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Energy and Climate Partnership of the Americas

Caribbean Water-Energy Nexus Dialogue

Marriott Courtyard
Bridgetown, Barbados
Stafford House B
November 15, 2016

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Organization of American States

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Overview

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- Objective
- Current water for energy scenario
- Status
- Challenges
- Opportunities
- Water-energy nexus regionalization

What do we mean by “water-energy nexus”?

- No formal definition
- Links and mutual reliance between energy and water
- Relationship between the water used for energy production, and the energy consumed to process water

Objective

- Define the water-energy nexus in the Caribbean context
  - Resource availability
  - Stakeholders and uses
  - Technology and Infrastructure
- Identify the types of interventions needed to improve decision-making and planning
- Implement actions based on the nexus approach

Current scenario

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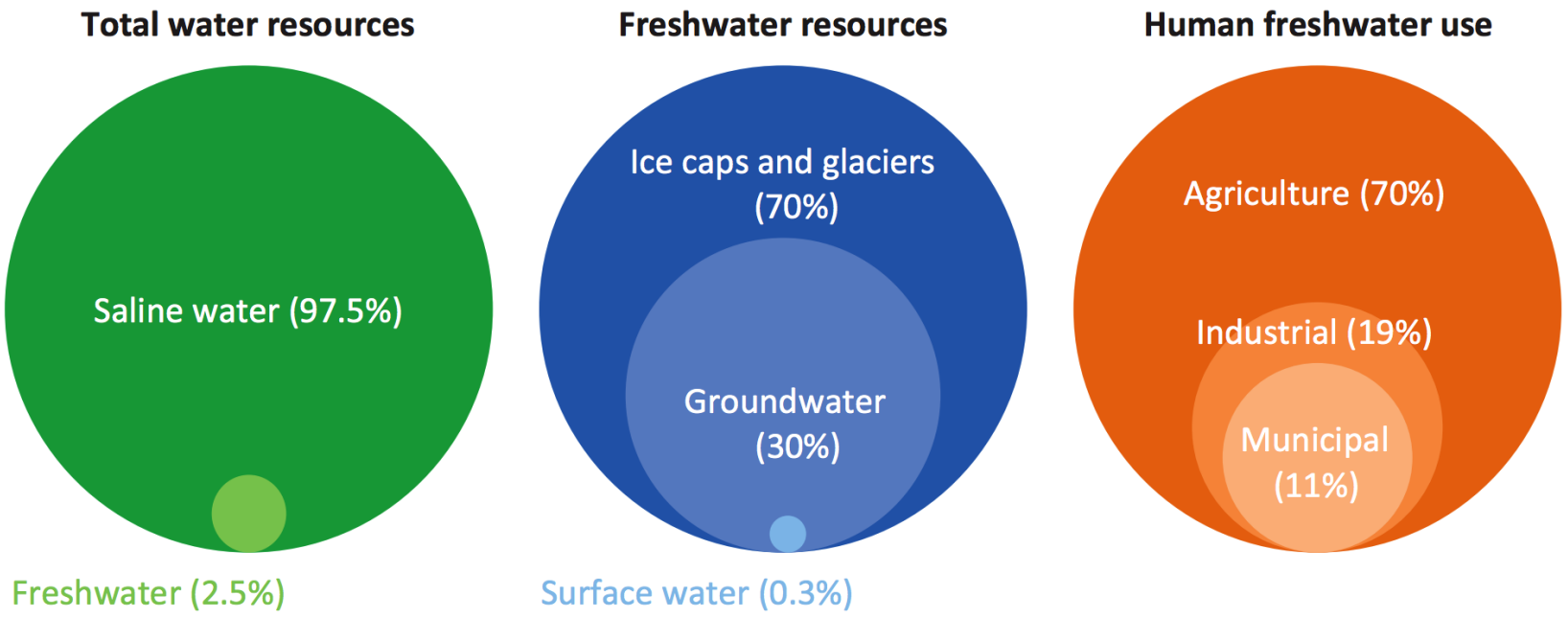
- Water availability and predictability affects energy systems
  - Climate change, El Niño, drought warnings, etc.
- Changing energy future
  - Availability of resources
  - Use and shape technology
  - Fluctuating oil market
- Multiple competent agencies in water and energy
  - Decision-making
- Private sector
  - Investment
    - Tourism, agriculture, transport, trade
  - Decision-making

Caribbean Institute for Meteorology and Hydrology CIMH

Current scenario

- Fresh water represents 2.5% of total water in the world
  - 1% surface or groundwater, 99% glaciers, ice caps, deep aquifers



Sources: Shiklomanov (1993); UN FAO Aquastat database.

Current scenario

- 15% of water withdrawals worldwide are linked to energy
  - By 2035 withdrawals increase 20%, but consumption increases 85%
  - Advanced systems reduce withdrawals but consume more
    - Water requirements for fossil fuel-based power plants can be reduced with advanced cooling systems
      - Higher cost of capital
      - Lower plant efficiency
- Water for biofuel
  - feedstock crops from irrigated or rain-fed lands
- Water for fossil fuels
  - Lower water requirements, though potential impacts on quality are a concern
- Renewable energy and energy efficiency
  - Reduces carbon footprint
  - **Saves water**

Water for energy

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Primary Energy	Uses	Potential water quality impacts
Oil & gas	Drilling, well completion and hydraulic fracturing.	Contamination by tailings seepage, fracturing fluids, flowback or produced water (surface and groundwater).
	Injection into the reservoir in secondary and enhanced oil recovery.	
	Oil sands mining and in-situ recovery.	
	Upgrading and refining into products	
Coal	Cutting and dust suppression in mining and hauling.	
	Washing to improve coal quality.	
	Re-vegetation of surface mines.	
	Long-distance transport via coal slurry.	
Biofuels	Irrigation for feedstock crop growth.	Contamination by runoff containing fertilizers, pesticides and sediments (surface and groundwater).
	Wet milling, washing and cooling in the fuel conversion process.	Wastewater produced by refining.

Water for energy

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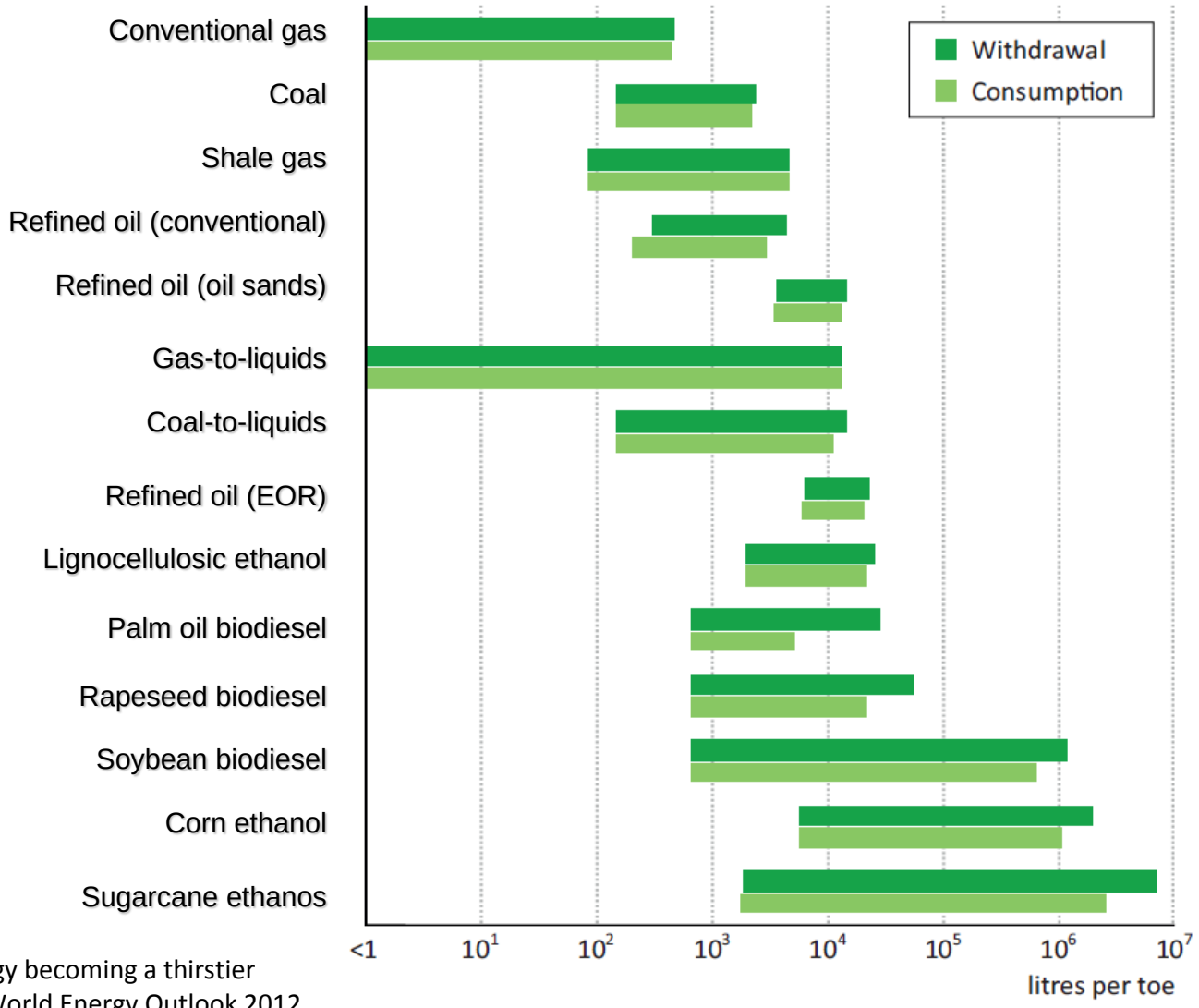
Power	Uses	Potential water quality impacts
Thermal (fossil fuel, nuclear and bioenergy)	Boiler feed, i.e. the water used to generate steam or hot water.	Thermal pollution by cooling water discharge (surface water).
	Cooling for steam-condensing.	Impact on aquatic ecosystems.
	Pollutant scrubbing using emissions control equipment.	Air emissions that pollute water downwind (surface water).
		Discharge of boiler blow down, i.e. boiler feed that contains suspended solids.
Concentrating solar power and geothermal	System fluids or boiler feed, i.e. the water used to generate steam or hot water.	Thermal pollution by cooling water discharge (surface water).
	Cooling for steam-condensing.	Impact on aquatic ecosystems.
Hydropower	Electricity generation.	Alteration of water temperatures, flow volume/timing and aquatic ecosystems.
	Storage in a reservoir (for operating hydro-electric dams or energy storage).	Evaporative losses from the reservoir.

Water for primary energy



Source: "Water for Energy. Is Energy becoming a thirstier resource?" IEA. Excerpt from the World Energy Outlook 2012

Water for power

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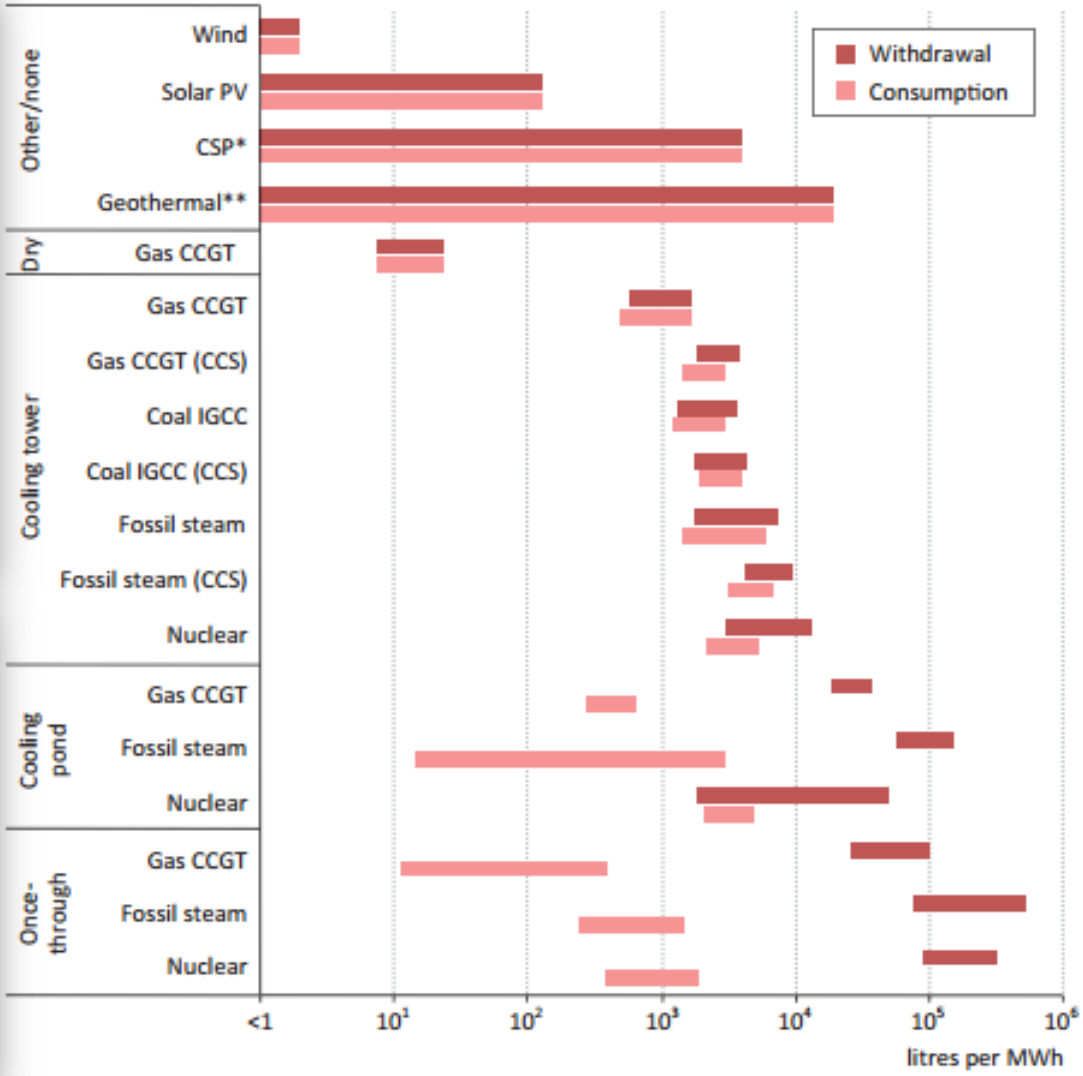

Water demand

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- Rising energy demand from the water sector
  - Rising water demand
    - Population growth and improved standards of living
    - Scarcer freshwater supplies near population
      - Climate change (distances, pumping, treatment)
  - More stringent standards for water treatment
  - Shift in irrigation practices from surface or flood (gravity) to pumping
  - More water-efficient but requires energy

Interdependence

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- Water requirements in all energy processes
  - Cooling, geothermal, biofuels, hydro, fracking, etc.
- Energy requirements in all water processes
  - Extraction, transport, distribution, sanitation, etc.
  - Residential, commercial, industrial & agricultural use
- Climate change, drought, El Niño

Status

- Changes in population, demographics, and migration patterns
- Increased frequency and intensity of extreme weather events
- Changing regional climate and hydrologic cycles
- Growing human influences on land use and land cover
  - Significant human feedbacks to regional climate systems and local weather patterns
- Increasing demands for energy
- Increasing competition for water
  - Changes in water supply
- Rapid evolution of technology and its performance
- Global economy with strong influences on development

Challenges

- Long-term plans based on historical data about climate, river flows, and extreme events becoming less relevant in a rapidly changing world
  - Spatial and temporal planning vary by need and type of user
  - Water-energy interactions affect most islands, but problems vary depending on topography, population density, level of economic development.
- Changes in weather and land use require costly adjustments
- Social conflicts
- Value of water

Nexus Approach: Opportunity to guide R&D and decision-making

- Improve water and energy data and models through integration
  - Input from researchers, decision-makers, investors, planners and users
- Share information models and R&D to optimize decisions
- Maximize infrastructure and resource use
  - Sinergies between energy and water systems (e.g., residual heat, water reservoirs, combined cycle)
- Priorize energy investment based on projected water availability and migration patterns

Defining the water-energy nexus in the Caribbean

Develop a Caribbean-tailored approach




THANK YOU!

Juan Cruz Monticelli

Sustainable Energy
Department of Sustainable Development
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