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ALTERNATIVE SUSTAINABLE ENERGY

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York University

Challenge what is. Imagine what could be.

Vietnamese Ministry of Natural Resources and the Environment
May 29, 2012

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PRESENTATION OUTLINE

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- Background on Sustainable Energy
- Energy Efficiency & Conservation
- Renewable Energy
- Smart Grid
- Lessons from Canadian Experience
- Discussion

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BACKGROUND – PETER LOVE

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- Environmentalist (staff and board) with experience in non-governmental organizations, private sector and government agency
- Most recently Chief Energy Conservation Officer with the Ontario Power Authority
- Currently President of the Energy Services Association of Canada and Adjunct Professor at York University's Faculty of Environmental Studies
- BA, MBA, ICD.D

MY BICYCLE TRIP OF VIET NAM

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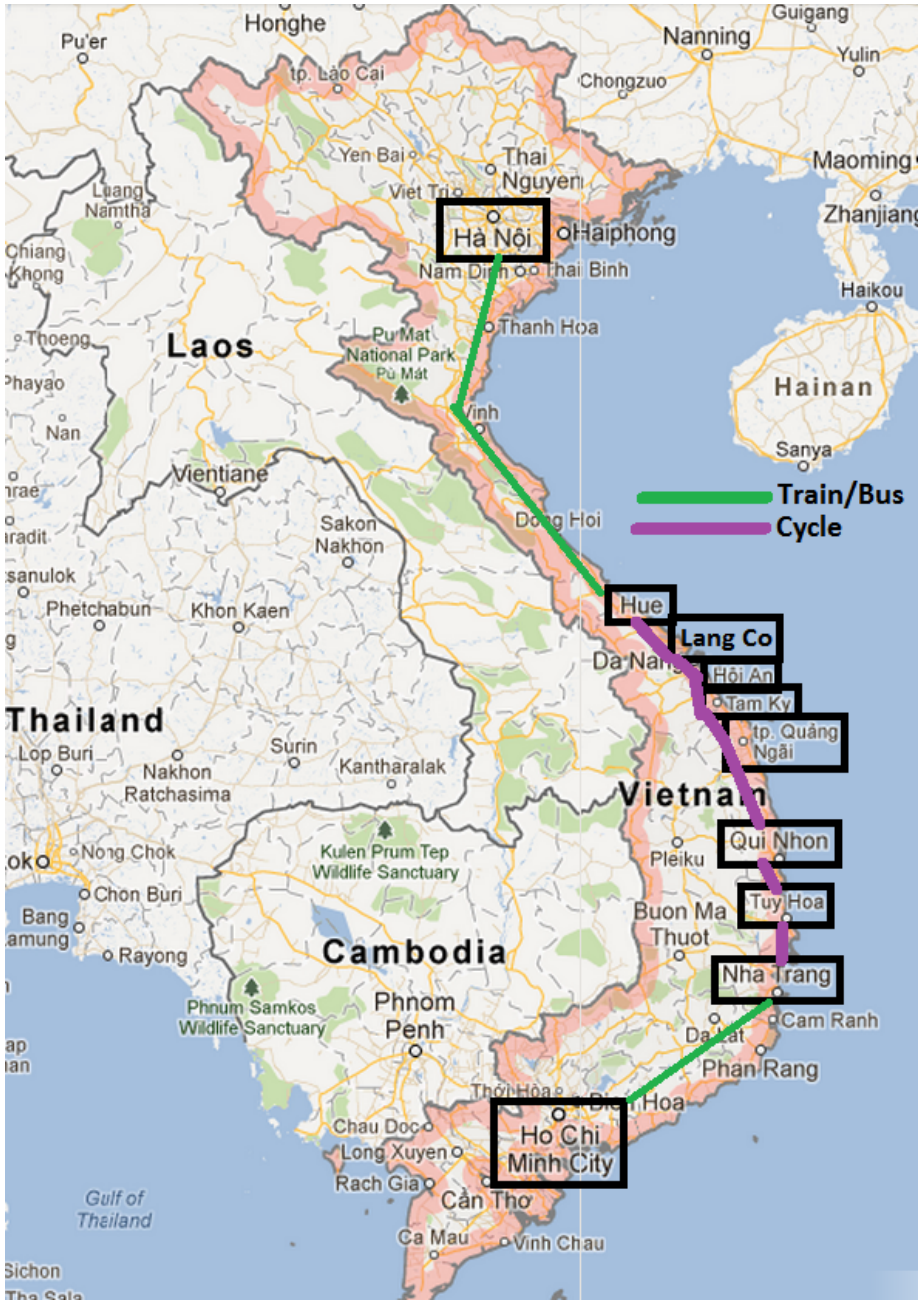

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COMPONENTS OF SUSTAINABLE ENERGY

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- Energy Efficiency & Conservation (EE&C)
- Renewable Energy
- Smart Energy Network
  - Electric Grid
  - Natural Gas Pipelines
  - Energy Storage

ENERGY FLOWS IN CANADA

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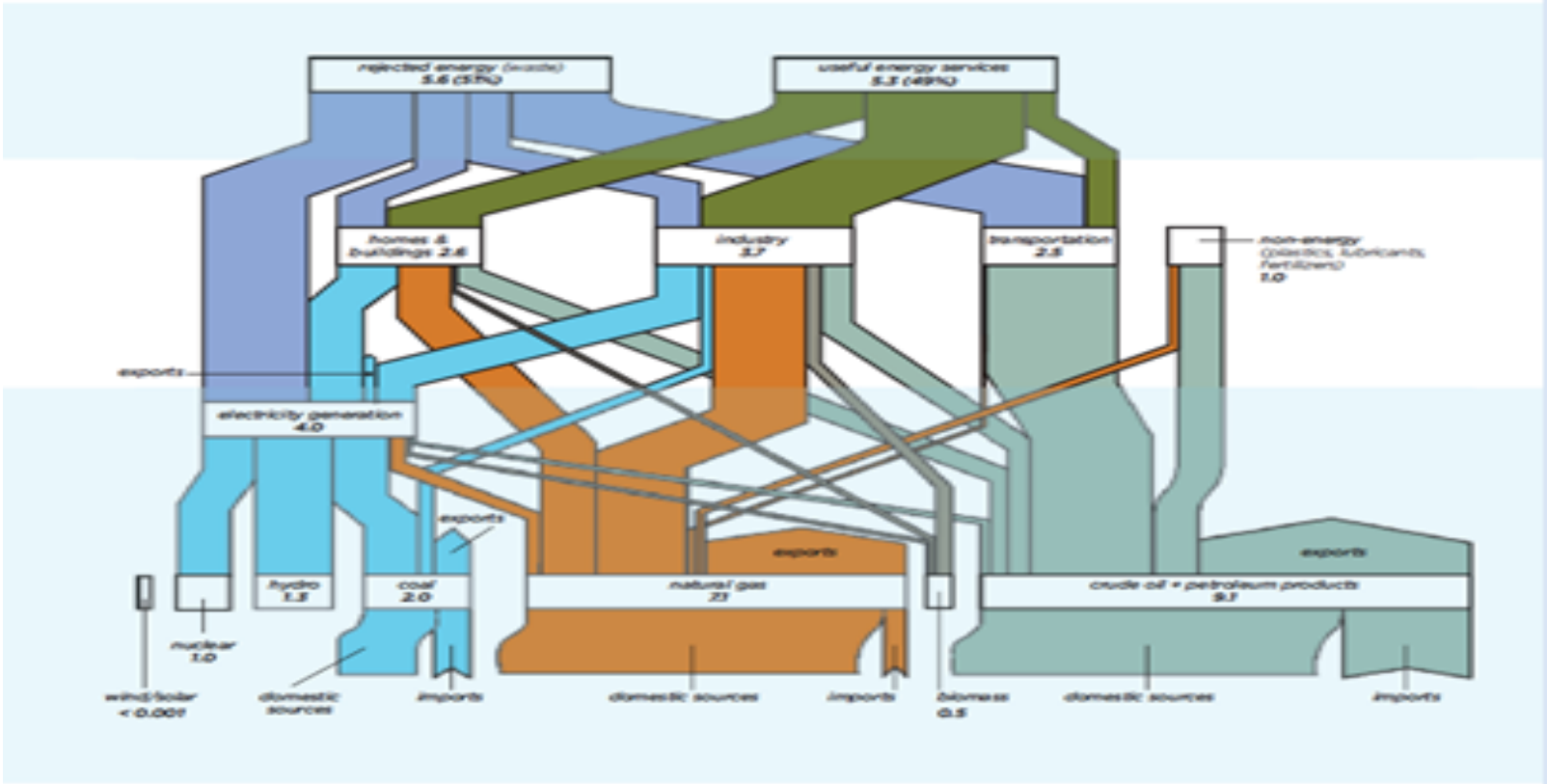
Figure 1-1: **Canada's Energy Flow, 2007** (exajoules; values are approximate)



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BENEFITS - EMPLOYMENT

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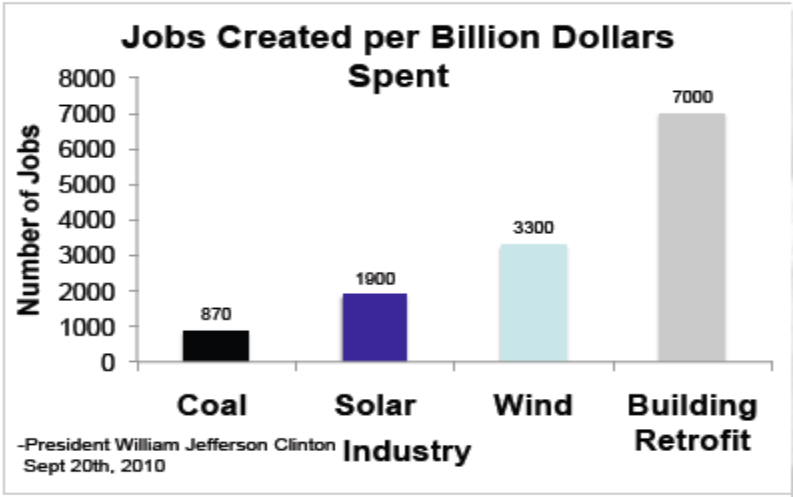

Empire State Building Retrofit:

- 8 month design phase, 60 ideas considered, 8 projects (financial and environmental ROI).
- 3.1 year payback
- Initial $20 million, 38% energy reduction, $4.4 million savings annually.
- Creation of hundreds of jobs

- www.esbnyc.com

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BENEFITS - ECONOMIC

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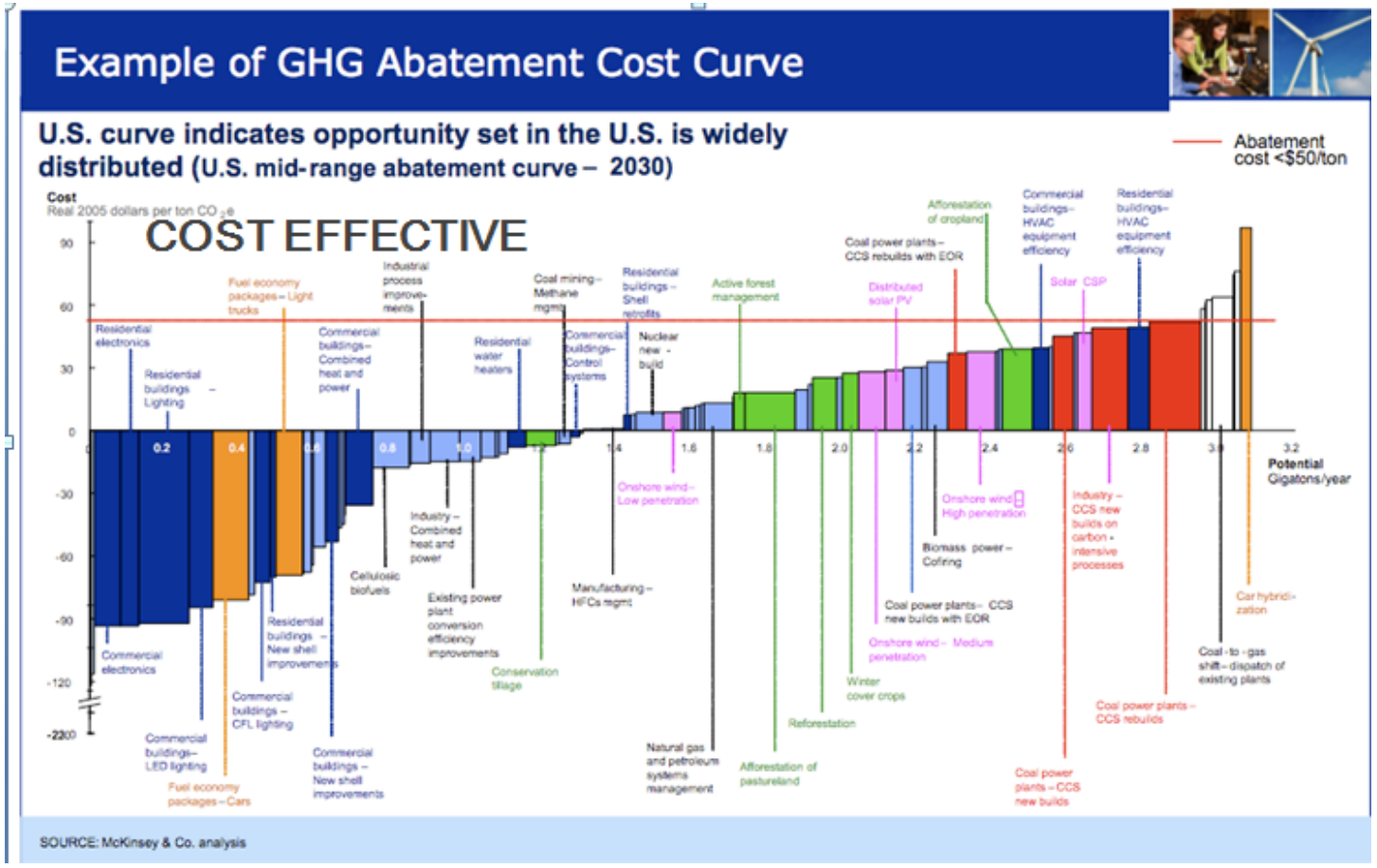

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BENEFITS - ENVIRONMENT

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IPCC – Most of the observed increase in the globally-average temperature since the mid 20th Century is *very likely (*i.e. > 90% likelihood) due to the observed increase in anthropogenic (i.e. man made) GHG concentrations

IEA -rising fossil-fuel energy use will lead to irreversible and potentially catastrophic climate change

Ban Ki-moon - slowing or even reversing the existing trends of global warming is the defining challenge of our ages.

World Economic Forum's - climate change has the highest combined perceived impact and likelihood

BENEFITS – SECURITY OF SUPPLY

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As a major energy exporter, not a major issue in Canada

Major issue in the US, Europe and Japan with limited domestic energy sources

THREE E's

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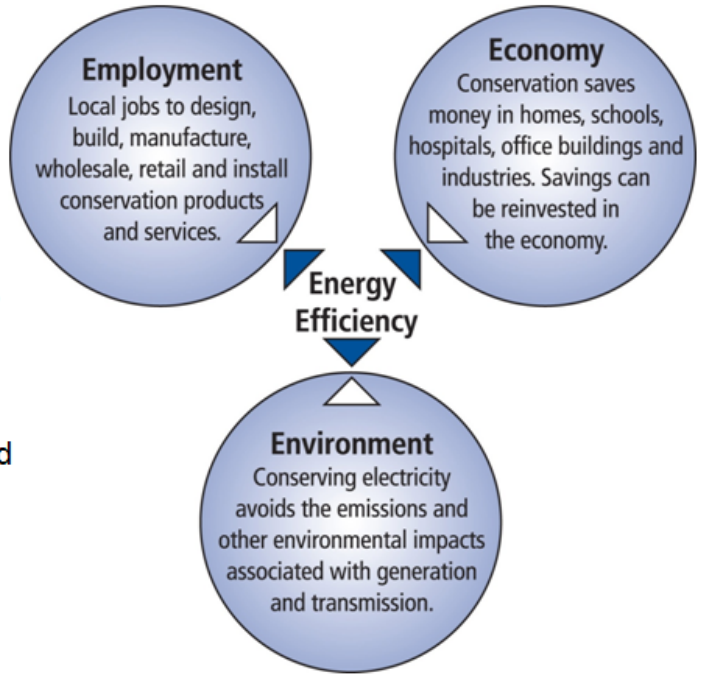
Benefits of Conservation

The Three "Es":

- **Employment** benefits: labour-intensive, local jobs
- **Economic** benefits: cost-effective for households and makes private sector more competitive
- **Environmental**/health benefits: reduced GHGs, acid rain, smog



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OPA Ontario Power Authority

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CONSERVATION

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Five Types

- Behavioural Conservation (no change in technology)
- Energy Efficiency (technical improvements)
- Demand Response (time of use)
- Fuel substitution (increases use of other fuel)
- On-site generation (excludes FIT contracts in Ontario)

CHALLENGES OF CONSERVATION

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- Most forms of energy and conservation is invisible
- Requires a Culture of Conservation as well as voluntary programs and minimum standards
- Requires all sectors to participate.
- Important role of pricing/elasticity of demand.

IMPROVEMENTS IN ENERGY EFFICIENCY

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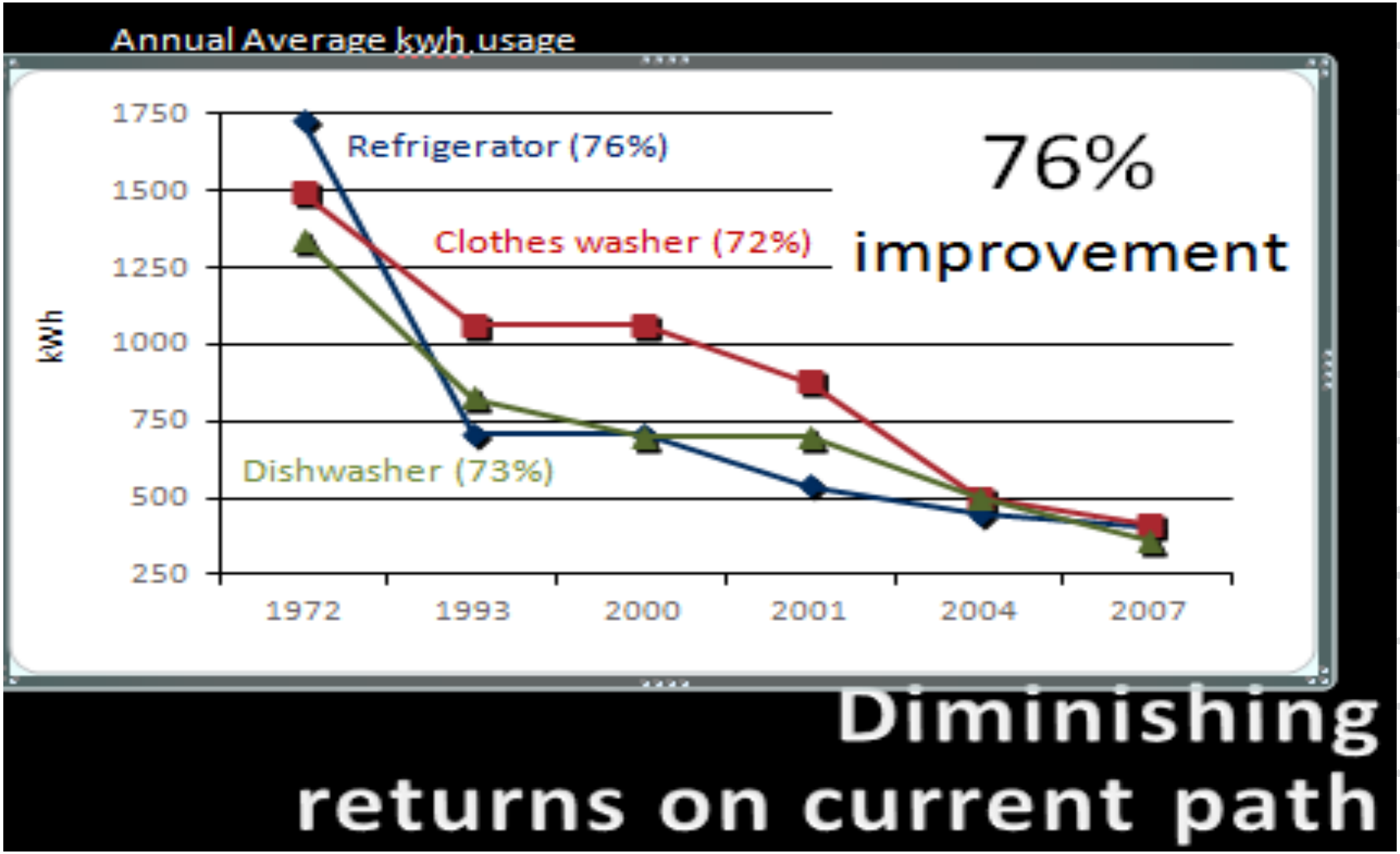

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LOAD DURATION CURVE

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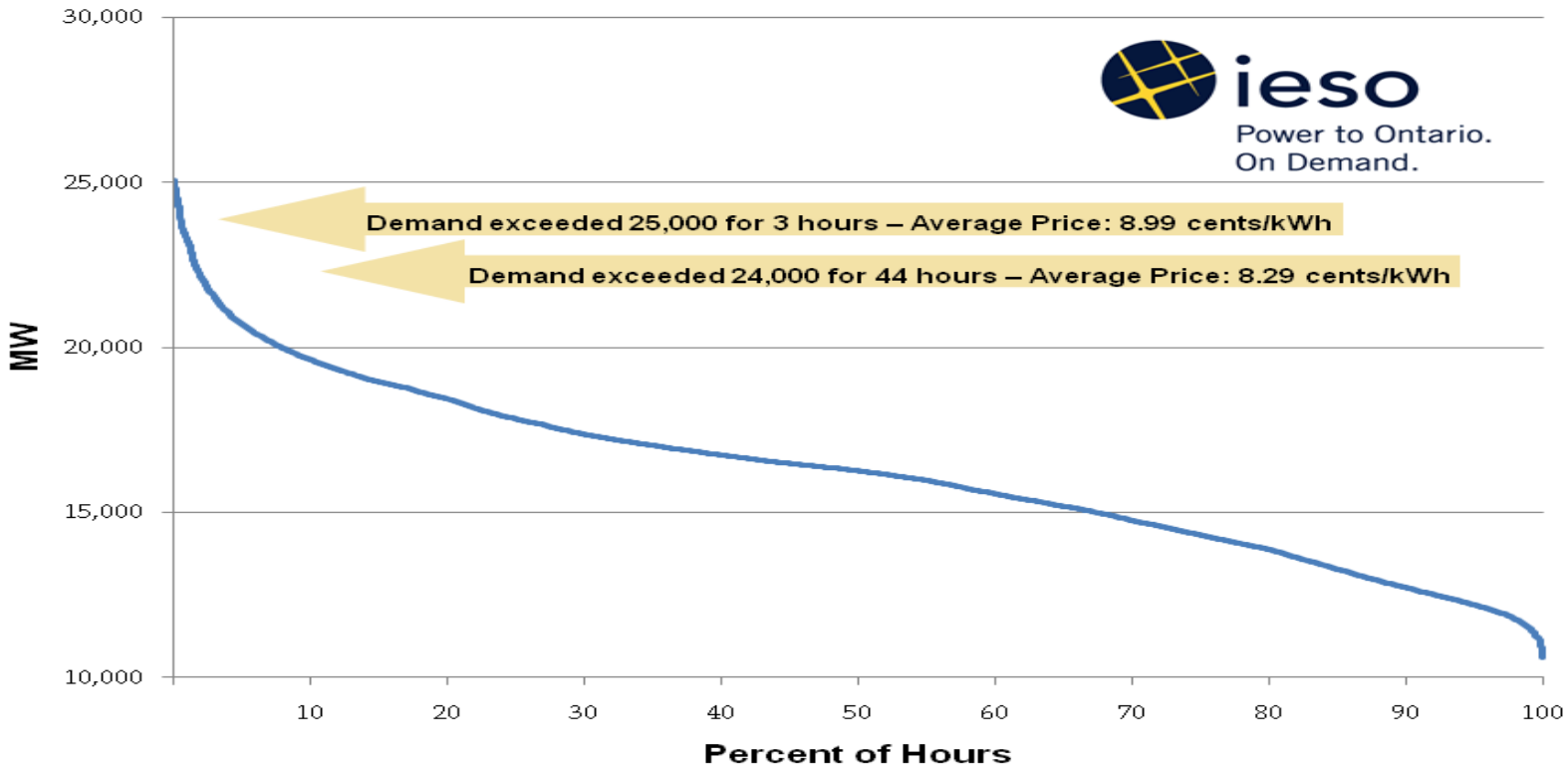

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TIME-OF-USE RATES

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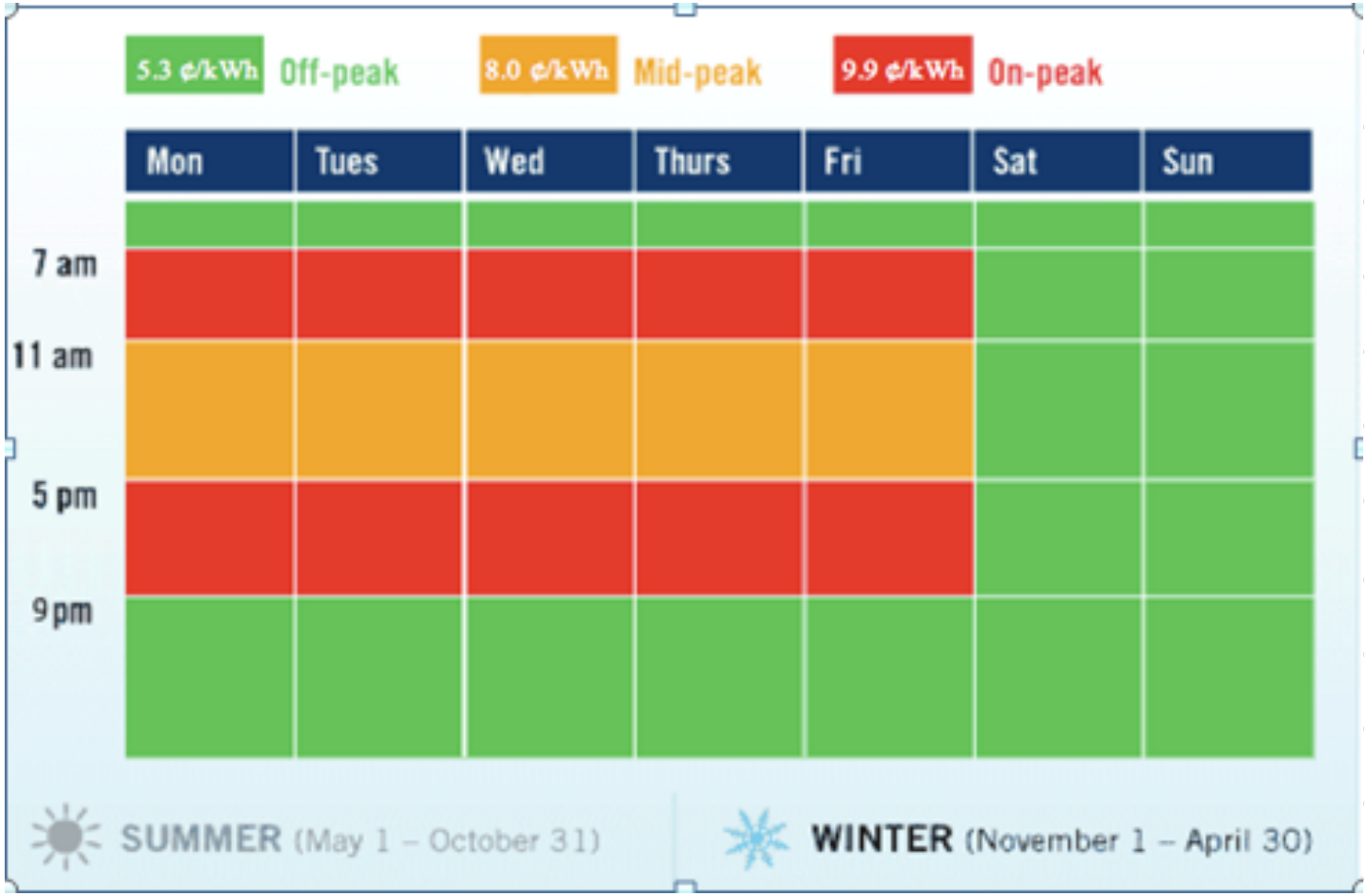

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ROLE FOR GOVERNMENT

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- Set aggressive targets, monitor/report on progress
- Develop, legislate and enforce codes and standards for buildings and equipment
- Establish permanent funding for voluntary conservation programs (paid by energy users, not government)
- Ensure proper evaluation, measurement and evaluation of all programs
- Encourage participation by private sector through energy performance contracts
- Set example in own facilities

MAIN TYPES OF RENEWABLE ENERGY

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Wind

Solar – water heaters

- PV for electricity

Hydro – small and large

Geothermal – low temperature for heating/cooling

- high temperature for electricity

Biomass – combustion/gasification for heat/electricity

- anaerobic digestion for methane

Ocean – waves, tides, current

CHALLENGES FOR RENEWABLE ENERGY

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- Many of most economic reserves already developed especially large hydro
- Typically involve high up front cost with minimal operating cost
- Technical improvements expected to result in cost reductions in future
- Resource potential often not well understood/mapped

GRID PARITY FOR SOLAR PV

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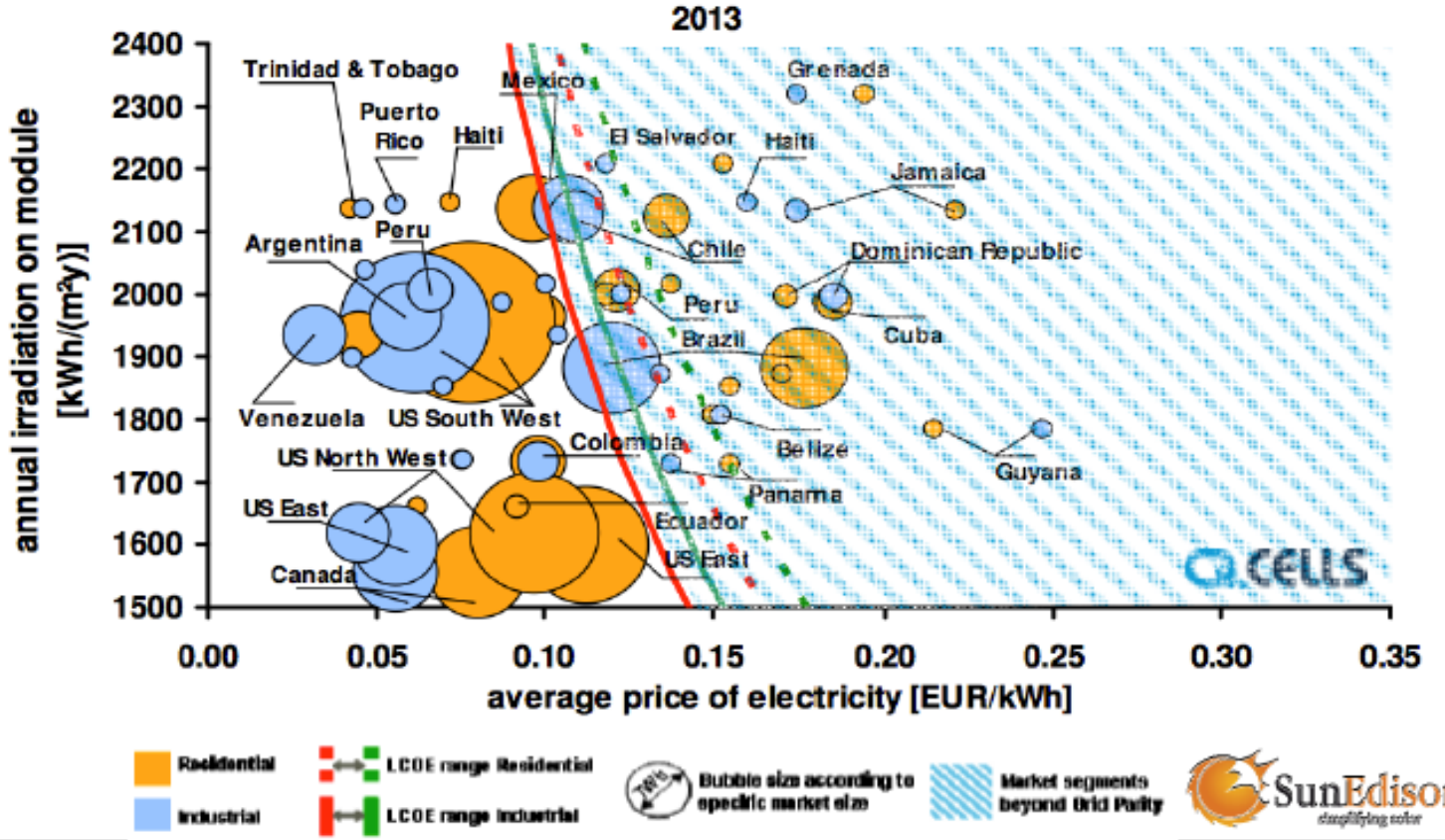
Grid Parity in Americas - 2013



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GRID PARITY FOR SOLAR - 2020

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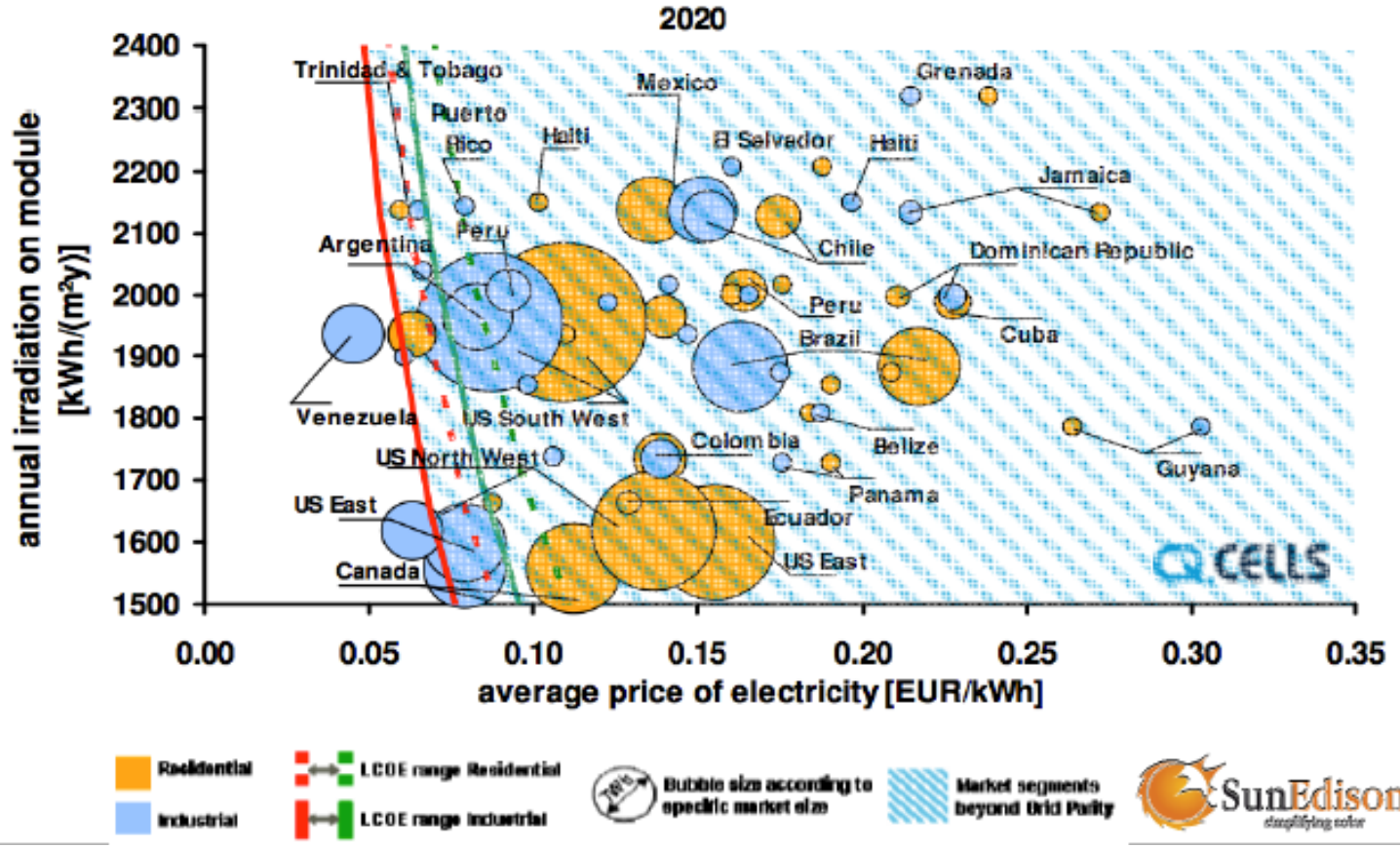
Grid Parity in Americas - 2020



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ROLES FOR GOVERNMENT

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- Set aggressive targets and monitor/report on progress
- Provide price support through a guaranteed, long term price using a feed-in tariff system
- Alternatively, set and enforce Renewable Portfolio Standard requiring specified amount of electricity or natural gas from renewables
- Ensure resource potential is identified/mapped and made publically available

SMART ENERGY NETWORK

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- Smart Electricity Grid
  - Smart meters & rates to promote demand response
  - facilitates integration of distributed generation
  - improves responsiveness and reliability

- Smart Natural Gas Pipelines
  - facilities integration of distributed sources from biomass
  - improves responsiveness and reliability
- Energy Storage

SMART ENERGY NETWORK

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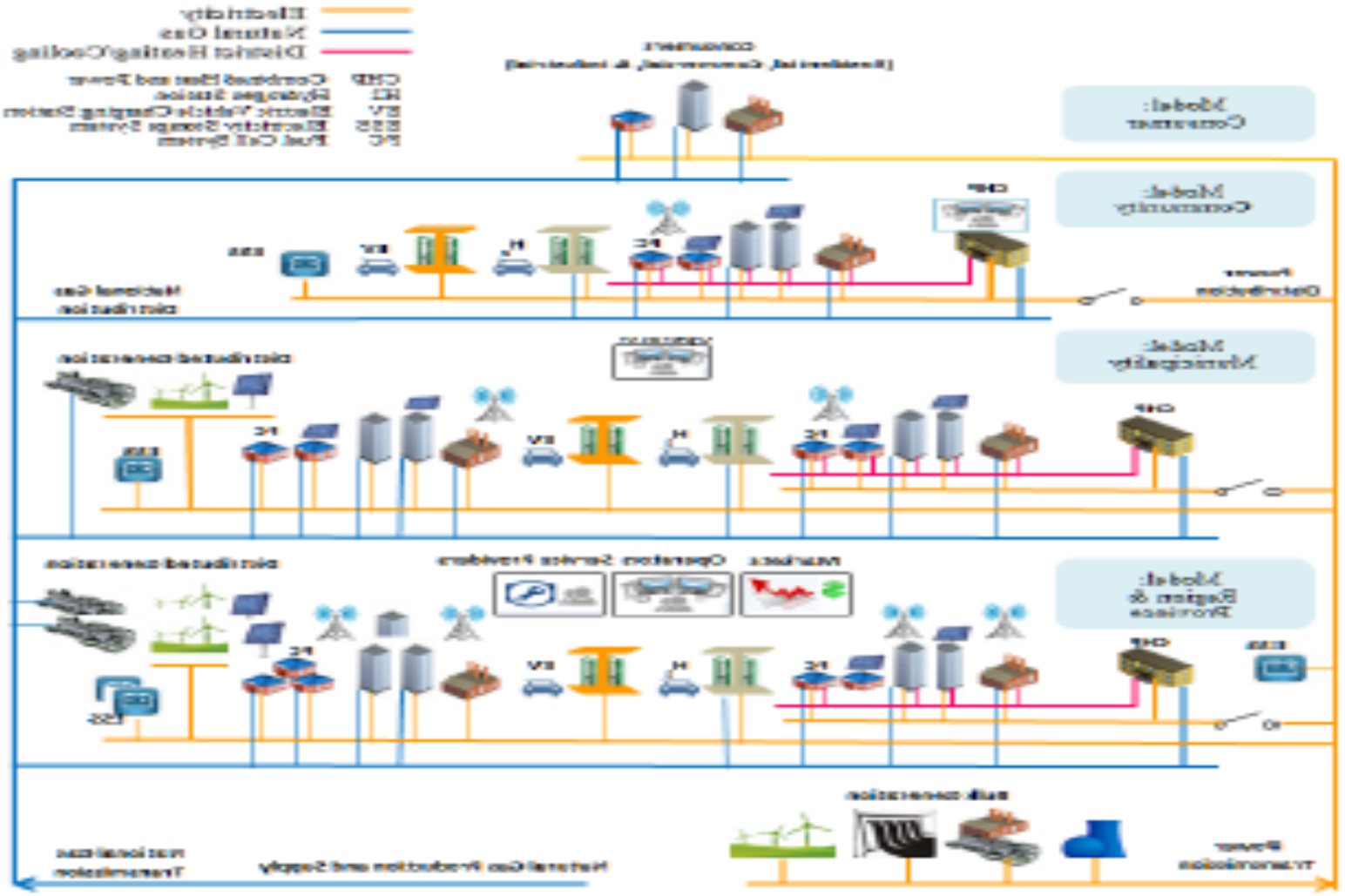

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ROLE FOR GOVERNMENT

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- Require phase in of smart meters over period of time
- Assign clear responsibility for implementation/operation

LESSONS FROM CANADIAN EXPERIENCE

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Important to have

- National Energy Strategy (development of conventional/ sustainable resources, smart network, energy & carbon pricing, and conservation
- Aggressive mandatory codes & standards
- Rate-payer funded voluntary conservation incentive programs
- Active energy service industry
- Feed-In-Tariff program for renewables
- Clear leadership in Smart Energy Network

DISCUSSION

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