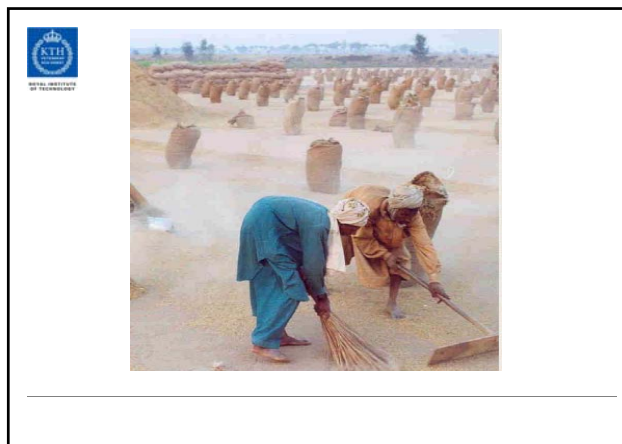






Energy, Food and Water – An integrated modelling approach

Finding CLEWs - Modelling Climate, Land use, Energy, and Water (CLEW)

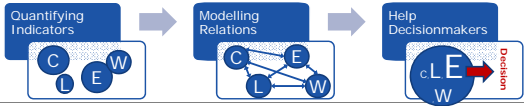
A joint approach with FAO, IAEA, IIASA, KTH, SEI-US, and UN-DESA


Aim of the CLEW approach




- Develop clear indicators and quantify physical interrelations between CLEW resources
- Test the tools and calibrate them to different environments / situations / setups through data collection and Case Studies
- Develop tools to assist decision makers to verify the effects on other CLEW resources




2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 3/21



Mauritius – pioneer for testing of CLEW modelling tool




- Small island with clear boundaries
- Producer and exporter of sugar (occupying 80 % cultivated land area)
- Dependent on fuel imports for its energy requirement
- Highly vulnerable to climate change
- Data availability




> Government vision for making Mauritius a sustainable island focussing on reducing dependence of fossil fuel and reducing GHG emission ...

2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 4/21





Modeling Tools Used



	Energy	Water	Land Use
Model	MESSAGE ^(IAEA,IIASA) LEAP ^(SEI) OSeMOSYS ^(KTH)	WEAP ^(SEI)	AEZ ^(IIASA)
„Scale of Operation“	From small island systems to large country analysis	Local water systems based on geographical data	Small scale to country analysis (flexible grid cells sizes)
Input	<ul style="list-style-type: none"> • Demand (current / future, load curves), • Existing + planned Power plants, • Imports and exports, and resource availability, • GHG emission factors 	<ul style="list-style-type: none"> • Climatic data, • Land cover data, • Soil data and water avail., • Water consumption, • Desalination and hydropower 	<ul style="list-style-type: none"> • Climatic data (plus projections), • Land cover data, • Soil data,
Output & Results	<ul style="list-style-type: none"> • Future optimal energy mix under different conditions, • Future GHG emissions • Costs 	<ul style="list-style-type: none"> • Water availability under different scenarios (CC and/or w. demand change) for ALL points in a modelled system 	<ul style="list-style-type: none"> • Crop Map (most suitable crops per area) • Crop Calendar • Future water demand • Fertilizer demand

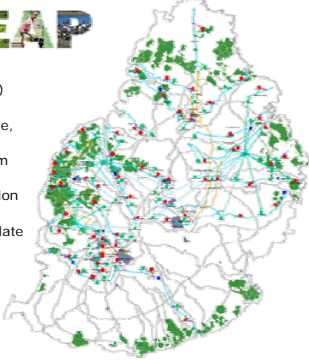
2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 5/21

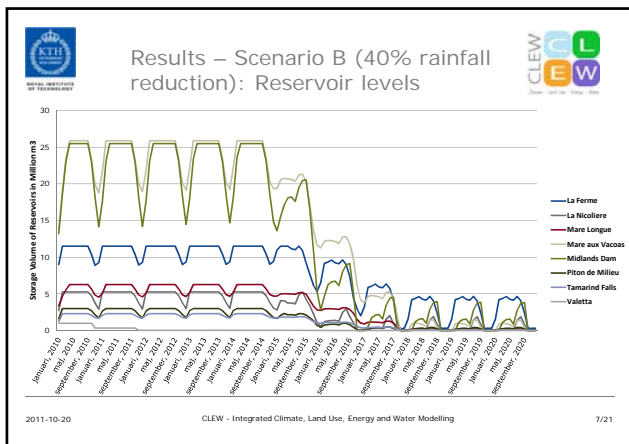
Water Evaluation and Planning

- Definition of all Catchment areas (60)
- Real Climatic Data (1996 – 2005): Rainfall, min & max temperature, humidity
- All main rivers & reservoirs plus stream flow data and reservoirs levels
- Modelling of existing canals / distribution systems
- Using GIS: land cover classes to calculate evapotranspiration
- Water Demand data (urban and agricultural) according to national statistics and population density

Result: Water availability for each point in the system



2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 6/21

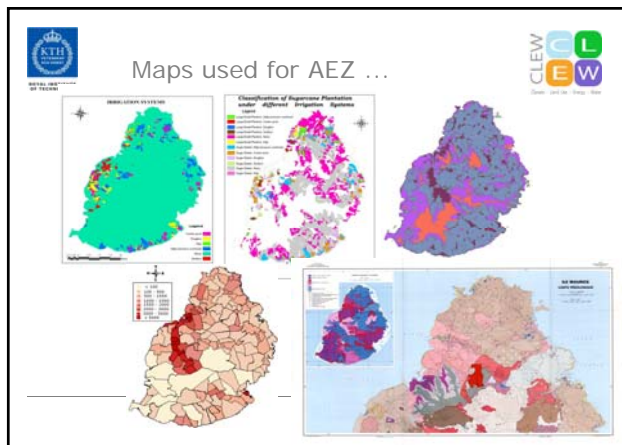
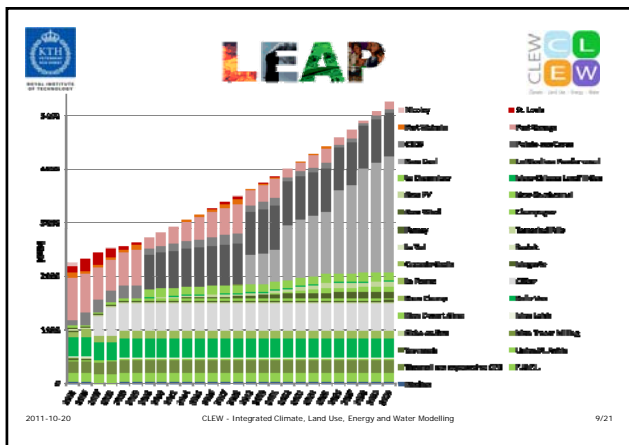


LEAP

Input Data

- Supply:
 - All existing and planned power plants (capacities and plant factors)
 - Hydropower Plants and monthly production
 - Potential renewable energy targets
 - Energy production from bagasse
 - Oil and Coal imports
 - In the Scenarios: 1st & 2nd generation from biomass plus bioethanol production
- Demand:
 - from national statistics and official projections, assumptions for pumping water and desalination
 - Demand for ethanol production from sugar cane (1st and 2nd gen.)
 - Energy needs for fertilizer production

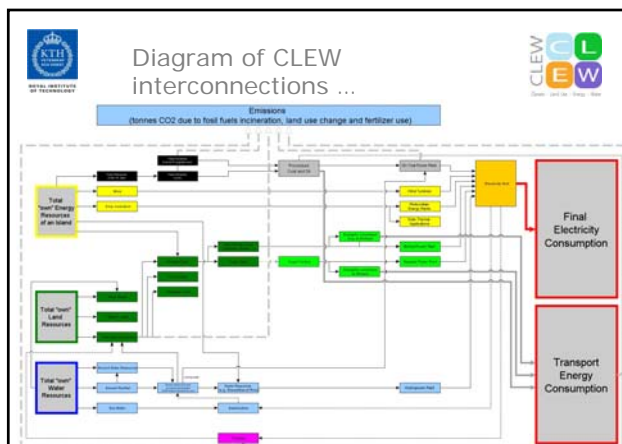
2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 8/21

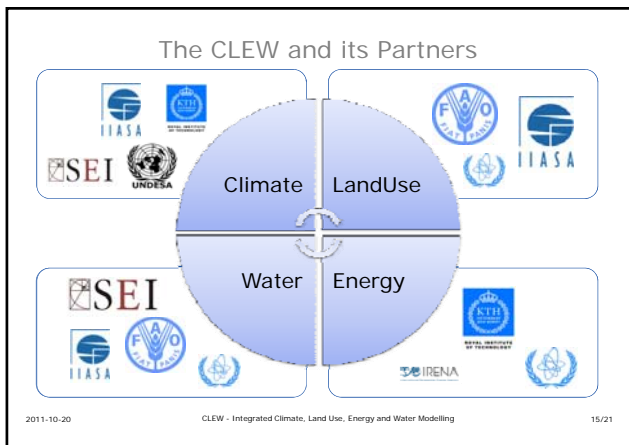
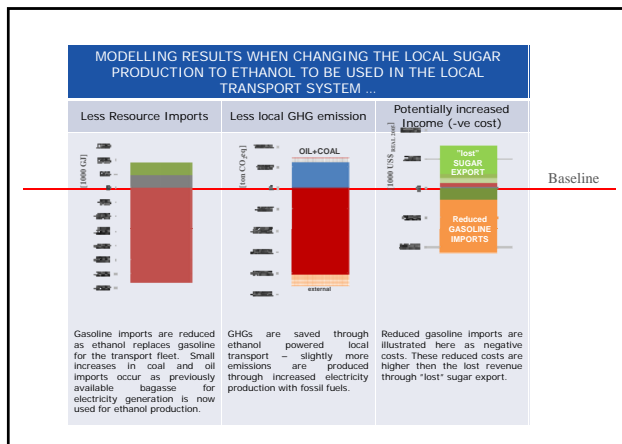
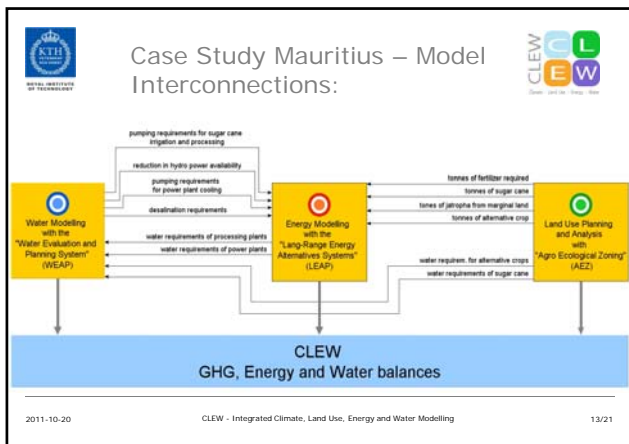


AEZ - The Land-Use Model ...

- Input:
 - Climatic Data
 - Detailed soil map and data from soil profiles
 - Slopes and marginal land
 - GIS data for landcover
 - Irrigated areas
- Output:
 - Grid map of Mauritius show optimal crops, potential water use, and potential yield
 - Crop calendar

2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 11/21





CLEWS - Activities

The collage highlights several key activities and conferences:

- ICP-MAA Modelling Conference:** A group photo of participants from various countries.
- UN Theme Group - CSD:** A banner for the United Nations Conference on Sustainable Development.
- RIO+20 United Nations Conference on Sustainable Development:** The logo for the major international event.
- ENERGY POLICY:** A book cover related to energy policy.
- Bonn2011 Nexus Conference:** A conference focused on the nexus between energy, water, and food.

2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 15/21

Thank You

Mark Howells (mark.howells@energy.kth.se)
 Sebastian Hermann (sebastian.hermann@energy.kth.se)
 Manuel Welsch (manuel.welsch@energy.kth.se)

Royal Institute of Technology – Stockholm – Sweden
www.kth.se

2011-10-20 CLEW - Integrated Climate, Land Use, Energy and Water Modelling 17/21