ENVIRONMENTAL ECONOMICS FOR EVIDENCE BASED POLICY

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IEEM: Evaluating Strategies for Achieving the Sustainable Development Goals

IEEM

Integrated Economic-Environmental Modeling

IDB

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IEEM and SDGs

To effectively achieve the seventeen Sustainable Development Goals (SDGs) set forth by the United Nations (UN) to end poverty and protect the environment, many nations are mainstreaming the SDGs into national development plans. In Guatemala, the recently approved National Development Plan K'atun: Our Guatemala 2032 is closely aligned with these SDGs as Plan K'atun's design and the in-country socialization process of the SDGs occurred simultaneously, both with support from the UN. Progress toward the previous Millennium Development Goals fell short due to their limited integration into Guatemala's national framework for development planning. Under Plan K'atun, 90% of the thematic areas addressed are closely aligned with the SDGs. Building upon these efforts and the unique development challenges in Guatemala, the Government is engaged in a prioritization exercise to define specific lines of action and develop estimates of costs of implementation that can prioritize SDG targets, align them with strategic actions set out in Plan K'atun, and create a statistical mechanism to monitor progress.

IEEM-GUATEMALA

To understand the full range of economic and environmental implications of these public policy and investment strategies on national wealth and well-being, the state-of-the-art Integrated Economic-Environmental Modeling platform for Guatemala (IEEM-GUA) was applied to estimate the economic, environmental and wealth impacts of implementing national strategies towards achieving the SDGs. IEEM's value added is its ability to analyze complex policy goals, and highlight tradeoffs, potential win-wins, and interlinkages between SDGs. IEEM-GUA can provide specific inputs into the policy formulation stage of the policy cycle by projecting the economy-wide effects of specific lines of action both individually and in an integrated way.

IEEM is calibrated with data based on the System of National Accounts and the System of Environmental-Economic Accounting (SEEA). What sets IEEM apart from other decision-making frameworks is the integration of rich environmental data based on the SEEA and the customized environmental modeling modules that capture the dynamics of environmental resources and their use. The indicators IEEM generates capture policy and investment impacts not only on measures of income flows such as Gross Domestic Product (GDP), but also on wealth which is the foundation of the economic development prospects of a country.

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ZERO HUNGER AND CLEAN WATER AND SANITATION IN GUATEMALA

Analysis with IEEM-GUA focused on two of the seventeen SDGs. SDG two–ending hunger, achieving food security and improving nutrition, and promoting sustainable agriculture–concentrating specifically on doubling agricultural productivity and incomes of rural producers (target 2.3); and SDG six–ensuring availability and sustainable management of water and sanitation for all–concentrating specifically on equitable access to drinking water and sanitation (targets 6.1 and 6.2).

Based on the Ministry of Agriculture and Livestock's research, irrigated agricultural investment can increase crop yields by 150% and improve incomes by even more. However, only 29% of potentially irrigable land is utilized within Guatemala. While enhancing agricultural productivity and competitiveness of the sector is central to Guatemala's Great National Agriculture and Livestock Plan 2016-2020, this large area of land apt for agriculture can also supply the resources needed to achieve SDG 2.3 (doubling agricultural productivity and incomes).

Additionally, 3 million residents lack access to clean water. Combined with poor sanitation coverage, this is the leading cause of death for children under five. By increasing water and sanitation coverage to 95% and 90%, respectively, (a key goal of Guatemala's Water and Sanitation National Policy), managers could drastically reduce the frequency of gastrointestinal sickness thus creating significant gains to health and economic well-being while nearly fulfilling SDG targets 6.1 and 6.2 (providing equitable access to drinking water and sanitation to all).

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BID

IEEM-GUA FOUR SCENARIOS

To examine the "what if" effects of policy initiatives on irrigated agriculture, water, and sanitation, IEEM-GUA was used to simulate four scenarios based on Plan K'atun and published Government policy directives, strategies, specific lines of action, and cost estimations. Two scenarios (IRRIG1) & (IRRIG2) were developed for making progress toward SDG target 2.3 and one scenario (WTSN) for making progress toward SDG targets 6.1 and 6.2. A fourth scenario (COMBI) evaluated the joint impact of the IRRIG2 and WTSN scenarios.

Scenario investment parameters:

1. IRRIG1

Goal: Rehabilitation and modernization of existing irrigated water supply systems and infrastructure.

Increase of irrigated area:
6,399 hectares

Cost:
US$6 million

Timeline:
5 years

SDG
2.3

2. IRRIG2

Goal: Increase irrigated agriculture. Combine IRRIG1 with an additional US$1.95 million investment.

Increase of irrigated area:
100,000 hectares
106,300 total

Cost:
US$1.95 million
7.95 million total

Timeline:
5 years

SDG
2.3

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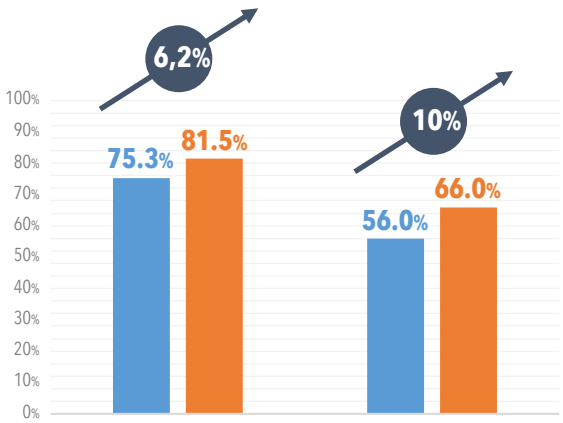
3. WTSN

Goal: Increase water and sanitation coverage.

Increase in coverage



WATER
Cost:
US$1.6 billion

SANITATION
Cost:
US$70.2 million

Increase in rural agricultural labor productivity due to better health:
0.44%

Timeline:
13 years

SDG

6.1 and 6.2

4. COMBI

Goal: Joint impact of IRRIG2 and WTSN scenarios

With these scenarios, IEEM-GUA results identified areas of significant gains by 2030, while also highlighting how investments may fall short and even negatively affect SDG targets. Overall, IRRIG2 tends to drive positive impacts on all macro indicators and private consumption increases by US$797.9 million. However, private consumption under WTSN only increases by US$74.5 million. In the COMBI-scenario, overall GDP gains of US$1.185 billion were estimated.

Results from the COMBI scenario also show a US$181.1 million impact on agricultural output. Output of non-export agricultural crops increases only 7% (from 52% baseline to 59% COMBI). This demonstrates a significant 41% gap (toward doubling agricultural output-SDG 2.3) that would require additional investment and productivity enhancements to reach 2030 goals.

Under the COMBI scenario, the urban wealthier households also experience a 1.31% increase in income compared to 1.05% for the poorest rural households. Taking baseline growth into account, per capita income increases between 9% (rural) and 18% (urban) across households and income quintiles. IEEM-GUA demonstrates, however that an 83% income gap remains to be bridged if SDG target 2.3 (doubling incomes) is to be achieved. Therefore, additional investments beyond the COMBI scenario would be required to reach 2030 targets.

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IEEM-GUA also indicates that by 2030 Guatemalan households would be better off by US$747 million (COMBI scenario). Considering a baseline poverty headcount of 44.77% for business-as-usual, the COMBI scenario projects 2.42 million people being lifted out of poverty, in addition to declining income inequalities. All investments are wealth enhancing considering a US$595.4 million increase in genuine savings (driven by household savings increases). And a strong government commitment of US$1.67 billion in water and sanitation investment would generate a US$69.5 million welfare gain, though the Net Present Value (NPV) of the investment would be negative. Applying a 12% discount rate, IEEM demonstrated NPVs of US$126.7 million (IRRIG1), US$2.1 billion (IRRIG2), negative US$718.5 million (WTSN), and US$1.3 billion (COMBI).

Finally, deforestation and emissions increased in all scenarios which reduced the overall increase in genuine savings. Total greenhouse gas emissions increased by 642,346 tons of CO2 equivalent in the COMBI-scenario. Additionally, water consumption per capita across all uses increased by 1,860 ML/capita in the COMBI-scenario.

Total greenhouse gas emissions increased by **642,346 tons of CO2**

Water consumption per capita across all uses increased by **1,860 ML/capita**

EXPECTED RESULTS

IEEM-GUA's forward-looking analysis enables Guatemalan policy makers to understand the full range of economic and environmental implications of specific policy and investment strategies in relation to the SDGs. Results generated with IEEM enhance transparency and enable the prioritization of objectives during the agenda-setting phase of the policy cycle, while IEEM's integrated approach allows policy makers to understand synergies where one line of action can make progress toward achieving multiple SDGs simultaneously.

IEEM results can be used to substantiate a business case for private investments or public private partnerships. For example, IEEM-GUA results could be used to support Government action in creating a legal framework for irrigation water management which would create an enabling environment for private investment in irrigated agriculture. Simultaneously, the integrated approach shed light on how individual SDGs can be mutually supportive to achieving the overall Agenda for Sustainable Development. Under IEEM-GUA, water and sanitation investments increase agricultural labor productivity, which increases agricultural output, contributing to SDG target 2.3. Additionally, overall investments grew GDP by US$1.37 billion, diversified the agricultural sector, and created jobs, thus contributing to achieving the first SDG (ending poverty in all its forms) as well as the eighth SDG (promoting inclusive and sustainable economic growth, and employment). These findings demonstrate that a portfolio approach can create win-win situations where lines of action generating greater investment returns, can compensate for those that do not.

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IEEM-GUA also demonstrated where lines of action must be weighed against commitments such as the Paris Agreement and applicable SDG targets. Expansion of agriculture and faster economic growth led to increased deforestation and emissions, a slide backwards from SDG 15 (promote the sustainable use of forests) and SDG 13 (action on climate change). As water consumption would increase in all scenarios, water availability/quality and potential negative externalities such as salinization in drought prone areas must be considered in relation to other SDGs (i.e. SDG 6.5 - the implementation of integrated water resources management, and SDG 6.6 - protect and restore water-related ecosystems). Thus, IEEM demonstrates that integrated landscape management (SDG 15) supporting a variety of ecosystem services must be considered as these natural systems are critical for sustaining rural livelihoods and making progress toward multiple SDG targets.

IEEM generates results in terms of wealth and natural capital impacts enabling a forward-looking analysis of public policy and investment impacts on multiple sectors and complex integrated economic-environmental objectives. These indicators are increasing in relevance and provide policy makers a broader evidence base upon which to formulate policy and engage with their constituents. Impacts are expressed in terms of GDP, income and employment (i.e. GDP gains of US$1.37 billion from investing in agriculture and water and sanitation). These economy-wide parameters offer compelling evidence to finance ministries and budget committees. IEEM also demonstrates how investments in one area (i.e. agriculture) affect other sectors and the environment (i.e. water consumption and emissions), highlighting win-win scenarios or necessary mitigation strategies with respect to health, economic and environmental well-being. As demonstrated, IEEM's language is grounded in economics, generating results that speak to policy makers with clear points of entry into the policy cycle, while quantifying and recognizing natural capital's contribution to economic development and the challenges posed by the SDGs.