnership Agreement on Literacy and Numeracy ($540m) which is promoting the effective use of student performance information to deliver sustained improvement in literacy and numeracy outcomes for all students, especially those who are falling behind.
- Digital Education Revolution online curriculum resources project ($28.6m) is developing online resources to support the Australian Curriculum. The project is focusing on trialing and validating national approaches that can be discovered and shared across jurisdictions.
- Development of the Australian Curriculum ($20 million over four years). The Australian Curriculum: Science is organised around three content strands: science understanding, science inquiry skills, and science as a human endeavour. It uses an inquiry based learning model that will engage students and lead to greater understanding. The Australian Curriculum: Mathematics includes three strands: measurement and geometry, number and algebra, and statistics and probability.
- Promotion of financial literacy in schools, building on the Australian Curriculum: Mathematics and embedded across the curriculum ($10m for the Australian Securities Investment Commission announced as an election commitment in August 2010). This program will provide practical opportunities to apply mathematical concepts in a range of financial and consumer contexts.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response:

Yes, the Australian Curriculum. Sustainability is a cross-curriculum priority in the new Australian Curriculum. This means that there is particular attention given to the learning knowledge, skills and understanding about sustainable patterns of living and how humans interact with the environment.
The sustainability cross-curriculum priority focuses on the need for both individual and collective action to protect environments in ways that are ecologically and socially just across local and global communities.

In Science environmental sustainability is present in content descriptions and/or elaborations in each of Years 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. This treatment includes areas such as resource use and management, caring for environments and environmental change. Water usage is an emphasis in Year 7 which ties in with a similar emphasis in Year 7 of the draft Australian Curriculum: Geography. Climate change occurs in Year 10.

Mathematics provides the understandings and skills necessary to measure, monitor and quantify change in social, economic and ecological systems over time. Statistical analysis enables prediction of probable futures based on findings and helps inform decision making and actions that will lead to preferred futures.
In addition, Geography has a strong emphasis on environmental sustainability. One of the seven concepts for geographical understanding is sustainability and it is included at all year levels. In Geography, students will:

- learn how to use their findings to make predictions about the future and suggest improvements to existing processes
- observe, measure, and analyse weather patterns and resource use
- learn about managing waste, recycling and caring for the environment

In Year 7 there is a major emphasis on water management, which ties in with Year 7 Science. The first of the two units in Year 10 Geography is titled Environmental challenges and geography and students study climate change, coastal erosion and sea level rise, marine resources and the oceans, river basins, urban biophysical environments, mountains and land degradation.
English also assists students to develop the skills necessary to investigate, analyse and communicate ideas and information related to sustainability, and to advocate, generate and evaluate actions for sustainable futures.

Australian Sustainable Schools Initiative:
The Australian Sustainable Schools Initiative (AuSSI) is an initiative of the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). AuSSI provides practical support to schools and their communities

to live and work more sustainably. It fosters a whole school approach with measurable environmental, educational, social and financial benefits.

AuSSI engages students, staff and members of the community to improve the management of a school's resources and facilities—including energy, waste, water, biodiversity, landscapes, products and materials. AuSSI also integrates these activities with teaching and learning across the curriculum, including key elements of social sustainability, such as cultural understanding and social justice. By participating in a learning by doing process, students achieve a better understanding of the world in which they live, and have opportunities to help create a more sustainable future. AuSSI helps to build sustainability knowledge, skills and motivation to take action.

AuSSI provides schools with:

- teaching materials relating to sustainability.
- tools for planning and reporting on sustainability outcomes.
- staff training.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response:
Implementation of the *Green Skills Agreement* (GSA) is overseen by the Green Skills Agreement Implementation Group (GSAIG). The GSAIG includes representatives from a wide range of government, community, educational and business organizations including the following peak organizations: the Australian Chamber of Commerce and Industry, the Australian Council of Trade Unions and the Australian Industry Group. The make-up of the GSAIG ensures business and industry have an important role in assisting with implementation of the GSA.
A key stakeholder in the Australian VET system are Industry Skills Councils (ISCs). ISCs provide advice to Australia, state and territory governments on the training that is required by industry. ISCs provide comprehensive representation of

industry in the managing and planning of VET, and advice and participation in the development of training products and services to meet industry needs. ISCs are responsible for collecting information on industry training needs from employers, unions and professional industry associations, thereby ensuring an industry-led VET system that is flexible and responsive. They advise government on how public funds should be spent within each industry, and have primary responsibility for the development and maintenance of Training Packages. There are eleven ISCs: Agri-food, Community Services and Health, Construction and Property Services, ElectroComms and Energy Utilities, Government Skills, Innovation and Business, Manufacturing Skills, SkillsDMC, Service Skills, Transport and Logistics and ForestWorks. The ISCs undertook the strategic review of Training Packages to embed skills for sustainability (objective 3 of the GSA) and have a key role to play in implementation of other projects and policies under the GSA and the Clean Energy and Other Skills Package.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response:
One of the four objectives of the *Green Skills Agreement* (GSA) is the strategic review of Training Packages (sets of nationally endorsed standards and qualifications for recognizing and assessing people's skills) to embed skills for sustainability. This work was undertaken by the 11 Industry Skills Councils (ISCs) throughout 2010 and the early part of 2011. As noted in the answer to question 4.1, ISCs have strong ties with industry and relevant employers, unions and professional industry associations. ISCs are responsible for ensuring the units of competency and qualifications included in national Training Packages meet the needs of industry, including in areas of technological change as Australia moves to a sustainable, low-carbon economy.

One element of the Clean Energy and Other Skills Package (CEOSP) is a baseline mapping project which will be undertaken in 2012. The project will:
- map the key occupations and industries responsible for the delivery of energy efficiency products and services;
- determine the key skill requirements in each of these industries;
- assess the availability of nationally accredited VET courses and university courses to address these skill requirements;
- review energy efficiency policies and programs established by Australian governments and organizations to ensure the CEOSP complements existing programs; and

- identify the most effective mechanisms for delivering skills to the existing workforce.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response:

One of the four objectives of the *Green Skills Agreement* (GSA) is the upskilling of VET practitioners so they can provide effective training and facilitation in skills for sustainability. A number of projects have been completed under this objective. The Innovation and Business Skills ISC has developed a training unit to assist the Australian VET sector and the VET workforce deliver and assess training for sustainability. An evaluation of professional development programs available for VET practitioners in relation to the provision of skills for sustainability training was completed in April 2011. Following on from this project, the Australian Government will fund delivery of a $1 million national Skills for Sustainability Professional Development program for VET practitioners in 2012. The program will comprise two streams:

1. Delivery of an accredited short course program incorporating face-to-face workshops and blended learning/online options to provide the maximum number of VET practitioners with the skills, knowledge and base accreditation to deliver skills for sustainability training.

2. Delivery of a Sustainability Champions Scholarship Program for selected VET practitioners who will undertake high-level training to become sustainability champions in their organizations. The program is designed to provide the Australian VET sector with the capability to deliver skills for sustainability training and continuous professional development for practitioners.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response:
The Australian Government is committed to building the capacity of the vocational education and training system to provide skills for sustainability to existing workers so they can participate in and benefit from the shift to a clean energy, resource efficient economy. As a part of this effort, the Australian Government established the Upskilling Workers in Skills for Sustainability Pilot Project in June 2009. This

project supported existing workers in the manufacturing, electro-technology and construction and property services industries to access industry-relevant skills for sustainability training, with a deliberate focus on SMEs.
While a significant number of workers were upskilled through this pilot project, a number of challenges were also identified during the role out, including the effects of an uncertain regulatory environment, the impact of the Global Financial Crisis and a difficulty in convincing SMEs of productivity benefits. However, the imminent introduction of a carbon price in Australia is expected to further increase demand for the upskilling of existing workers in sustainability skills.

In addition, under Round 1 of the Critical Skills Investment Fund (CSIF) two projects are being funded which focus on upskilling workers in sustainable practices. The Sunshine Coast Region Solar & Waste Water Training Project will up-skill existing workers and train new potential workers in a range of qualifications for the renewable energy and domestic waste water management sectors in the Sunshine Coast region. While the Electrotechnology Worker Upskilling project will up-skill existing workers and train new workers in instrumentation, sustainable energy, air-conditioning installations and hazardous areas in Western Australia. More potential projects that may have a sustainability focus are currently being evaluated under CSIF Round 1.1 and the National Workforce Development Fund.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response:
The work taking place under Objective 4 of the *Green Skills Agreement* to develop a transition strategy to re-skill vulnerable workers is also supporting regions to take advantage of economic development opportunities that will emerge as Australia moves towards green growth. For instance, the Murdi Paaki Green Skills Project Final Report maps current and potential employment opportunities in the emerging green economy and relevant training pathways for the 16 Indigenous communities across the Murdi Paaki region of NSW.

In the transition to a green economy, the Murdi Paaki region will benefit from public and private investment in sustainable agricultural practices, clean and renewable energy generation, housing and infrastructure retrofitting, natural resource management, and the water and waste management industries. These investments offer jobs and enterprise opportunities for Indigenous Australians in the region.

The report considers the training and employment pathways required for Indigenous Australians in the Murdi Paaki region to access the employment and enterprise opportunities that will arise across these industry sectors. The recommendations in the report support a collaborative and consultative approach to building the capacity of the Indigenous workforce to take advantage of opportunities in the emerging green economy. The report recommends that the Murdi Paaki Regional Assembly (MPRA) should strengthen its role as the first point of contact for public and private sector and community stakeholders to identify and promote green employment and enterprise opportunities in the region and also further develop a targeted regional approach to green skills and sustainable development for the Murdi Paaki region.

To explore the opportunities identified in the report, DEEWR will continue to broker discussions between Australian and NSW Government agencies, service providers and Murdi Paaki community stakeholders.
DEEWR has also commissioned the National Centre for Sustainability (Swinburne) to conduct Stage 1 of the Skills Transition for the Latrobe Valley – Implementing the Low Carbon Road Map Project. The project will build on a Climate Works Australia study of the lowest cost carbon abatement opportunities for the Gippsland region, through concurrent research into the skills and jobs profiles of local workers in carbon-intensive industries.

The research program will identify the skills sets of workers and the jobs that may be in transition in carbon intensive industries, and map these to the employment opportunities and skills that can contribute to the delivery of the cost abatement opportunities in the Gippsland region. The findings of the project will assist government in developing appropriate training and employment program response strategies to ensure a just transition to a low carbon economy for workers in the Latrobe Valley and Gippsland region. Projects such as these are also being complemented by the 34 Regional Education, Skills and Jobs Coordinators (RESJs) that DEEWR is deploying to work with regional communities and local stakeholders to help deliver regional solutions to skills and employment issues. As part of their role, RESJs will provide information and advice on the potential green growth job opportunities in their area, and identify training and skills development pathways for community members to access these opportunities. The activities of each RESJ in the community will be articulated through a Regional Education, Skills and Jobs Plan to be developed and implemented locally.

The regional focus of the RESJs accords with the Australian Government's commitment to help regional economies take advantage of new green growth opportunities, particularly in regions that have a narrow economic base and a heavy reliance on emission intensive sectors.

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?

Response:
Implementation of the *Green Skills Agreement* (GSA) is being overseen by a high level representational body, the Green Skills Agreement Implementation Group (GSAIG). Members of the GSAIG represent:
- Adult Learning Australia
- Australian Chamber of Commerce and Industry
- Australian Council of Private Education and Training
- Australian Council of Trade Unions
- Australian Industry Group
- Australian Commonwealth, state and territory governments
- TAFE Directors Australia
- Universities Australia

The make-up of the GSAIG ensures that a wide range of groups from government to peak community, business, union and educational organizations are involved and have input into implementation of a key government strategy aimed at ensuring the development of appropriate training as Australia moves to a sustainable, low-carbon future.

❖ CANADA

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

In Canada, responsibilities for education and training are delegated to the various provinces and territories; while the federal government maintains an interest in skills development to enhance labour market productivity. Recognizing the differences between the provinces' and territories' training, education, and labour market systems, there is no common definition of green economy and green jobs which currently exists in Canada. As well, there is no empirically standardized method of calculating the size and scope of the green economy in Canada. In addition, almost all provinces and territories have either government-wide or ministerial/departmental-specific legislation governing green economic measures, including: sustainable development strategies; climate change and emissions reduction targets and action plans; water strategies; green building policies;

ongoing reviews of education, training, and apprenticeship programs; green elements in innovation plans; renewable energy strategies; some publicly-funded research and development; and commissioned studies on the green economy and green labour market.

Provinces and territories are working on offering training for the developing green economy through university, college, vocational, and private training programs such as:

- **"Explicitly Green Programs" have emerged to meet the needs of the green economy in sustainable or conservation-oriented areas. These include programs in areas such as: renewable energy development and support, energy assessment programs, and green-focused building design programs.**
- **"Traditional Green Programs" include environmental studies programs, environmental protection fields, and environmental engineering-related studies.**
- **"Programs with Green Elements" promote green elements in an otherwise traditional field of study (e.g. commerce, MBAs, etc.), in the form of courses, job options, or field work.**

As apart of the Government of Canada's Sector Council initiative, Environment Careers Organization (ECO) Canada was established in 1992. ECO Canada's services reach all participants of the environmental sector including employers, practitioners, educators and students.

Canada's environment industry is characterized by growth, diversity and on-going developments within the fields of science and technology. In order to help define this dynamic sector, ECO Canada has identified three core areas of specialization:

- Environmental Protection
- Conservation and Preservation of Natural Resources
- Environmental Sustainability

Within these categories of the environmental sector there are a broad spectrum of employment opportunities including (but not limited to) Air Quality, Water Quality, Waste Management, Fisheries and Wildlife, Mining, Energy, Research and Development, and Communication and Public Awareness.

For more information: www.eco.ca

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

As mentioned, almost all provinces and territories have either government-wide or ministerial/departmental-specific legislation governing green economic measures, including: sustainable development strategies; climate change and emissions reduction targets and action plans; water strategies; green building policies; ongoing reviews of education, training, and apprenticeship programs; green elements in innovation plans; renewable energy strategies; some publicly-funded research and development; and commissioned studies on the green economy and green labour market.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

In Canada, every effort is made to provide equal access for all to labour market, education and skills development opportunities. Although information has not been provided for provincial and territorial governments, the federally-supported Sector Council – ECO Canada -- has gathered some limited data on the participation of vulnerable groups within the environmental sector:

- 40% of all environmental employees are women (representing 45% of the total Canadian employed labour force);
- 2.5% of all environmental employees are Aboriginal persons;
- 5.5% of environmental employees are recent immigrants (within the past 5 years); and
- About a quarter (24%) is below 30 years of age. Fourteen percent of the environmental workforce is age 55 or older.

Environmental employees for selected demographic groups

Demographic Group	Number of Environmental Employees	Percentage of Environmental Employees	Percentage of Total Workforce
Female	271,603	39.8%	45.1%
Aboriginal	16,925	2.5%	2.75%
Recent immigrant (in the past 5 years)	37,867	5.5%	N/A*
All Environmental Employees	**682,289**	**100%**	**100%**

* Statistics from the 2006 Survey are the most recent data available, but are not comparable with the findings of this survey because they do not represent recent immigrants from the past five years (2005-2010).

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in

rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response:

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response:

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Response:

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

No information has been provided for provincial and territorial efforts. At the federal level, the ECO Canada Sector Council works directly with industry stakeholders to develop programs to respond to emerging labour market needs in the green economy.

The scope of the environment industry is very broad with environmental employment spanning all major industries in Canada. There are over 682,000 environmental employees in Canada who spend 50% or more of their time on environmental activities. (Source: ECO Canada)

Over 318,000 organizations in Canada employ at least one environmental employee (approximately 17% of Canadian organizations have one or more environmental employees)

Industries with the highest concentrations of environmental employees include:

- Agriculture, forestry, fishing, and hunting (11%)
- Construction (8%)
- Administration & support, waste management, and remediation (6%)
- Professional, scientific, and technical services (5%)

Retirements of environmental workers will create vacancies over the next decade as over 100,000 environmental employees (14% of the environmental workforce[1]) reach retirement age. From a recent survey conducted with employers, strong growth in demand for environmental skills is apparent in the construction, manufacturing, and agricultural sectors.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Canada has thirteen provinces and territories, each with their own regulatory environments. At the federal level, ECO Canada has a set of National Occupational Standards, which are competencies required to perform successfully in a particular environmental occupation. They are a set of statements describing the standard acceptable skills and knowledge requirements of professionals. NOS are considered the benchmarks against which people of a particular profession measure their level of performance and competency.

All of ECO Canada's NOS are compiled using a methodology that relies heavily on broad-based input from professionals in the field. Using this bottom-up approach, in conjunction with the guidance of senior experts, ECO Canada strives to ensure the standards are of the highest quality and relevance – creating an accurate depiction of current and emerging competencies.

For more information: http://www.eco.ca/occupationalprofiles/

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response:

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

No provincial or territorial information has been provided.
The largest influence of the green economy on employment is in terms of jobs being adapted or reallocated, with existing workers having to learn new skills and/or broaden their pre-existing skill sets. The movement towards greening the

[1] http://www.eco.ca/public/about/fast-facts/323/

economy has resulted in a need for increased economic integration and increased demand for a more holistic economic approach.
ECO Canada has been conducting additional research to define the skills required for new emerging sectors, such as green construction. Since the 2007 survey of environmental employers[2], there has been strong growth in environmental skills required in the construction sector. Growth is most likely in occupations such as trades workers and site managers/supervisors, and also involves the emergence of a few specialist occupations (energy auditors, blower door testers, etc.). The skill sets required in the emerging green construction sector are not well defined and a relatively high percentage (18%) of the construction workforce uses at least some environmental skills in their work.

In addition, ECO Canada helps to prepare employers to transition to a highly skilled workforce to increase productivity in some industries, such as the agricultural/forestry/fishing/hunting sector, and the manufacturing industry. Strong growth in demand for environmental skills was observed in these two sectors. However, at the same time the total number of workers employed in the manufacturing and agricultural sectors have declined since 2007. These opposing trends suggest that employers are transitioning to a more highly skilled workforce that plays a value added role in increasing the productivity of these two sectors.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

In Canada, responsibilities for education and training are delegated to the various provinces and territories. Almost all provinces and territories have either government-wide or ministerial/departmental-specific legislation governing green economic measures, including: sustainable development strategies; climate change and emissions reduction targets and action plans; water strategies; green building policies; ongoing reviews of education, training, and apprenticeship programs; green elements in innovation plans; renewable energy strategies; some publicly-funded research and development; and commissioned studies on the green economy and green labour market.

[2] http://www.eco.ca/pdf/Profile-Of-Canadian-Environmental-Employment-ECO-Canada-2010.pdf

Provinces and territories are working on offering training for the developing green economy through university, college, vocational, and private training programs such as:

- "Explicitly Green Programs" have emerged to meet the needs of the green economy in sustainable or conservation-oriented areas. These include programs in areas such as: renewable energy development and support, energy assessment programs, and green-focused building design programs.
- "Traditional Green Programs" include environmental studies programs, environmental protection fields, and environmental engineering-related studies. "Programs with Green Elements" promote green elements in an otherwise traditional field of study (e.g. commerce, MBAs, etc.), in the form of courses, job options, or field work.

In addition, as apart of Canada's Sector Council initiative, Environment Careers Organization (ECO) Canada was established in 1992. ECO Canada's services reach all participants of the environmental sector including employers, practitioners, educators and students.

Canada's environment industry is characterized by growth, diversity and on-going developments within the fields of science and technology. In order to help define this dynamic sector, ECO Canada has identified three core areas of specialization:

- **Environmental Protection**
- **Conservation and Preservation of Natural Resources**
- **Environmental Sustainability**

Within these categories of the environmental sector there are a broad spectrum of employment opportunities including (but not limited to) Air Quality, Water Quality, Waste Management, Fisheries and Wildlife, Mining, Energy, Research and Development, and Communication and Public Awareness.

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

At the provincial and territorial level, Manitoba is working on the links between TVET and Green Economy/Green Jobs.

- Manitoba Education has created a Guide to Green Jobs and Sustainable Careers (still in draft form), which provides available definitions of a green economy and green jobs. In addition, Manitoba Education in partnership with the International Institute for Sustainable Development hosted on February 22,

2011 an intergovernmental workshop on Green Jobs/Green Economy. The purpose of this meeting was to open a discussion on how to begin to prepare young people to help build a green economy in Manitoba.

- Apprenticeship Manitoba in the Department of Entrepreneurship, Training and Trade, has committed to review changes to program standards through the lens of green processes and technologies. This review occurs through the Apprenticeship Board and the Program Standards Standing Committee. As a part of its Strategic Plan, the Board has also identified the designation of new trades as a primary priority. The Community Liaison Standing Committee will continue to expedite the review of potential trades, including those occupations that support the green economy or include green practices, as they are brought forward through formal requests by industry.

- Manitoba Education's Technical Vocational Initiative (TVI) received funding in March 2011 to develop a new sustainability focus including green technologies, and alternative and renewable energy sources that will focus on programming in energy-efficient and sustainable technologies with emphasis on geothermal, biomass, solar and wind. TVI`s curriculum is undergoing review and revisions so as to reflect the increasing importance of sustainability and "green" issues relative to skills development.

- Manitoba Education is currently conducting a survey designed to gather information on Education for Sustainable Development (ESD) in technical and vocational institutions in Manitoba. Information collected in the survey will be used to produce a report, to help us to asses what has been done to mainstream ESD into technical/vocational education in Manitoba. The information collected will be used in the following ways:
    - As a directory of best practices that can be used to replicate or develop new sustainable development initiatives within TVET.
    - As a resource to support curriculum.
    - To prepare technical/vocational students for "green jobs". "Green jobs" include not only environmental technologies, but also jobs in which environmental issues are taken into consideration (e.g., the building trades and new transportation technologies)

5.4 Additional information

Recruiting practices during the economic downturn have been limited as employers across Canada have looked for ways to cut costs during the downturn. In the past (March 2009- March 2010), thirty-nine percent (39%) of environmental employers hired or tried to fill at least one vacant position. (Source: ECO Canada)

At the time of the survey (March 2010), a slightly higher percentage of environmental employers 44% expected to hire or attempt to hire for at least one position in the next two years. While business confidence has been down during the economic downturn, it is likely to improve in the near term, and most certainly in the long term, which could drive up the number of employers that begin to actively recruit workers.

Environmental employers identified referrals and internal recruitment (promotion from within) as the most effective methods of recruiting. Online job banks (such as monster.com), on-campus recruiting, and co-op programs were also ranked as effective methods for finding qualified candidates.

Interestingly, the most effective methods place a greater emphasis on relationship-based recruitment. The results suggest that a company's current workforce is one of the most important assets in recruiting future employees (through referrals, internal promotion, co-op programs and on-campus recruitment). Only 25% of employers use on-campus recruitment and only 23% have a co-op program for students or recent graduates. A greater emphasis on these recruiting methods may be a solution for environmental employers who face difficulties attracting the skilled workers they need.

❖ **Chile Response - #1**

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response: Yes. Following the commitment between the Ministry of Education and APEC (Japan, 2004), Chile promotes today Education for Sustainable Development (ESD) in the official education curricula for primary and secondary education. At a level of tertiary education the government encourages Universities to adopt in their curricula courses and topics that aim toward a Sustainable Development.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response: Yes. All the description from above is part is part of the National Policy of Education for Sustainable Development. These broader policies involves also citizen education for Sustainable Development, network coordination with other institutions (private sector, NGO, and other ministries) and introduce ESD policies in the labor market, especially in their on-the-job training program.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response: All the different policies described towards a better ESD are implemented in public schools and job training programs. This institutions have has a primary goal to target the more vulnerable people in the society.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response: The Ministry of Education has incorporated in their curricula, for all educational levels, formation tools related to Sustainable Development. This change in the curricula has also affected the STEM area.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response: Now students have activities both in the classroom and the field where they learn how to relate with the environment in a sustainable way.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Response: The National Policy of Education for Sustainable Development has a component where encourage business to adapt green technologies. By promoting Sustaining Development in the labor market and schools at the same time, we are connecting, and incentivizing the creation of links between, students with skills and certification in some TVET related to Sustainable Development and Firms that are also adapting similar policies.

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response: The work with business has being mainly informational but also with a component that promoted on-the-job training for the use of technologies that consider Sustainable Development.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response: The coordination between the labor market and the education provided towards a green economy envisions the creation of specific credentials to ensure a good match between the specially trained student and the specially trained firm.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response: Most of the efforts have being towards providing the correct information and educational material to teachers.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response: We encourage firms to use efficient and environmentally friendly technologies. When doing so, we usually match our proposals with on-the-job training suggestions.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response: As part of our integral approach, described in the National Policy of Education for Sustainable Development, the government supports initiatives coming from the private sector and NGOs that are align with a plan towards a green economy.

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other “intermediaries” helping coordinate green growth efforts with TVET and education systems?

Response: They provide a space for field experiences with schools. Also the government encourages internships initiatives coming from firms, NGOs and unions that will present the student with a on the job experience related to practices towards a sustainable economy.

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Response: The government has promoted recently a grant project where female entrepreneurs have their chance to present their business ideas that are align with a Sustainable Economy vision. The project that presents the best combination of profitability and green growth will be the winner.

❖ **CHILE Response - #2**

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response:

Some background on Chile´s educational system on VET education:

In Chile compulsory education includes eight years of basic education (*educación básica*) and four years of secondary education (*educación media*). During the first two years of secondary education, students follow a general curriculum. During the last two years, they choose between the general track (chosen by two-thirds of the students) and the vocational track (chosen by one-third of the students). After completing the four grades of secondary education, students obtain the secondary school leaving certificate (*Licencia de Enseñanza Medi*a). To obtain a VET certificate they have to complete a period of 480–960 hours of workplace training (*práctica profesional*), which typically takes place after graduation from secondary school. Available estimates suggest that half of the students do not complete their workplace training period. Tertiary-level VET includes two-year programs offered in technical training centers (*Centros de Formación Técnica, CFT*), and four-year programs provided by professional institutes (institutos profesionales, IP). There is still a large need for the connection between the academic field and the job

market. Cooperation between these two sides of the same equation has got to be established under the umbrella of real cooperation (working together).

Some of the advances have been:
1. The **dual model of education** that started in 1992 (based on the German model) in Chile as a pilot experience and that is currently active at 180 high school institutions in all the regions of the economy. From year 2001 this program of training is developed in all the regions in Chile, and it is under the responsibility of the Ministry of Education and the Regional Secretaries of Education (*SEREMIS).*
This system of training establishes that the task of educating needs the participation of two places: the school and the job placement (firm, company, industry, etc.). Under this model there is a process of moving from one place to the other, in a systematic and organized manner. The student (11^{th} or 12^{th} grade) is incorporated into the job market and into the productive process according to a learning process, being supervised by the school coordinator. At the workplace he/she has a tutor who has also received training from the school where the student belongs.

The main idea is that students are able to get firsthand experience about the work they will be performing after graduating, they learn new vocabulary on their specialties and get the necessary knowledge they need to become good employees after they graduate.

2. The establishment of the **Council of Advisors (Consejo Asesor Empresarial**) from firms and companies at some higher education institutions which train medium level technicians. This has been central for the training institutions to create links with the productive world and by signing collaboration agreements and has helped to create the graduation profile of the careers that are based on the competencies scheme.

3. A national certification system for vocational skills has been under development for several years. Regulated by law since 2008, it has been designed to cover the entire labor market, although standards have not been developed for a significant part of the job market (e.g. tourism, food and beverage production, construction, technical and mechanical installations). The qualification framework would improve the access to higher-level education for all, facilitate lifelong learning and help sustain a broader reform effort. International experience suggests that a qualifications framework in Chile also has the potential to unify a fragmented vocational education and training (VET) system and to increase transparency, so that the value of different qualifications can be more clearly recognized. Currently, VET is provided at numerous levels and in many learning contexts, but the lack of institutional or curricular co-ordination has still inhibited progression within the system.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response:
Since the 1980s Chile has implemented environmental policies, often using innovative instruments and regulatory reforms. For instance, it has pioneered tradable permit mechanisms for water rights, particulate emission permits in Santiago, and fishing quotas, which have provided valuable experiences for Chile and other economies.
However, there is still a need for integrating environmental objectives into a wider range of key economic sectors, such as mining, forestry, tourism, energy, agriculture, aquaculture and transport, to achieve green growth. It is also recognized that the government needs to make broader use of market-based instruments, such as environmental taxes and permit trading.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response:
There has been an important effort to give more opportunities for those students who have the talent and interest in pursuing a career on TVET but do not have the resources to pay for tuition or other expenses during the time they study. We provide now some examples of the scholarships available for this student population. [3]

1. Beca Nuevo Milenio (New Millenium Scholarship)
In order to help students to want to pursue studies on vocational and technical education, from year 2001 the Ministry of Education has offered the "Beca Nuevo Milenio" (new millennium scholarship). This scholarship is given to those students who want to attend a higher education institution for a technical career and need financial support. The scholarship covers part of the tuition for a maximum fixed amount of around US$500 dollars a year. The big majority of benefited students study outside of Santiago and attend technical training centers *(Centros de Formación Técnica, CFT).* Probably the most important aspect is that students form quintiles I and II always get financial support through this scholarship.

[3] The 2012 budget for scholarships got an increase of 87% with respect to 2011 and includes the creation of 110.000 new scholarships. For the first time it is guaranteed that all students with merit and talent from middle class (third quintile) will have a scholarship to pay for their studies.

2. Programa Técnicos para Chile (Technicians for Chile Program)
This program was created in 2009 as a response to the need of implementing policies to improve technical training of higher level. The main objective is to contribute to the generation of new competencies for those who already have a technical degree from a higher education institution, by financing: Specialization courses and certification on technical competencies at the best institutions of technical education abroad, that are highly linked to the productive sectors; Identification and validation of training programs abroad and the training of competencies according to the productive job market needs and financial support for language courses in order to eliminate inequality factors for those who really need to go abroad but don't have the necessary language command and fluency.

3. Tax exemption for technical higher-level careers focused on competencies
This benefit allows firms and companies to hire training modules for their workers specialized on job competencies, provided by centers of technical training, CFT. This tax exemption has increased over time so more working places can have access to it.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response:
These contents are covered within the program for each subject during the school year. No other special programs have been put into action at national or regional level.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response:
These contents are also covered within the program for each subject during the school year. Nevertheless, some schools have chosen to move a step forward on the environmental involvement.
National system of environmental certification of educational institutions (SNCAE)

This is a program coordinated by the environmental education of CONAMA (National Agency for the Environment), the Ministry of Education, CONAF (National Forestry Corporation), the ACHM (Chilean Association of Municipalities, UNESCO and the DGA, General Direction of Water.
The idea of this program is to promote actions towards the enhancement of the importance of a culture for sustainability and to promote values and preservation of the environment with the school population.
The purposes of this program are: contribute to the improvement of the quality of Chilean education; promoting in Chile education for sustainable development; contribute to the cultural change through the promotion of a friendly behavior towards the environment;
This certification system establishes environmental standards that measure the presence of the environmental component on three fields of the educational work: pedagogical and curricular; management and the relationship with the local community.

A school or educational institution can have three certification levels. Basic, medium and excellence level. Each school chooses to apply to any of these levels and establishes progressive goals during a determined period of time.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Response: NA

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response:
Research and Development in Chile is mainly financed by the government and carried out in universities and public research organizations. Only around 46% of R&D is financed by industry as compared to an OECD average of more than 60%. Links between universities, public research institutes and the private business sector are weak. Therefore, the private business sector`s propensity to engage in innovation is low by OECD standards.

One important step happened in 2008 with an R&D tax credit, along with other measures. Firms can claim a deduction of 35% of the payment made to a public research institute they have contracted to conduct R&D and can deduct 65% of the remaining amount from taxable income. Research centers and R&D contracts have to be certified by the Economic Development Agency (Corfo), and in-house R&D is excluded from the tax credit. It remains to be seen whether the tax credit will induce more R&D. While it is too early to carry out a full evaluation, it should be monitored continually. In addition it would be commendable to investigate the reasons for the relatively low number of certified contracts. At some later stage, when the current volume-based scheme is up and running, the Chilean authorities may consider a switch to an incremental scheme that provides incentives only for additional R&D.

One important component that Chile has tried to reinforce is the concept of "competencies", as the basis for the curricular development within academic institutions. There is a special fund created inside the program MECESUP (Program for the Improvement of the Quality of Higher Education) that provides funding for different institutions, which apply to it by fostering and enhancing competencies on their curricula.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response:
From 2002 Chile had a program called Chilecalifica (Chile qualifies). This was a joint effort from the Ministries of Education, Work and Social protection, through organisms like SENCE (National Service of Training) and Economy, with the purpose of improving general training and competencies for the job market for the active population with low levels of literacy, offering opportunities to finish their elementary and secondary studies and also by providing them with specific training. The idea of the program was to improve the quality and the articulation of technical education at all levels and to increase the coverage of the training of high level technical people.

The program also searched for National Qualification System of Competencies for the job market. The final idea was to create a system of lifelong education and training so people could get different competencies throughout their lives, and to be updated by acquiring new knowledge along with the social and professional recognition for the skills they incorporated to their work environment.

Among the main accomplishments of this program we can mention: the design and implementation of a flexible model of studies for elementary and secondary as well a special evaluation system; the curricular reform of adult education and the incorporation of different choices of training for different job positions and the link between the academic world and the job market.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response:
Even though there are no massive or general interventions on this matter, some individual or particular efforts have been put into place.
We can mention that in year 2010 a manual was developed called "The Energetic efficiency at the school curriculum for technical education". [4] It was an interministerial initiative, with a main role from the Ministry of Energy.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response:
Chile could benefit from greater sector and geographic diversification, while continuing to add value to established sectors to make them more competitive. Chile's lack of economic diversification and over-dependence on primary commodities make the economy vulnerable to sudden changes in international commodity prices and secular shifts in demand, despite the stabilizing role of the structural fiscal rule, and may constrain long-term growth potential. At the same time, resource dependence raises environmental concerns: intensive agriculture in the centre and south, and forestry and salmon platforms in the south, lead to soil erosion, loss of native forests, a rise in the presence of pesticides and fertilizers in rivers, and contamination of water from the salmon industry. In the north, intensive copper production results in emissions of arsenic and carbon monoxide into the presence of pesticides and fertilizers in rivers, and contamination of water from the salmon industry. In the north, intensive copper production results in emissions of arsenic and carbon monoxide into the air and water around the mines. OECD economies are generally much less dependent than Chile on natural resources.
It is evident that Chilean regions need to transform static advantages into dynamic ones by producing more complex and higher value added goods in the sectors of specialization. Science, technology and innovation policy can play a key role by exploring new products in emerging sectors and by making existing sectors more

[4] The publication can be found at: http://www.sinia.cl/1292/articles-49500_GuiaEficienciaEnergetica.pdf

productive and efficient. The technological upgrading of traditional industries for innovation-led growth can be a spur for regions like Valparaiso and Bio-Bio, and for the northern regions in which manufacturing is underdeveloped. The mining industry could be the nexus of a broad set of diversified and interrelated services and manufacturing activities. Furthermore, as Chile develops higher skills and technology in resource-based sectors, it can transfer knowledge and productivity gains to other sectors.

One very interesting initiative has been the Regional Allocation of the Innovation for Competitiveness Fund (FIC, *Fondo para la innovación y la competitividad*). It was created in 2006 as an instrument to channel financial resources from the royalties in the mining sector towards innovation. Starting in 2008, 25% of the Fund's resources were allocated on a regional basis. The regional government, taking into consideration the national innovation strategy, the corresponding regional development strategy, the strategic innovation agenda and the plans for improving competitiveness of the regional development agencies, will define the use of these resources. The projects must focus on science, applied research, innovative entrepreneurship, specialized human resources formation and development, or the transfer and diffusion of technology. Finally, the resources must be transferred, through agreements, to CORFO, Innova Chile, CONICYT, state universities or those recognized by the state, and/or technological scientific centers of excellence.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response:
One important private institution that deals also with TVET sector and the job market is *Fundación Chile*. Through the *Human Capital Project*, in Fundación Chile they have innovated management and development by transferring labor competence standards and management and learning technologies that raise the organizations' competitiveness. This impact aims at providing 15 production sectors, 394 companies, and 82 workers and students with more job skill certification, training in employability, and digital.

Large strategic guidelines include development of a National System of Labor Competences, employability and the labor market, the upgrading of education and training, human capital and innovation management in companies, company networks, and clusters. The Foundation is also strong on environmental and sustainability issues.

They develop different workshops inviting diverse audiences. For example in September his year they developed the workshop “Measuring Sustainability” joined with ProChile and Walmart Chile. The expert Jonas Bengtsson, director and founder of Edge Environment, Australia, and a specialist in life cycle analysis, certifications and sustainability rating, participated in the activity. Finally, Fundación Chile was selected among 100 sustainable initiatives worldwide. Developed by the United Nations and the Euro-Brazilian Sustainable Development Council –EUBRA, the initiative seeks to recognize high impact projects that contribute to building the basis for a new kind of economy. Thanks to its contributions to promoting a green economy, Fundación Chile and its model of environmental innovation for businesses was selected among 100 outstanding sustainable initiatives worldwide and was included in the “Bright Green Book” or “Green Book for the 21st Century.”

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other “intermediaries” helping coordinate green growth efforts with TVET and education systems?

Response:
As mentioned on a previous response, the dual training system is a way of involvement for organizations different to the Ministry of education. Also some companies own schools and fund them.
However, coordination is still a challenge for TVET educational system at secondary and higher education level.

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Response:
“Know your water footprint” initiative: In the midst of the coming energy crisis resulting from the drought that is battering several regions in the economy and in order to promote the sustainable and efficient use of water, the Municipality of Vitacura and Fundación Chile began their campaign “Know your Water Footprint”.
The initiative closed its first phase with the presentation of the results of the measurement of the Water Footprint of eight well know public figures who live in Vitacura. This initiative aims to present information about the water resource and its footprint to anyone who is interested, including news, experiences, projects and best practices, to foster discussion and decision-making. As part of this first stage, Fundación Chile measured the Water Footprint of the community’s Civic Center and its Bicentenary Park, making Vitacura one of the first municipalities

internationally to undergo this measurement. The idea is that in the future, all citizens can measure their own footprint.

❖ JAPAN

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response:
Japan has no TVET strategies exclusively to support and promote a successful transition to a sustainable, clean energy future. However, for general career and vocational education, the report “Future Vision of Career Education/Vocational Education in Schools (tentative translation)” was submitted to the Minister of Education by the Central Council for Education in January 2011. It is a response to new challenges on education, employment and labor in accord with globalized and knowledge-based society as well as changes in employment structure and practices.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response: N/A

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response:
Going beyond green growth, the people in Japan including vulnerable populations have constitutional right to receive an equal education and all sorts of efforts have been put into practice to ensure that. The recent example is that the official Courses of Study for high schools and schools for special needs education, which was revised in 2009, prescribes efforts to improve career education and guidance

in cooperation with business and the local community, in order to expand employment of vulnerable populations, specifically students with disabilities.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response:
In order to train students to have problem-solving skills and who are needed in the green economy, the following projects have been implemented especially for science and mathematics education. Subsidies for scientific instruments: Subsidizing equipment and instruments used in experimentation and observation Super Science High school (SSH): Some high schools are designated as SSHS and receive support for advanced science and mathematics education, such as development and implementation of curricula beyond the Course of Study, and introduction of experimental and problem-solving learning. Science Partnership Program: Supporting experimental and problem-solving activities, conducted in collaboration between universities or research institutes, and junior and senior high schools; for example, special lectures by researchers, science-camping, scientific club activities and the like. Also, “Kagaku-no-Koshien;” a nation-wide scientific competition for high school students has been established.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response:
Japan integrates the perspective of environmental sustainability into the Course of Study at the primary and secondary level. For example, the Course of Study for upper secondary school includes as follows:

General Provision:
- ❖ High schools teach morality in order to train those autonomous people who contribute to the protection of the environment and will build the future.

Geography and History:
- ❖ Searching for a vision of a sustainable society from a historic viewpoint

- ❖ Considering the necessity for efforts on the part of each economy and international cooperation, with the objective of realizing a sustainable society based on environmental, resources and energy issues

Civics:

- ❖ Researching problems of modern society where a sustainable society is required
- ❖ Researching problems related to the environment, resource and energy in international politics and economics

Science:

- ❖ As a treatment of contents, Learning environmental problems, etc., based on the importance of a sustainable society

For concrete examples, a) conversion, conservation and effective utilization of energy, b) kinds, properties, functions and reuse of plastic and metals, c) properties and functions of energy from water, fossil fuels, the atom, and the sun, d) balance of ecosystem, importance of biodiversity, e) global warming, ozone layer destruction, El Nino phenomenon, f) relationship between nature and human lives, such as what is beneficial to nature or disasters.

Home Economics:

- ❖ Consumption based on proper decision-making with consideration of resources and nature, in order to bring about a sustainable society. In addition, the perspective of environmental sustainability is integrated not only into general courses, but also into specialized courses.

Agriculture:
Objective: Teaching students basic knowledge and skills in agriculture and helping them to understand the meaning and role of agriculture in society. Training students to acquire the innovative and practical abilities and attitudes needed to solve problems in agriculture actively, reasonably and morally, and to strive to develop a sustainable and stable agriculture and society.
Engineering:

Objective: Teaching students basic knowledge and skills in engineering and helping them understand the meaning and role of engineering in society. Training students to acquire the innovative and practical abilities and attitudes needed to solve problems in engineering actively, reasonably and morally, and to strive to advance engineering and society.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-

recognized certificate, or other credential demanded by the emerging green economy?

Response: N/A

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response: N/A

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response: Japan has no specific quality assurance system exclusively for the green economy. However, students are required to earn enough credits in certain subjects specified in the official Course of Study in order to graduate. This system ensures qualification.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response: Japan has the following systems in which teachers, including teachers in TVET, can take courses based on individual experience, ability and area of specialty. 1) beginning teachers' training 2) ten-year mark teachers' training 3) long-term internship 4) sabbatical to attend graduate school. In addition, to help teachers update their knowledge and skills, MEXT implemented in April 2009 a system to renew educational personnel certificates that requires educators to take and complete specified courses every 10 years. The courses are given at universities and include the most advanced knowledge based on the current social and economic situation, such as "considering myself as an educator and understanding changes in children, education policies, and cooperation between those inside and outside of schools" and "the strengthening capacity of education in each subject".

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response: N/A

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response: N/A

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?

Response: N/A

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Response:
Education for Sustainable Development (ESD), which we think as an approach for Green Growth, has been implemented in society as whole, including schools as well as industry. ESD has promoted activities based on Corporate Social Responsibility (CSR), such as cooperative projects between industries and schools.

❖ **Mexico**

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response:
Yes, in the Mexican economy, there are three main technical and technological educational systems (TVET) that take care of this issue:

1. **Higher education**: The System of Technological Universities (SUT - Sistema de Universidades Tecnológicas), which comprises 89 universities located in 29 States, offers the careers of Higher Technician in Environmental Technology and in Renewable Energies (Two year studies after high school) and also offers the careers of Engineer in Environmental Technology and in Renewable Energies (Four year studies after high school) http://cgut.sep.gob.mx/

2. **Upper secondary** TVET education: National College of Technical Professional Education (CONALEP - Colegio Nacional de Educación Profesional Técnica), which comprises 308 technical high schools located in 32 States, and offers the technical career in Conservation of the Environment (Three year formation after lower middle school) http://www.conalep.edu.mx/

3. Training Programs and Courses: Work skills formation and certification-equivalent to secondary technical formation. The System of Centers for Work Skills Formation (SCFT - Sistema de Centros de Formación para el Trabajo), which comprises 198 centers located in 32 States, offers the technical certification on water treatment: lab analyst and plant operator (300 to 360 hours courses, after completion of primary school and upwards).
http://www.dgcft.sems.gob.mx/
As regards general education at upper secondary level, the new curricula has introduced a new compulsory course that is offered at 6th semester and is called Ecology and Environment, where students are formally instructed on these topics.
http://www.dgb.sep.gob.mx/informacion_academica/programasdeestudio/cfb_6osem/ECOL_Y_MED_AMBIEN.pdf

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response: Yes

The curricula of the above mentioned careers and programs are aligned with the requirements emitted by the Secretariat of Environment and Natural Resources (SEMARNAT – Secretaría del Medio Ambiente y Recursos Naturales)

http://www.semarnat.gob.mx/leyesynormas/Pages/inicio.aspx
Also, this Secretariat offers economic support to initiatives presented by education and social sector institutions for the following purposes: Formal environment education, training to promote sustainable development and information about environment education.

http://www.semarnat.gob.mx/APOYOSSUBSIDIOS/EDUCACION/Paginas/inicio.aspx
The Secretariat of Economy (SE – Secretaría de Economía) and the National Council for Science and Technology (CONACYT – Consejo Nacional de Ciencia y Tecnología) have created a special Found for Technological Innovation where one of the seven topics subject to receive financial support is directed towards promoting the usage of clean technologies and renewable energies:
http://www.economia.gob.mx/mexico-emprende/programas/41-fondo-de-innovacion-tecnologica

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response:
All educational systems abide by the rule of the non-discrimination policy, and the federal government provides with scholarships to the students from vulnerable population sectors.
This policy is reinforced by the program called “Oportunidades”, which is run by the Secretariat of Social Development (SEDESOL – Secretaría de Desarrollo Social), where vulnerable students from primary and secondary levels are provided with scholarships to ensure the completion of their formation at these compulsory educative levels.

http://www.oportunidades.gob.mx/Portal/

Also, through the program called “PRONABES”, which is the National Program of Scholarships for Higher Education run by the Secretariat of Public Education (SEP – Secretaría de Educación Pública), vulnerable and high performance students are provided with financial aid to attend school.
http://www.becasuniversitarias.sep.gob.mx/index.html
Under the concept of Sustainable Human Development, the opportunities created by these financial programs, are focused upon the main objective to liberate the ecosystems and biosphere reserves from depredation occurred by the activities done in the communities.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response:

From 2004 to 2010, the Secretariat of Public Education has reformed the curricula of the three compulsory educational levels: primary, lower secondary and upper secondary. In all three levels, STEM learning now plays a relevant role in the formation of students. The new curricula focuses on competency based learning models, as described in the following sites:
Primary education: http://basica.sep.gob.mx/reformaintegral/sitio/ y
http://basica.sep.gob.mx/reformaintegral/sitio/pdf/primaria/plan/PlanEstudios.pdf
Middle secondary education: http://basica.sep.gob.mx/reformasecundaria/
Upper secondary education: http://www.reforma-iems.sems.gob.mx/

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response:
At primary and lower secondary level, the academic programs incorporate the competency based curriculum design methodology, which ensures that the appropriate topics about environmental sustainability are incorporated.
Also the upper secondary and higher education levels for TVET programs incorporate the competency based curriculum design methodology.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Response:
The Mexican economy has opened several web pages with information regarding the general requirements of the professional careers in order to inform the alumni of secondary level of the opportunities encountered by each profession. Also there are other web pages that describe the types of employment and qualification that are to be met by applicants.
http://www.decidetucarrera.ses.sep.gob.mx/

http://www.observatoriolaboral.gob.mx/wb/ola/ola_principal

http://www.empleo.gob.mx/

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response:
The academic model for TVET education requires that prior to the opening of any new career; a panel of experts should meet. The panel is generally composed by 10 to 16 members, from which, at least, half of them should work in industry or business. The general and specific competencies that a student should complete by the end of his/her studies are developed by this panel, and conforms the first input into the curriculum design of each profession.

Also, the Mexican economy has created the national standardized system, which is operated by the National Council of Certification and Evaluation (CONOCER – Consejo Nacional de Certificación y Evaluación), a non-profit organization, in charge of developing the specific standards that are require by the industrial sector. These standards are employed by the education sector and are incorporated in the curricula designs that are used by the various TVET systems in Mexico, http://www.conocer.gob.mx/

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response:
Each TVET institution has established a Linkage with Industry Committee that meets at least two times each year, where all aspects regarding technological changes are discussed and recommendations are made to incorporate these changes either within the curriculum or by developing special programs to meet new challenges.
Also, each University counts with an area of attention that brings orientation both to students and workers about this issue. The general information regarding cooperation programs between higher education and industry is described in the linkage with industry web site mentioned below. This is a main joint venture promoted by the main industry and business associations, higher education institutions, entrepreneur and incubators programs, supporting foundations, and social organizations:
http://www.vinculacion.ses.sep.gob.mx/

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response:

The TVET schools have developed teacher´s internships in industry to maintain their academic staff updated.
There are also several specific training programs, which are offered to keep updated faculty members of the academic institutions. For this purpose, each school develops its own training program according to the teachers' background and the requirements to be met in each course.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response:
As an example, the System of Technological Universities (SUT - Sistema de Universidades Tecnológicas) has developed a training program to update teachers in this field, by promoting the study of a Master Degree in renewable energy offered by the Material Research Center (CIMAV – Centro de Investigación en Materiales) located in the city of Chihuahua. This program is offered to teachers in a bimodal basis: on line courses and on site evaluation and assessment. By the end of 2011, 80 teachers completed their Master Degree focused in solar energy and 120 were currently enrolled in this program.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response:
There are several policies set up by the Mexican economy, as described in the following sources of information:
The Secretariat of Environment and Natural Resources (SEMARNAT – Secretaría del Medio Ambiente y Recursos Naturales) recognizes and aids 17 NGOs that deal with energy savings programs, usage of solar energy and clean technologies, promotion of sustainable development, scientific collaboration, climate change, eco-agroindustry, forest preservation, among other topics.
http://cambio_climatico.ine.gob.mx/ongycc/ongsnacionales.html

The web page "tupatrocinio" reports 27 NGO that deal with environmental issues, with bases in 13 States (out of 32 States). These NGO have developed proper

financial programs based on social cooperation. Some of these NGO work towards preservation of natural resources, particularly with indigenous populations where the preservation of rain forest is of the outmost importance, and some others work with tutoring and cultural programs to educate children and young people on the need to preserve the ecology.
http://ong.tupatrocinio.com/medio-ambiente-mexico-c16-p12.html
Also, the web page “ecoportal” promotes several green NOGs located in Iberoamerica.
http://www.ecoportal.net/content/view/full/158/offset/1

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other “intermediaries” helping coordinate green growth efforts with TVET and education systems?

Response:
The private sector contributes with the reduction on gas emissions and promotes the usage of carbon bonus in order to mitigate climate changes:
http://cambio_climatico.ine.gob.mx/sectprivcc/sectorprivycc.html
The National Academy for Environment Education (ANEA – Academia Nacional de Educación Ambiental) has taken several actions towards spreading in Mexico a conscientious recognition of the need to preserve the environment within the general public, and has published several of the research results accomplished in this area.http://anea.org.mx/

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Response:
The annual Award to the Environmental Merit (Premio al Mérito Ecológico), which is bestowed by the President of Mexico, has examined 1453 initiatives presented by social, education, government and non-government institution since 1993. The following article collects the 73 stories of strategies and practices which have been awarded a price in the period 1993-2011.Lately, this award covers 6 categories: research, individual initiatives, social proposals, formal environment education, non-formal environment education, and environment communication.
http://www.semarnat.gob.mx/educacionambiental/meritoecologico/Documents/Historia_PME_2011.pdf

In 2007, the institution “ProMéxico” was created as an organism of the federal government that is in charge of the coordination of strategies directed to

strengthen the participation of Mexico in the global economy; by helping export business and coordinating foreign investment. It has also helped to promote the usage of clean technologies and of renewable energy sources in Mexico. In 2010, Mexico produced 13,210 MW of clean electrical energy (24.2% of the overall energy generated in the economy) based on renewable energy sources: hydroelectric (84.6%), geothermic (7.3%), biomass (4.2%), and eolic (3.9%). http://www.promexico.gob.mx/es_us/promexico/Renewable_Energy

❖ **Russia**

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response: Yes. There is the Federal Target Program for 2011-2015, devoted to the development of education in Russia. The program supports implementation of TVET technologies in educational programs. Moreover, business communities and educational centers develop their own green grow innovation technologies and organize competitive tendering for their further application.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response: Yes, on the level of international business companies, most of all.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response: The access is opened for all the groups of population without any restrictions.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response: Companies implement new innovative ecology technologies with the support of the government and this is the main reason for Institutions to change their programs with the regard of sustainable development economy.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response: They develop their own training and educational programs on the base of standards, developed by the Ministry of Education and Science. They consider recommendations and economic up-to-date situation as well.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Response: the demand on HR market is the best motive. Many big companies started to use innovative and ecological oriented technologies and they need the relevant staff.

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response: N/A

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response: N/A

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response: advanced trainings of teachers

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response: slow expansion of innovations, less of coordinated information between authorities and business companies, weak focus ion ecological problems.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response: N/A

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?

Response: N/A

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Response: N/A

❖ **Chinese Taipei**

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

In response to the global climate change and the reusable and sustainable energy, green policies are the worldwide administrative trends. To support the demand of

the national economic development and green energy talents, the introduction of new technologies and ideas, to promote green energy industrial skills and manufacturing capabilities, all the branches offices under the Bureau of Employment and Vocational Training (BEVT) have strengthened the formulations and implementations of the green energy related VETs, to cultivate the talents requested and to promote the sustainable and restructuring of the energy industries. The VETs for the on-the-job trainings are: LED application, indoor temperature monitor, carbon footprint supervision and 3D building interior designs.

To match the future trend in the green energy, VETs also are included into the collegiate campus, to subsidy the development of the related curriculum, such as : energy-saving vehicle motors skills, green energy industries, energy management, soil conservation, environment quality and green product monitoring, plant organ cultivations, environment conservation, intelligent low-carbon interior decoration design, LED application, leisure farming marketing and website store management, low-carbon energy and environment technology etc.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

BEVT's branch offices implement the VETs for the unemployed by means of self-sponsored, commissioned and subsidizes; as well as the on-the-job training for the industrial talent cultivation, to team up the training resources of the private sectors, the coordination and cooperation strategies between the private and public sectors, and targeting both the unemployed and on-the-job training in the fields of green energy related courses; in order to expand the sustainable economic development and green energy development strategies.

The current VET courses are answering regulations and designs promulgated by the environment protection and energy departments; as well as responding the job descriptions of the related industries.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

To meet the demands of national economic development and green energy industries, provide the talents with quality and quantity, to promote the employment opportunities for the unemployed, BEVT's branch offices have implemented the related VET courses in compliance with the local green energy developments. The branch offices conduct their VETs by the manners of self-sponsored, commissioned, and subsidies for the unemployed, to promote their employments, especially for the vulnerable populations. As long as the applicants are categorized as the vulnerable groups, all the VETs of green energy are fully subsidized.

To promote the employment for the vulnerable groups, the employment consultation, promotion, VETs, on-the-job trainings, encouraging industries to employ the vulnerable groups and other schemes are available and in operation. On top of these, providing services such as employment rehabilitation, individual case management, demand-oriented programs, sponsoring MEPP training, employment adaptation; for those unable to enter the work place immediately, after the evaluation, providing short-term employment by subsidies, or referring to the MEPP projects, to alleviate the livelihood challenges.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

In order to respond to international trends and actions in the field of environmental protection, the Chinese Taipei government has treated environmental education for primary and secondary education as a key issue. It has been incorporated into the Grade 1-9 Curriculum Guidelines and 7 learning areas (Languages, Mathematics, Science and Technology, Social Studies, Health and Physical Education, Arts and Humanities as well as Integrative Activities). The curriculum goal of environment education is listed as a key issue and aims to cultivate the right values of interaction between human and the environment for students through various kinds of learning activities so as to make them environmentally aware and sensitive, and to be able to communicate knowledge of environmental sustainability. By doing so, our government expects to equip our students with the needed knowledge and skills for addressing environmental problems and to provide them with the needed experience of environmentally-related competencies when they face regional or global environmental issues so that they can become global citizens with environmental literacy.
For senior high school education, the goals of the Senior High School Curriculum Guidelines that were implemented in 2010 consist of: To enhance the competencies of the humanities, society and technology, to improve the capabilities of logical thinking, judgment, aesthetic appreciation as well as creativity, to strengthen teamwork skills and to develop a spirit of democracy and law as well as a sense of duty, to enhance the capabilities of self-study and cultivate an attitude of life-long learning, to improve the capacity of self-understanding and career development, and to implant the idea of respect for life and globally sustainable development. The related mandatory subjects in the current Senior High School Curriculum include: Mathematics (16 credits), Fundamentals of Physics, Fundamentals of Chemistry, Fundamentals of Biology,

and Fundamentals of Earth Science. The last 4 subjects belong to the category of natural science (16 credits), which requires at least 2 credits for every subject.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

For primary and secondary education, the implementation of environmental education teaching programs can be incorporated into 7 learning areas or the school integrated curriculum plan so that theme-based teaching can be conducted in the session of alternative curriculum. By adopting the infusion curriculum methodology, the problem of causing the extra burden of teaching and learning or crowding out the teaching hours for curricula of other learning areas because of this additional curriculum can be avoided. By incorporating the curriculum into the school integrated curriculum plan, theme-based teaching can make this subject a built-in one instead of an extra one, thus ensuring fixed and complete sessions for carrying out the teaching of environmental education. The above teaching strategies and methods can both improve the chance of achieving the competence indicators and curriculum goals of environmental education.

The curriculum design of environment education can be built on either the school or community characteristics to make environmental issues in the region where the school is situated the teaching content and part of the curriculum, or on the current globally hot environmental issues to determine the curriculum theme and content. This way will awaken our students' new awareness of their surroundings and of existing environmental problems related to global sustainability.
In terms of incorporation of the issue of environmental sustainability into senior high school education, one of the goals of the Senior High School Curriculum Guidelines that were implemented in 2010 was to implement the idea of respect for life and globally sustainable development. All related themes, such as global warming, alternative energy, nuclear energy, recourse recycling, conservation of biological diversity, pollution control and so on are introduced in the 5 mandatory subjects (Geography, Fundamentals of Chemistry, Fundamentals of Physics, Fundamentals of Biology, Fundamentals of Earth Science).
With an eye to enhancing the civic environmental awareness, one of the mandatory subjects in the current Senior High School Curriculum is Civics and Society that lists the theme of societies of diverse cultures and includes the issues of awareness of global citizenship and globalization as well as reviews if Chinese Taipei can make a contribution to the development of globally diverse cultures to reach the objective of social equality as well as integration of diverse cultures. The theme of a global village and its reflection deals with the issue of economical globalization that results in some problems, such as reasonable distribution of trading profit (international and domestic) and trans-boundary pollution (like global warming). The theme of Chinese Taipei's environmental and biological problems addresses the issue of Chinese Taipei's environmental pollution and biological

destruction and why Chinese Taipei is supposed to comply with related international conventions as well as the necessity to have civil environmental protection movements.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

The enforcement of related laws can encourage students to acquire a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy. For example, in compliance with “The Environmental Education Act”, the curriculum in environmental protection is supposed to be implemented in government agencies of all levels and primary as well as secondary schools, which create a lot of demand for qualified teachers with specialty areas relating to environmental education. Additionally, environmental education institutions and environmental education facilities by law must designate those professionals of environmental education, which will also stimulate the demand for employees with environmental education credentials on the market of promoting environmental education and motivate students of the departments to be concerned with achieving related certificates/degrees or credentials.

Section IV: The TVET System’s Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

When implementing the VETs for the labor, the green environment protection regulations will be abided by to match the workplace demands.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

The MOE of Chinese Taipei is promoting industry-academia cooperation, in addition to training individuals for the needed for the emerging green economy, and through inter-ministerial as well as industry, government, and academia coordination and interaction assures that appropriate credentials and qualifications can be defined, thus assisting students and incumbent workers to adapt to technological changes within the emerging green economy.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

There are a variety of categories of VET teachers in Chinese Taipei, however there is no qualification verification system running nor the related regulations.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Chinese Taipei takes the local color of their green industries into consideration when developing and implementing the VETs, in order to assist the local workforce to gain the related skills.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

At the end of 2009, Chinese Taipei organized an Energy Saving and Carbon Reduction Promotion Committee. One of the roles of the committee was to connect Chinese Taipei with the United Nations Framework Convention on Climate Change (UNFCCC). Although not a member, Chinese Taipei keeps asking for observer status. Meanwhile, Chinese Taipei has been working through its economic ties in various economies in the region to promote green growth. For example, the Federation of Thai Industries and Chinese International Economic Cooperation Association (Chinese Taipei) has focused on green growth at the 22nd Joint Economic Cooperation Meeting between FTI and CIECA, which was co-organized by External Trade Development Council (Chinese Taipei).

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?

All the BEVT's branch offices coordinate and integrate intensively the resources of the local NGOs, institutes, associations, trade associations, colleges and universities, by means of seminars, workshops, to acknowledge the demands of the green industries, encourage the private VET units to propose the training

programs. The branch offices then sponsor or subsidize the training programs to cultivate the talents in demand.

Chinese Taipei also promotes the “Industrial talent investment program” and the “Assist the enterprises to upskill workforce program”, to assist the workers to upskill their green energy skills. To assist our youth to involve in the green areas, by implementing the industries, campuses and training VETs as follows:

(1) Under the scheme of “Subsidize the collegiate and university employment program”, inviting the green related experts from the private sectors for those junior and senior students, to instruct the green related courses such as energy-saving motor integration, green energy industries, energy management, soil environment manager, environment quality and green product monitoring, plan organ cultivation, soil conservation, intelligent low-carbon energy-saving interior decoration, LED applications, leisure farming marketing, website store management, low-carbon and environment technology etc, to facilitate the college students to increase their green capability.

(2) Student Trainee Program” provided by BEVT for the teenagers to participate the professional skill cultivation programs (ex. Solar energy application), the trainees are scheduled to have a full package training in both theory and hands-on practices.

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

By promoting the environment green energy related courses, encouraging the workforce to initiate the learning to upskill their green skill; also support the enterprises to sponsor the related courses for their staff and workforce to cultivate the green skill.

❖ **Thailand**

Section II: General Questions

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

Response: Yes, currently TVET by Office of Vocational Education Commission (OVEC) has made a lot progress and accomplishment during the past decades, especially in terms of integration of sustainable development issues in TVE . As a result, the quality and quantity of TVET from the occupational competencies and skill needs are accomplished by the four key strategies: increase TVET participation, social services, research innovation and entrepreneurship development and quality improvement. According to those strategies it can be expand to important example as the following:

The Project on **"Fix It Center"** started on 15 August 2005 to present. The project is designed to reduce people's expenses in both the agricultural and non-agricultural sectors. Under the project, a number of vocational students across the economy are sent to various villages to help repair machines and appliances for local people, so that they last longer for use in their farm and at home. They offer technical know-how on the maintenance of engines , tools, and other machinery used in daily life for saving energy and clean energy.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Response:
Yes, in Thailand, TVE Colleges also is active in helping to conserve energy and clean energy policy. For examples;

- There are continuing projects with the Ministry of Energy in cleaning air conditions of public offices, which would help to save electrical energy and to distribute information on clean energy. At the same time, make the public realize the importance of energy conservation. Services in cleaning home air conditions are also offered by TVE colleges.

- The automotive industry, which is the focus industry in Thailand is also required to provide green skills for the workers who are in manufacturing where the upgrading skills are provided by their employers. The alternative energy application is another focus policy for Thailand where the Ministry of Energy provides various training courses for technicians in industries,
teachers from the vocational schools, instructors of the training institutes and villagers in the area of the application of alternative energy.

2.4 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

Response: Thailand has made continuous efforts in improving its quality of human resource and as manifested in its National Economic and Social Development Plans (currently the 10th, 2007-2011). Strategies concerning skill development in response to greening of the Thai Government can be considered as follows;

1) Under the 10th National Economic and Social Development Plans (currently the 10th, 2007-2011), it states that "Extend knowledge to people and continuously enhance institutional capability at all level. Enable concerned people to gain skills and efficiency in using the body of knowledge and techniques required by their ministerial roles and missions."

2) Department of Skill Development (Ministry of Industry) Provides and facilitate green trainings;
- Pre-employment training
- Workplace training

3) The government issued the Skill Development Promotion Act 2002 as the incentive and compulsory measure to stimulate and promote the workplace training. Furthermore the Thai government follows the practices proposed in the Recommendation 195 Concerning Human Resources Development.

4) The proposed establishment of a "National Green Skills Office" at the Ministry of Labor

5) The agricultural sector is the main economic sector that creates the main revenue to Thai economy. Therefore, the campaign for green process and products is a strong concern of the Ministry of Agriculture, which provides training for agriculturist to be aware and apply bio fertilizer that does not harm the consumers. To protect the Thai environment and ecology and make Thai society to be a green and sustainable society, His Majesty the King Bhumibhul Adulyadej of Thailand has initiated various pilot projects. The results were positive and the projects have been transferred to concerned ministries so that they are able to adopt and implement them, providing training to concerned people so that they can acquire knowledge and skills for operation.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Response: Thailand has been trying to support primary and secondary students to join activities or programs relating to STEM learning**.** Nowadays, the concepts of science camp and science club are well accepted in schools, and this has become a regular school mechanism to nurture young scientists throughout the economy. Recently, Chiang Mai University introduced the robotics camp model, which is based on STEAM education to promote creative activities to students. The robotics camp (I-Tim) was conducted in Chiang Mai University in Thailand. I-Tim (Interactive Technologies for the Inventive Mind) robotics camp is participated by secondary school students in Thailand. The goal of this camp is for the students to produce creative robots or machines for home appliances, agriculture, industry, environmental, energy efficiency, etc.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

Response: The interest of the Government of Thailand and the Ministry of Education in the development of school science curricula arose long time ago, and good examples of STEM education curricula at secondary level is the establishment of Mahidol Wittayanusorn School. Mahidol Wittayanusorn School. In 1999, government policy pushed for the development of science-specific schools to accommodate students talented in the scientific and mathematic fields. Mahidol Wittayanusorn School was accordingly remodeled as an autonomous public organization under the supervision of the Minister of Education on 25 August 2000, and was designated the economy's first specialised science school. Under this new structure, the school came under direct authority of the Mahidol Wittayanusorn School Board, and enjoyed more flexibility as well as greater financial support from the government. The school developed its own curriculum and teaching systems.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

Response: 1) Department of Skill Development (Ministry of Industry) has skill training courses and skills assessment to all trainees included giving advices or information about TVET degree to students and new TVET graduates who attend the pre-employment training courses organized by Skill Development Institutes and Centers located throughout the economy. 2) Students are interested in TVE colleges and TVET degree, they can contact, Office of Vocational Education Commission or http://www.vec.go.th. 3) With respect to information about industry-recognized certificate, students can visit website of Office of Industrial

Economics, Ministry of Industry (www.oie.go.th) , then they will find “Labor Economic and Education Data Exchange Plus (LEED-X Plus) “ which is being used to gather up-to-date information about the number of workers in different industries and issue warnings about too many or too few workers in nine industries, as well as qualifications that do not meet employers' demands. LEED-X Plus was upgraded in 2010 from Labour and Economic Data Exchange (or LEDX) created in 2009.

Section IV: The TVET System’s Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

Response: At present, in Thailand all TVET institutions or providers, both public and private, are required to involve industrial groups, and local agencies in development of policies, guidelines, and curriculum. Partnership and networking with enterprises are extensively enhanced. In order to make TVE more attractive, guidance and counseling put special emphasis on work-based learning, earning a living during they learn, opportunity for employment as well as for furthering education in the higher level. The main objectives of partnership and networking are not only looking for training place for students or direction in producing manpower but also identifying competency required by enterprises. At present, main industrial groups that partnership and networking are well-developed are, for example, Petrochemical, Gems and Jewelry, Textile and Garments, Automobile, Tourism and Hospitality, Food, and etc. Through partnership system, teacher training, curriculum development, and competency-based training are organized and implemented.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

Response: Joint committees between Office of Vocational Education Commission (OVEC) and industrial clusters are organized under cooperative projects to identify competencies required by each industrial cluster and career path. This is an attempt to develop sense of ownership in TVE of industrial clusters and encourage them to work closely with OVEC in developing and producing qualified TVE graduates.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

Response: Office of Vocational Education Commission (Ministry of Education) has encouraged TVE teachers to carry out research work for new knowledge and innovation / technology in order to ensure sustainable development, for instance "One Page Research" and "Classroom Action Research". This is to inspire TVE teachers to continue to improve their performance through data collection and make use of it. Students are also supported to work on project based learning to create technology / innovation related to their areas of specialty including green economy.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Response: In Thailand, now there is still no integrated plan for skills development for the existing workforce in energy efficiency and renewable energy sectors, and there are some solutions in our TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors. As a result, the Ministry of Energy had to train people on energy efficiency in the establishments, buildings and production process. Trainees were the technicians working in industries, technicians in the villages, instructors of training institutions and teachers from the vocational schools.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Response: There are some examples with regard to green manufacturing: the Fujikura (Thailand) Ltd., the Canon Hi-Tech (Thailand) Ltd. and the Daikin Thailand. These companies confirmed that they provided upgrading on specific emerging new green skills for their employees through training courses designed by their mother companies and also designed job descriptions of

Employees who work in occupations that will be transform to be green occupations.

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?

Response: - Training of instructors and teachers of vocational schools on green substance

The Ministry of Industry organized various training courses for industries and establishments on green curriculum. There was one project supported by Ministry of Industry through the Thailand Automotive Institute (TAI) and the Electric and the Refrigeration and Air Condition Association, work closely with universities and training institute to provide upgrading courses to achieve green jobs. Some examples are the training of Department of Skill Development's instructors and teachers of vocational schools on green substance for air-conditioning refrigeration, modifying auto machines for LPG, NGV.

- Youth Camp organized by Public Company Limited (PTT)
This program was intended for enhancing informal education and skill development for youths. This included Generation P Energy Conservation Youth Camp in its11th consecutive year. About 80 children from various schools were accepted to the camp, provided with instructors and learning activities. These students were required to make use of the knowledge received from the camp for the development of their 20 projects under the concept of 'New Energy, Sufficiency Energy from School to the Community' during a six-month period. The winning project was 'Changing the wind into alternative energy' belonging to Muang Phon Phittayakhom School from Khon Kaen, the Northeast of Thailand. Team members won scholarships and entitlement to further their studies at the Faculty of Engineering of Khon Kaen University

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

Response:
1) The Green Project in local schools, Samui Island, the south of Thailand In 2008, two of the Thai Hotels Association's member-resorts combined to sponsor a local school in Samui Island, the south of Thailand. The two resorts pooled their resources, created " the green programs " for the students, organised trips to see

working examples of conservation and recycling, set up the first Green Project in the school and established all of this as an aspect of the school's curriculum. It was hugely successful and more schools were included, similarly paired with nearby resorts. Samui's local government authority was impressed and the Deputy Mayor became an enthusiastic crusader for the project. The 'Green Fingers Club', an association of all the gardeners from the island's resorts was similarly keen to become involved. With everyone working to support the project, this 'green' program of school events and activities was refined and expanded. Student projects were extended to also include their local communities, and schools' curricula modified to incorporate all this as a permanent element in the education of Samui's young people. Before the end of 2010, all of Sumi's schools, serving 18,000 youngsters, were participating. In just two years, resorts across the island along with local officials succeeded in making the Regional Green School Curriculum a part of all 26 government managed schools.

2) Promoting Dual Vocational Training (DVT)

Office of Vocational Education Commission (Ministry of Education) promotes cooperation with the private sector in dual vocational training (DVT) through training contracts that are signed between companies and trainees. Core to the success of DVT is the active participation of the private sector, whether by providing training allowance for the trainees or the private sector, whether by providing training allowance for the trainees or the training curriculum training curriculum itself that is developed to target at the job in the workplace.

United States Government

2.1 Does your economy have TVET strategies to support and promote the successful transition to a sustainable, clean energy future? If yes, please describe briefly.

The U.S. Government (USG) has articulated strategies in a number of public policy areas to transition towards a sustainable clean energy future.

- The U.S. Department of Energy leads the USG in the development of energy strategies, making significant investments in recent years into technologies to improve energy efficiency and develop alternative energy sources.

- The U.S. Department of Labor's (USDOL) TVET programs are designed to enable training providers, educational institutions, and workforce intermediaries to effectively respond to the training needs of businesses in their local or regional economies, and equip workers with the skills and

competencies needed to take advantage of opportunities in green jobs. Large investments devoted to training and research in green jobs were made available by funding from the American Recovery and Reinvestment Act of 2009 as well as additional investments to encourage the publicly-funded workforce investment system to align existing programs with green technology and practices and help ensure that the Registered Apprenticeship system deem green occupations as apprenticeable.

- Other agencies of the federal government, such as the Small Business Administration and the U.S. Department of Education have made contributions to shifting the economy towards sustainable economic approaches, such as clean energy, through supportive policies and programs.

- Some U.S. state governments have implemented environmental policy initiatives that exceed those of the USG. Most notably, California has invested state funds in energy efficiency research, developed innovative energy pricing models, and adopted the nation's most stringent automobile fuel standards.

A number of sustainability strategies have been developed in other sectors of the economy, including education and industry. Through an initiative called the American College and University Presidents' Climate Commitment, many institutions of post-secondary (tertiary) education across the economy have committed themselves to a zero-carbon future, aggressive recycling programs, and the adoption of curricula that support a broad economic shift towards sustainable energies. Further, select industry groups have formed independent sustainability strategies, as long-term trends towards rising global energy prices spark greater investment in research and development around alternative energy sources.

2.2 Is the above skills strategy aligned or coordinated with broader sustainable economic development or clean energy policies or strategies? If yes, how?

Within the USG, there has been an unprecedented effort to coordinate strategies for economic development, education and training investment, trade support, and, in one significant case, research investment, to move towards a sustainable future.

The United States has a long history of economic and geographic diversity and of decentralized government. Economic regions within the United States span multiple local jurisdictions and can even cross state lines. In response, the USG has begun rapidly expanding the number of investments that are made through "regional innovation cluster" approaches – a strategy for coordinating investments

across multiple Federal agencies, in support of a broad range of partners seeking to develop the economy of each region.

In 2010, the Obama Administration created an interagency Taskforce for the Advancement of Regional Innovation Clusters (TARIC), led by the Economic Development Administration of the U.S. Department of Commerce, to develop and administer interagency grant competitions to promote the development of Regional Innovation Clusters (RICs). A RIC is defined as a "geographically-bounded, active network of similar, synergistic or complementary organizations in a sector or industry that leverages the region's unique competitive strengths to create jobs and broaden prosperity." The TARIC's first project was the energy regional innovation cluster (eRIC) initiative anchored around a Department of Energy funded Energy Innovation Hub focused on energy efficient building systems design.

Another TARIC project is the ongoing series of Jobs and Innovation Accelerator Challenge grant competitions. The first round of these grants, awarded in September 2011, includes several green projects (http://www.doleta.gov/ETA_News_Releases/20111398.cfm).[5] Additional competitions are being held to promote specific areas of interest. For example, the Rural Jobs and Innovation Accelerator Challenge (http://www.rurdev.usda.gov/RuralJobsAccelerator.html), awarded in August 2012, is funded mainly by the U.S. Departments of Commerce and Agriculture, while the Advanced Manufacturing Jobs and Innovation Accelerator Challenge, competed in summer 2012, is funded by the U.S. Departments of Commerce, Energy, and Labor and the Small Business Administration.

2.3 How do you ensure inclusive access to green growth education, training, and employment for vulnerable populations?

A number of investments by the USG provide under-represented U.S. populations with access to a variety of education, training, and employment opportunities, including those related to green jobs.

Department of Education Efforts

Within the education sector, the primary role of the USG is to ensure equity for students from underrepresented and vulnerable populations. The U.S. Department of Education (ED) makes many targeted investments to improve education for students from ethnic minority groups, from low-income families, or who have disabilities. Public school systems throughout the United States are required to offer free, compulsory education through the secondary level (12th

[5] For information on the winning grantees, go to http://www.dol.gov/dol/grants/grant-app-database.htm and search for "Innovation Accelerator" and then check the boxes of entries that show a grant award amount.

grade). In addition, ED promotes greater access to post-secondary (tertiary) education through its funding for need-based student financial aid, which provided approximately $113 billion in assistance to almost 13 million students and their families in Fiscal Year 2009. ED has also focused technical assistance on education and training promoting growth in sectors that would help support green the economy.

Department of Labor Efforts

Many USDOL programs target or serve disadvantaged or underserved populations. In addition to employment and job training funding allotted to states through formula to serve adult jobseekers, dislocated workers, youth and business customers, DOL also administers a number of regularly competed training grants directly to a variety of entities, including state or local government agencies, local workforce investment boards, community colleges, and/or non-government organizations (NGOs) to support targeted employment and job training services to specific vulnerable populations. These populations include Native Americans/American Indians, agricultural workers (the majority of whom are Spanish-speaking immigrants), low-income older workers (age 55+), at-risk youth (including school dropouts), and adults and youth who have criminal records. Through its Office of Disability Employment Policies, DOL operates numerous grant and technical assistance programs to increase employment opportunities for persons with disabilities to be fully integrated with workers without disabilities.

In 2009-2010, USDOL invested nearly $500 million American Recovery and Reinvestment Act of 2009 (ARRA) funds in a series of grant competitions to support training for careers in the renewable energy and energy efficiency industries and research in green jobs. Priority was given to applicants serving low-income workers, unemployed youth and adults, high school dropouts, ethnic minority communities, areas of high poverty, and other underserved sectors and vulnerable members of the workforce, as well as communities most impacted by global restructuring of the automotive industry. ARRA “Pathways Out of Poverty” grants targeted residents of high-poverty geographic areas (ranging from neighborhoods in urban areas to several counties in rural areas) designated by the U.S. Census Bureau. ARRA Green Capacity Building Grants focused on enabling existing USDOL grantees, including many targeting some of the vulnerable populations listed above (Native Americans, farmworkers, disadvantaged youth, women, older workers, and persons with disabilities), to train for entry-level jobs in green industries.

In addition to these temporary investments under ARRA, DOL has worked to “green” its existing programs, including those that target vulnerable populations. For example, Job Corps, USDOL’s residential program for low-income youth ages 16-24 that provides remedial education, occupational skills training, and support services, leveraged ARRA funds to add green technology content to its existing

career technical training programs in Advanced Manufacturing, Automotive and Machine Repair, and Construction, and to make Job Corps Centers more energy efficient. More information about these efforts is available at http://arrareport.jobcorps.gov.

Likewise, USDOL's YouthBuild program is integrating green training and certification into its program model. YouthBuild provides academic education towards a high school diploma or General Educational Development (GED) certificate of high school equivalency to youth who have dropped out of high school, integrated with occupational training in construction skills through the building and rehabilitation of low-income housing. More information about the YouthBuild model is available at http://www.youthbuildinternational.org.

In February 2012, DOL's Women's Bureau published *Why Green Is Your Color: A Woman's Guide to a Sustainable Careers* (http://www.dol.gov/wb/Green_Jobs_Guide/), designed to aid in increasing women's access to high-growth and in-demand occupations in the green jobs sector nationwide. The Women's Bureau formulates standards and policies to promote the welfare of wage-earning women, improve their working conditions, increase their efficiency, and advance their opportunities for profitable employment.

Career Pathway Models

A growing number of USG funded programs are utilizing "career pathways" models to help expand access to careers in high-growth industries, including green careers, particularly for low-skills individuals from under-served populations. Career pathways are clear sequences of coursework and credentials within a particular field that help individuals, of varying skill levels, earn credentials valued by employers, enter rewarding careers in in-demand occupations, and advance to increasingly higher levels of education and employment. Career pathways offer multiple entry and exit points and links to supports such as basic adult education or social services.

In April 2012, the U.S. Departments of Labor, Education, and Health and Human Services released a joint letter highlighting their commitment to career pathway approaches as a promising strategy to help youth and adults acquire marketable skills and industry-recognized credentials through better alignment of education, training and employment, and human and social services among public agencies, and through better linking those services with employer needs. This letter and several other resources from the Career Pathways Technical Assistance initiative were disseminated throughout the U.S. public workforce system and are available at http://wdr.doleta.gov/directives/attach/TEN/ten2011/ten39-11acc.pdf. Additional information about career pathways is available at

https://learnwork.workforce3one.org/page/tag/general_information_on_career_pathways.

Section III: Science, Technology, Engineering, and Math (STEM) Education and Skills for Sustainable Development

3.1 How has your economy engaged primary and secondary students in rigorous STEM learning to meet the skill needs of the future workforce for the emerging green economy?

Compared to other APEC economies, the USG has a limited role in primary and secondary ("K-12") education, which is administered mainly by state and local governments. However, the USG has some targeted investments to promote STEM education. For example, the National Science Foundation has made large investments in school programs that promote interest in science and, to some extent, sustainable technologies. The National Oceanographic and Atmospheric Administration (NOAA), part of the U.S. Department of Commerce, has invested in science education programs with a focus on preserving the biosphere. The U.S. Department of Education has also initiated a recognition program, the Green Ribbon Schools program, which recognizes and highlights schools that have sought to comprehensively promote sustainability through the school culture, student activities, and the curriculum. Further, disciplinary organizations within science education at all levels have promoted programs and policies to support a renewed investment and interest in STEM education.

Recently President Obama proposed a new US$1 billion program to form a corps of "master teachers" in STEM fields; selected teachers will receive annual bonuses of up to US$20,000. Further, new awards were made recently to colleges seeking to improve minority participation in STEM-related study at the college and graduate level. Large philanthropic foundations such as the Gates Foundation, the Carnegie Corporation of New York, and others are building private support to make STEM education a larger priority in the United States.

3.2 How do institutions at the primary and secondary level integrate environmental sustainability into STEM education curricula and standards?

The following examples illustrate activities followed by school districts in many places in the United States to integrate sustainability into STEM curricula and standards.

- The public school board for the city of Virginia Beach, Virginia selected sustainability as one of eleven 21st century skills required of all K-12 students. The Department of Curriculum and Instruction developed a

continuum of skill level expectation at each grade level. Additionally, beginning in April, 2012 interested Career and Technical Education (TVET) students, many of whom are in STEM related programs, have been piloting a Green Education Foundation Sustainability 101 on-line course that carries a first of a kind sustainability certification and is also eligible for one college credit.

- The Wisconsin Department of Public instruction has identified Environmental Education as a discipline of study. Environmental Education is most often taught at the secondary (high school) level. Environmental science is integrated into many curricula at the elementary level. Some examples of projects are:
    - Harbor Side Elementary School established gardens for their school grounds.
    - Bane Elementary School sponsors a sustainability camp at the college where students learn about solar, wind and gardening.
    - McKinley Middle School students participate in Earth Day events to clean a local creek. Further, high school students participate in an environmental science club with tours of the energy labs at Gateway Technical College.
    - Lakeview High School has an engineering partnership that placed a wind turbine on top of the school to study the effects of wind power. Indian Trail High School hosts a partnership to develop an urban farm to raise food for the school cafeteria and the local food pantry that provides food to the needy.

3.3 How has your economy sought to align secondary-to-tertiary education by showing students what they must accomplish to attain a TVET degree, industry-recognized certificate, or other credential demanded by the emerging green economy?

In technical fields as a whole there is a complex patchwork of credentials in use in the United States that vary by technical specialty, and by geography. Given the extent and variety of credentials and occupational licenses, the USG has been active in trying to compile, provide access, and disseminate information in searchable online databases on industry-recognized credential so that consumers are better-informed about higher education and job training options.

Career Clusters
The U.S. Department of Education has been supporting state governments for years to articulate, on the basis of industry input, a set of career pathways that show students what they need to learn and be able to do in order to enter into

particular career fields. The large numbers of potential career paths across the entire economy have been clustered into 16 groupings under a National Career Clusters™ Framework. These "career clusters" are regularly reviewed, revalidated, and updated in extensive consultation with panels of subject matter experts that include business representatives. The end result is a suggested sequence of study from the ninth grade (beginning secondary) into the first two years of tertiary education, which for many students takes place at community colleges. More information about the Career Clusters is at http://www.careertech.org/resources/clusters/.

Competency Models

DOL, with industry partners, has developed *competency models* that provide a detailed understanding of the foundational and technical skills and competencies required for workplace success in a particular industry. Industry competency models give education and training providers an industry-driven framework for preparing workers with 21st century skills in high-demand sectors of the economy; informs federal investments in education and training activities; promotes portability of credentials; and prevents future duplication of effort by sharing research and information through a database of existing and newly developed competency-based resources. Components related to green skills, sustainability, or environmental concerns are included in number of the industry competency models that have been developed, such as advanced manufacturing, aerospace, automation, construction (commercial and residential), energy, mechatronics, transportation, and water sector. More information about the industry competency models is in the response to Question 4.1 and at http://www.careeronestop.org/CompetencyModel/.

Electronic Tools

USDOL has also developed several on-line tools for students and job seekers, including veterans, to learn about the skill requirements of various career fields, including those in the green economy, including the *My Skills My Future* website (www.myskillsmyfuture.org) for laid-off workers and other career changers; the *My Next Move career* exploration website (www.MyNextMove.org) for youth and other new job seekers; and My Next Move for Veterans (www.MyNextMove.org/vets) for military veterans transitioning to civilian careers. Both *MyNextMove* and *MyNextMove for Veterans* use a green leaf symbol to mark "Careers in the Green Economy," listed at http://www.mynextmove.org/find/green and http://www.mynextmove.org/vets/find/green, respectively. Job listings in these websites also indicate whether a Registered Apprenticeship program exists for occupations and whether such occupations have a "Bright Outlook" or positive outlook based on their projected job growth and job openings.

In addition, USDOL's CareerOneStop career information portal includes a Green Careers site at http://www.careeronestop.org/GreenCareers/GreenCareers.aspx.

It provides information on current and projected jobs numbers, earnings, and required training and credentials for over 200 green occupations.

Registered Apprenticeship
Construction, transportation, advanced manufacturing, utilities, and building maintenance are critical industries at the forefront of the transition to a green economy. In the United States, the primary training model for skilled occupations in these industries has been Registered Apprenticeship, since the system was codified by the National Apprenticeship Act of 1937. This unique earn-while-you-learn model provides immediate wages and benefits to the workers being trained, while ensuring employers that training, standards and safety are taught in a consistent and cost-effective manner. Apprenticeship sponsors include employers, employer associations and labor management organizations.

USDOL's Office of Apprenticeship has increasingly received requests from Registered Apprenticeship stakeholders concerning the development of apprenticeable occupations aligned with green jobs. The Registered Apprenticeship system is integrating green skills via new green occupations, by "greening" existing occupations, and by "greening" pre-apprenticeship programs, which are designed to reach out to youth. More information about the U.S. Registered Apprenticeship system is available at http://www.doleta.gov/oa, while more information about its green apprenticeship activities is available at https://21stcenturyapprenticeship.workforce3one.org/page/tag/green.

Section IV: The TVET System's Role in Green Growth and Employment

4.1 How has the TVET system in your economy worked with business and industry to identify current and future skills and competencies needed to succeed in the emerging green economy?

As stated in the response to Question 3.3, there has been continuous and consistent consultation with business and industry to articulate the skill needs of the workforce in a myriad of technical fields of relevance to the green economy. The products of these consultations include the *career clusters* supported by the U.S. Department of Education (described in the response to Question 3.3) and *industry competency models* described in the response to Question 3.3) supported by the U.S. Department of Labor (DOL).

As mentioned in the response to Question 3.3, DOL works collaboratively with employer and education partners to develop and validate industry-driven competency models intended to identify skills necessary to pursue a successful career in a specific industry sector.

As part of USDOL's Registered Apprenticeship program, requests for DOL to recognize new apprenticeable occupations are industry-driven, and as such are generally submitted for consideration by industry associations or labor organizations. In determining whether an occupation satisfactorily meets the criteria of being apprenticeable, USDOL's Office of Apprenticeship solicits input from industry subject matter experts. The national Registered Apprenticeship system recognizes more than 900 occupations, which are listed at: http://www.doleta.gov/oa/guidance.cfm. Several green occupations recently gained DOL recognition as being apprenticeable, including Wind Turbine Technician, Energy Auditor and Analyst, Geothermal and Well Drilling Operator, and Home Performance Laborer.

Many Registered Apprenticeship program sponsors have updated their program standards to include training elements emphasizing the use of green technologies and/or processes. These updates ensure that Registered Apprenticeship programs provide the most up-to-date training that enable the apprentices and their employers to better compete in today's "greening" global economy.

More and more Registered Apprenticeship sponsors are partnering with organizations that offer pre-apprenticeship training in green occupational skills and awareness. Pre-apprenticeship training provides individuals from traditionally hard-to-serve populations (such as those described in the response to Question 2.3) with the requisite knowledge and skills needed to enter Registered Apprenticeship programs, ultimately providing a pathway to good-paying jobs and sustainable careers. Pre-apprenticeship programs also benefit employers by expanding the pool of skilled workers who familiar with the latest green technologies and processes.

4.2 How has the TVET system in your economy sought to assure that appropriate credentials and qualifications are defined, thus assisting students and incumbent workers to adapt to technological changes in the emerging green economy?

USDOL has issued administrative guidance to state and local operators of the public workforce system that clarifies its terminology regarding credentials. The guidance, Training and Employment Guidance Letter (TEGL) 15-10, is posted on-line at http://wdr.doleta.gov/directives/attach/TEGL15-10acc.pdf. Below is an excerpt from the guidance letter regarding credentials:

> "To bring ETA's terminology in line with the fields of education and industry, the term credential…will be used as the umbrella term which encompasses postsecondary degrees, diplomas, licenses, certificates and certifications…

> A credential is awarded in recognition of an individual's attainment of measurable technical or occupational skills necessary to obtain employment or advance within an occupation. These technical or occupational skills are generally based on standards developed or endorsed by employers. A variety of different public and private entities issue credentials… For further information about the various types of credentials and resources for identifying them, please see the Credential Reference Guide in Attachment 2 [posted on-line at http://wdr.doleta.gov/directives/attach/TEGL15-10a2.pdf]."

USDOL is supporting several research projects to gain a better understanding of the impact of green economic activity on occupations and their associated skill requirements, as well as to identify and count green jobs. Examples of such efforts are noted below:

USDOL maintains the Occupational Information Network (O*NET) program, which is the nation's primary source of occupational information, a database that contains information on more than 950 standardized and occupation-specific descriptors. Based on regularly updated surveys of a broad range from each occupation, O*NET describes the real-world skill needs for occupations across the economy. (More detailed information about O*NET is available at http://www.onetcenter.org/overview.html.) To assist the public workforce system in providing skills training for the green economy, DOL used its O*NET project to examine the occupational changes spurred by green economic activity, as well as the corresponding skills needs. In February 2009, the Greening of the World of Work: Implications for O*NET and New and Emerging Occupations was issued http://www.onetcenter.org/reports/Green2.html. This study examined the potential impact of the green economy on occupational requirements via three likely consequences: 1) the emergence of new green occupations; 2) changes in skill needs within existing occupation as a direct result of green economic activity; and 3) occupations expected grow as a direct result of green economic activity, but with few changes in skills requirements. Two hundred green occupations were identified as most likely to experience changing skill needs.

In November 2009, ETA awarded State Labor Market Information (LMI) Improvement Grants, funded by the Recovery Act, to state workforce agencies and multi-state consortia to collect, analyze, and disseminate LMI and enhance the labor-exchange infrastructure for jobs and careers within the energy-efficiency and renewable-energy industries. Grantees quantified the number of green jobs at the local level and also determined the skills and credentials necessary for those jobs, which helped grantees develop products and tools to train jobseekers for green jobs and help workers transition to green occupations. To access the grantees' survey results, reports, tools, and other deliverables, go to https://wfsolutions.workforce3one.org and search for "LMI" under "Keywords."

Evaluation reports on these grants will be published by early 2013 and will be included in the searchable database of ETA research publications at http://wdr.doleta.gov/research/keyword.cfm.

USDOL's Bureau of Labor Statistics (BLS) was appropriated funding beginning in Fiscal Year 2010 to develop and implement the collection of new data on green jobs. In developing its green jobs definition, BLS reviewed a wide range of studies, including several surveys conducted by State Workforce Agencies as well as international studies, and consulted with a variety of stakeholders, including federal agencies, the State labor market information offices, and industry groups. In its final definition, published in September 2010, BLS defined "green jobs" as:

- Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources; and
- Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

Based on this definition, BLS developed two new surveys of business establishments: a Green Goods and Services survey, which provides a measure of national and State employment in industries that produce goods or provide services that benefit the environment, and a Green Technologies and Practices Survey, designed to collect data on establishments' use of green technologies and practices and the occupations of workers who spend more than half of their time involved in green technologies and practices. For more information about BLS' green jobs initiatives, see http://www.bls.gov/green.

4.3 What has been done in your economy to assure the capacity of teachers in the TVET system to prepare workers for the above-discussed qualifications?

The National Research Center for Career and Technical Education (www.nrccte.org), funded by the U.S. Department of Education, is developing an evidence-based model for preparing new secondary TVET teachers. Research has shown that up to 75 percent of new secondary TVET teachers are selected for their subject-matter expertise in TVET fields, with little or no preparation in how to teach. Research also shows that those TVET teachers who are well trained and supported in entering the teaching profession are more likely to remain in the field and build their teaching skills over time, thus improving both the quantity and quality of TVET teachers.

The evidence-based teacher induction model, now being studied, aims to equip new TVET teachers with the skills they need to intellectually and emotionally engage students in rich, academically rigorous activities, enabling students to

succeed in higher study and careers. New TVET teachers will participate in the induction model, through both professional development and support services.

The professional development component of the model emphasizes four areas of knowledge and skill that teachers need to improve student achievement:

- Planning standards-based instruction,
- Using research-based instructional strategies,
- Assessing students to promote learning, and
- Effectively managing classrooms.

The teacher support element of the model includes:

- Mentoring by an experienced educator in the teacher's school,
- Coaching from an experienced instructional coach,
- Guidance of a school principal, and
- Peer support via electronic "communities of practice."

An evaluation report on the effectiveness of this induction model for secondary TVET teachers is expected to be released by the end of 2012. For project information, see http://www.nrccte.org/resources/studies/alternative-licensure-cte-teacher-induction-model.

4.4 What are special challenges and solutions in your TVET system for upskilling or reskilling the existing workforce for employment in energy efficiency and renewable energy sectors? Please focus on innovative or successful approaches.

Special challenges to the U.S. TVET system's efforts to "upskill" or "reskill" the existing workforce for the energy efficiency and renewable energy sectors include:

- Defining credentials: in the United States, there is no national system for creating or issuing credentials. As noted above, credentials are generally industry-recognized, based on standards developed or endorsed by employers and issued through a variety of public and private entities.
- Skill mismatch: up to one-third of the recent rise in the U.S. unemployment rate is due to mismatch between the occupations and industries that have lost the most jobs versus those where employers are hiring. (National Bureau of Economic Research, http://www.nber.org/papers/w18265.pdf.) The U.S. labor market increasingly requires post-secondary education or apprenticeship training (http://www.bls.gov/news.release/ecopro.nr0.htm), which many long-term unemployed job seekers lack.
- Government budgetary constraints: the recent recession caused state and local governments in the United States to considerably reduce their hiring, benefits, and services

USG solutions for upskilling or reskilling the U.S. workforce for high-growth and emerging industries (including energy efficiency and renewable energy) include: increasing credential attainment, promoting and supporting comprehensive partnership networks, expanding Registered Apprenticeships, and developing career pathways. Registered Apprenticeships and career pathways are described in the response to Question 5.2.

Increasing credential attainment. USDOL plays a vital role in increasing access to credentials in partnership with community colleges, businesses and labor unions. Most important is the emphasis on credentials that are industry-recognized, "portable" to different locations across the economy, and "stackable" as part of a sequence of credentials accumulated over time to build an individual's qualifications. These credentials help workers obtain the measurable and specific skills needed to move along career pathways to different or potentially higher-paying jobs, while giving employers access to the skilled workers they need to compete globally. DOL has set a high-priority performance goal to increase credential attainment by 10 percent among customers of the public workforce system by September 30, 2013. To support this goal, DOL is: 1) aligning federal, local and regional policies and service delivery models to increase enrollments in credential-bearing training programs; and 2) coordinating with local and regional employers and training providers to identify and develop industry-recognized credentials for in-demand occupations.

Most recently, USDOL launched its Credentials Forum in May 2012 and sent invited businesses and industry associations to share information on their preferred credentials in four sectors: advanced manufacturing, healthcare practitioners and support, utilities, and information technology. Based on information gathered through the Forum, USDOL will be able to help job seekers, businesses, and American Job Center staff better understand which credentials are most valued by employers.

Promoting and Supporting Comprehensive Partnership Networks. Partnerships, and the information and service networks they create, play a key role in training, developing, and supporting the workforce as workers transition to high-growth and emerging industries, including renewable energy and energy efficiency. In successful Recovery Act funded green jobs training projects, partners have included non-profit organizations, the public workforce system, employers and industry-related organizations, the education and training community, and labor organizations. Public investments in education and training can be magnified through smart skills policies and programs that are well-targeted and cost effective, and based on shared responsibility between government, employers, and individuals.

An example of an innovative USG approach to reskilling the U.S. workforce through the solutions described above is an inter-agency grant program for Trade Adjustment Assistance Community College and Career Training (TAACCCT). In September 2011, the USDOL, in close coordination with the U.S. Department of Education, awarded $500 million in the first-round TAACCCT grant competition. These grants enable community colleges, in partnership with employers in high-growth and emerging industries, to develop targeted training programs for economically dislocated workers, especially those affected by globalization. Every grantee institution has at least one employer partner that has jobs available for trained workers. A number of first-round TAACCCT grants are supporting training for a variety of green industries, including clean energy generation, resource conservation, sustainable agriculture, recycling, and green building construction and management. The second-round TAACCCT grant competition for another $500 million closed in May 2012, with awards to be announced in fall 2012 at http://www.doleta.gov/grants/grants_awarded.cfm. Applicants must demonstrate strategic alignment of industry, public workforce system, and educational institution partners and also provide accelerated paths to attaining industry-recognized credentials.

Section V – Role of Intermediaries and Strategic Partnerships in Green Growth

5.1 How has your economy sought to engage NGOs and other organizations in supporting regional economic development approaches to green growth?

Since the mid-2000s the USG has implemented initiatives to promote coordinated economic and workforce development at the regional/metropolitan level. Please refer to response to question 2.2 for more information on the President's Interagency Taskforce for the Advancement of Regional Innovation Clusters.

5.2 How are organizations such as governments, employer organizations, labor organizations such as unions, NGOs, or other "intermediaries" helping coordinate green growth efforts with TVET and education systems?

USDOL's green jobs training grants involve partnerships between numerous stakeholders, including the public workforce system, educational institutions, employers, labor unions, and community-based NGOs. For example, in June 2011, USDOL awarded a total of $38 million in Green Jobs Innovation Fund (GJIF) grants to organizations in 19 states and the District of Columbia. (See http://www.dol.gov/opa/media/press/eta/eta20110949.htm.) The grantees included a labor union sponsored training center, a state workforce agency, an industry sponsored training center, and several NGOs. The GJIF funds are helping organizations with existing career training programs to build sustainable

green career pathways that include attainment of industry-recognized skill credentials. GJIF grantees are required to:

- Forge linkages between Registered Apprenticeship and pre-apprenticeship programs that prepare underrepresented populations to enter apprenticeships, and/or
- Deliver integrated basic skills (e.g. literacy, numeracy and job readiness) and occupational training through community-based NGOs.

Other training strategies through which employers, labor organizations, and NGOs are collaborating with the education and public workforce systems on green growth efforts include Registered Apprenticeships (described in the response to Question 3.3) and Career Pathways (described in the response to Question 2.3).

5.3 Can you provide some good examples of strategies and practices that help align and coordinate efforts between the economic development sector, business and industry sector, and training and education sectors to green growth?

A successful initiative to support the "greening" of the U.S. automotive industry is highlighted in a recent U.S. Government Accountability Office (GAO) report about collaboration between the business and industry sector with the training and education sectors to support workforce needs in critical U.S. industries. The Michigan Department of Career Development, the state-level public workforce agency, created the Michigan Academy for Green Mobility Alliance (MAGMA) to speed the growth and development of skills in emerging green vehicle design technologies. The academy classes are offered to incumbent and displaced engineers and technicians. The state workforce agency's partners, in addition to six Local Workforce Investment Boards, include multiple automotive manufacturers and suppliers (including the "Big Three" firms—General Motors, Ford, and Chrysler) and multiple education providers. Major contributing factors in the project's success include employer input into the training curriculum and MAGMA staff becoming knowledgeable about the engineering competencies needed in the automotive industry. The report (GAO 12-97), *Workforce Investment Act: Innovative Collaborations between Workforce Boards and Employers Helped Meet Local Needs*, is available at http://www.gao.gov/products/GAO-12-97 (The MAGMA initiative is described on pages 58-59.)

Appendix III: APEC Symposium Evaluation Results

Symposium participants were asked to complete a brief questionnaire soliciting their reactions to and opinions on the symposium organization and content as well as next steps for APEC in the area of human capital polices for green growth. Nineteen participants submitted questionnaires, and analysis of results was performed. The questionnaire was separated into three sections: Overall Rating of the Symposium and Rating of Sessions, each of which asked respondents to rate their opinions on a numerical scale, and comments, which were an open response. Overall ratings were very positive, with a plurality of respondents noting significant satisfaction with the symposium in general (53% strongly agree that they were satisfied) as well as the panel session format (47% strongly agree) and the logistical arrangements (44% strongly agree). While satisfaction was substantial, one respondent each indicated that they did not agree and that they strongly disagreed that they were satisfied with both the panel session format and with the logistical arrangements provided.

Respondents rated nine sessions that occurred during the symposium on a numerical scale of "1" indicating poor to "5" indicating excellent, and the results again reveal a high level of satisfaction. Seven sessions received mean rating scores of 4.00 or above, indicating very positive feedback, and the other two sessions received scores of 3.83 and 3.95. The highest rated session was the luncheon event "National Training and Education Resource" with a mean rating score of 4.61, followed by "Role of Intermediaries and Strategic Partnerships in Green Growth and Employment" and "Transitioning to a Green Economy – Employer Engagement, Economic Development, and Job Creation" with a mean score of 4.39 each.

The final section of the questionnaire solicited comments concerning symposium highlights and opportunities for improvement, recommended topics for future activities, and open-ended responses. Trends in responses to the question "What did you like best about the Symposium?" included learning promising and best practices from fellow economies, the opportunity to network with fellow practitioners and researchers in the region, and the symposium topic and session content. When asked "What did you like least about the Symposium?" most respondents indicated that time could be better managed to include more active participation and more detailed discussion of the topics.

Respondents provided varied answers when asked "What other topics, themes, activities, or research questions do you recommend for future APEC projects?" One prominent theme that emerges is the suggestion to develop standardized green growth curriculum and educator training for schools. Several respondents indicated interest in capacity building activities to apply promising practices in the field, as well as tools to share information and promising practices, especially with economies that are developing green growth policies. The open-ended comment

section received a variety of responses that indicate overall satisfaction with the symposium and anticipation of future substantive work for APEC in the green growth arena.