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The Water-Energy Nexus: Mindanao Case Study

Workshop on Improving Energy Resiliency in Off-Grid Areas in APEC

Member Economies 15 – 17 June 2016

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Shangri-La Resort, Boracay, Philippines

EC-LEDS and B-LEADERS

Enhancing Capacity for Low Emission Development Strategies (EC-LEDS)

Building Low Emission Alternatives to Develop Economic Resilience and Sustainability (B-LEADERS)



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Bridging science and policy – an independent, non-profit research institute working on sustainable development



Developers of Long-range Energy Alternatives Planning System (LEAP) and Water Evaluation And Planning System (WEAP): software tools for policy and scenario analysis

National Mitigation Cost-Benefit Analysis

- Mitigation options from across sectors were analyzed to inform the GPH **Intended Nationally Determined Contribution**, including:
 - National Renewable Energy Plan capacity targets, waste-to-electricity, energy efficiency in homes/businesses/industry, electrified transport, and more

3.4 GtCO₂e cumulative
reduction by 2050

Less than **\$50**/tonne

5% of total abatement identified
4% of electricity generated in 2050



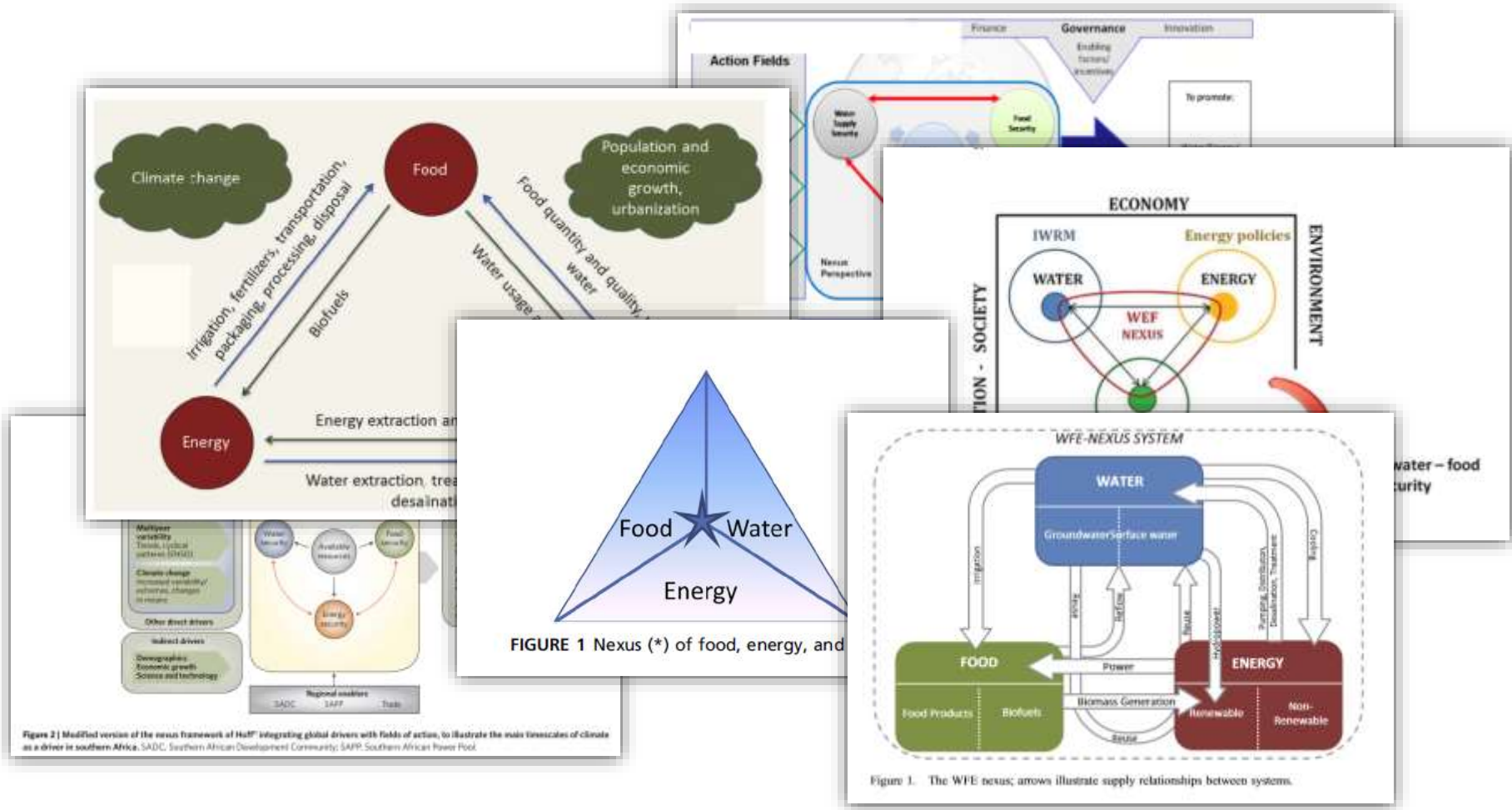
Water/Energy Relationship in Mindanao

But in Mindanao, over half of electric generation comes from hydropower

Meanwhile, PAGASA estimates 10 – 30% reduction in summertime rainfall over 30 years in Mindanao.

What does this mean? What tools allow us to investigate these futures?

Nexus Research since 2011



The Nexus is:

- Complex **interdependencies** and **linkages** among water, energy (and food) systems, including trade-offs and feedbacks between them
- Implies a **need to manage water/energy/food as a single system**
 - Reduce unintended consequences
 - Increase synergies and efficiency
 - Better handle scarcity
- Creates **additional governance challenges** but once understood, presents an **opportunity for improved governance**

“Energy resiliency in off-grid areas is the ability to restore and sustain availability and accessibility of energy in off-grid areas in the most timely and efficient manner, in the aftermath of natural and man-made disasters.”

The Nexus and Off-Grid Energy Resiliency

A nexus perspective provides especially interesting insights on **off-grid energy resiliency**.

- Small, run-of-river hydro vulnerable to changes in rainfall
- Biogas digesters may interact with crops and fertilizer requirements
- Off-grid areas tend to be more agricultural, amplifying nexus issues inherent in food and bioenergy production
- As access to clean water improves in off-grid regions, energy requirements will grow

Empirical Nexus Studies



Study Motivation

- Threat Dominated
- Scarcity Dominated
- Other

Number of Studies

- = 1
- = 6

Mindanao, El Niño 2015/16



Republic of the Philippines
MINDANAO DEVELOPMENT AUTHORITY
INTEGRATING MINDANAO

Mindanao hydro power output falls as effects of El Niño set in

Minda News
This is OUR Mindanao

SUN STAR
DAVAO

Mindanao power situation now precarious

Mindanao to rely more on coal and diesel as El Niño threatens hydro plants

Hydro's resiliency to climate change *affects capacity to meet (I)NDC!*

Mindanao Study Objectives

How will climate change affect hydropower availability, the energy and water systems, and prospects for development and mitigation in Mindanao?

- Quantify changes in hydrology and hydropower availability in Mindanao under various climate scenarios
- Assess technical and cost impacts, focusing on power sector
- Consider both business-as-usual case and a scenario where national mitigation plans are enacted
- Compare findings to hydropower assumptions in national and regional policies

Overall Methods

Joint modeling of energy and water systems in Mindanao

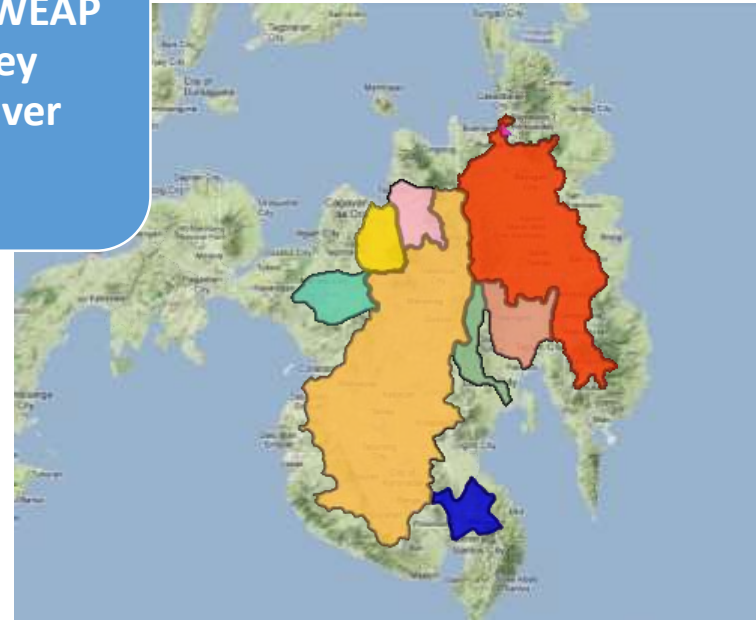
LEAP



Using National CBA LEAP model as starting point, develop regional energy system model for Mindanao

Develop new WEAP model of key Mindanao river basins

WEAP



Timeline and Outputs

- **April 2016:** Project inception
- **May-June 2016:** Data collection and development of first draft models
- **July-August 2016:** Model refinement and scenario analysis
- **September 2016:** Second stakeholder workshop to discuss results
- **October-December 2016:** Final analysis and project report

Key outputs: Final report including summary for decision makers, study models, briefing materials for stakeholder workshops

Thank you for your attention!

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