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# Smart Energy Network

A review of the  
'state of the art'

# Outline

- Context
- Methods
- What is a SEN?
- Where is activity happening?
- So what?
- Summary

# Context

- Waterloo Institute of Sustainable Energy is interested in exploring Smart Energy Networks (SENs), which is to say the optimal integration of multiple energy fuels into an energy system
- Recruited an Advisory Panel, commissioned White Papers on SENs
  - **WP2** – What are the pieces; costs & benefits
  - **WP1** – “What’s over that hill?” What is a SEN, where is it happening, and why are people moving in this space?
- Leadership Conference (September 2013)
- [wise.uwaterloo.ca/sen](http://wise.uwaterloo.ca/sen)

# Some notes on methods

- Reconnaissance mission
- Intent is exploratory
  - Outline 'big picture' of SEN, scope research area
  - Begin building understanding of area to start discussions, inform a research agenda
- Limitations: 'systematicness'

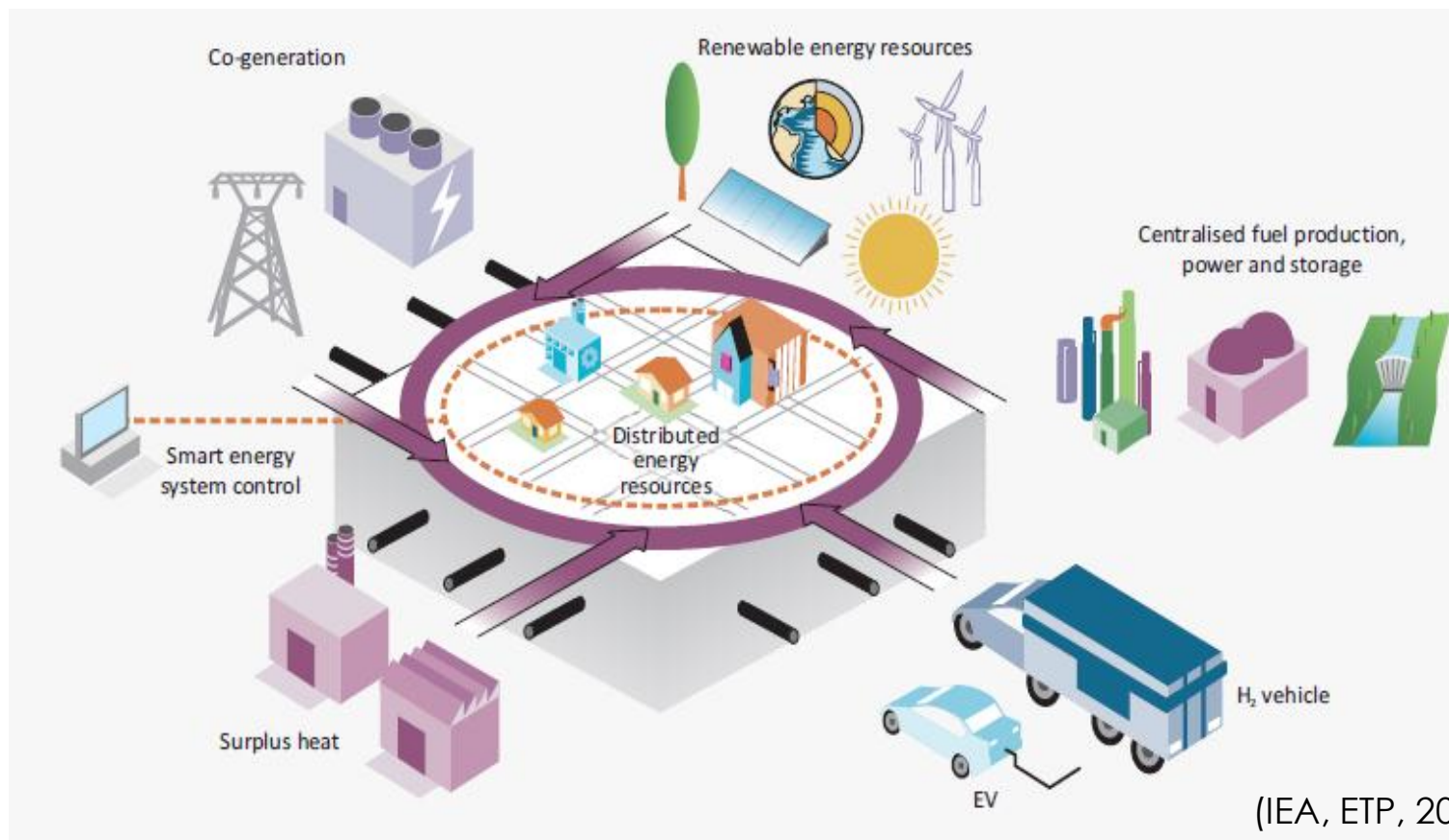
# Some notes on methods

- Review of 'grey' literature
  - International Energy Agency
  - European Union's Joint Research Centre
  - government documents
  - individual projects

# What is a SEN?

- SENs use advanced information and communication technology to monitor and manage the transport of energy from multiple fuel sources to meet the varying energy service demands of end users.
- Novelty: capacity to **optimally** coordinate **multiple fuels with ICT**
  - E.G: An energy system that uses ICT to determine when best (eg. peak) to switch to an alternate fuel, such as natural gas or heat.

# What is a SEN?

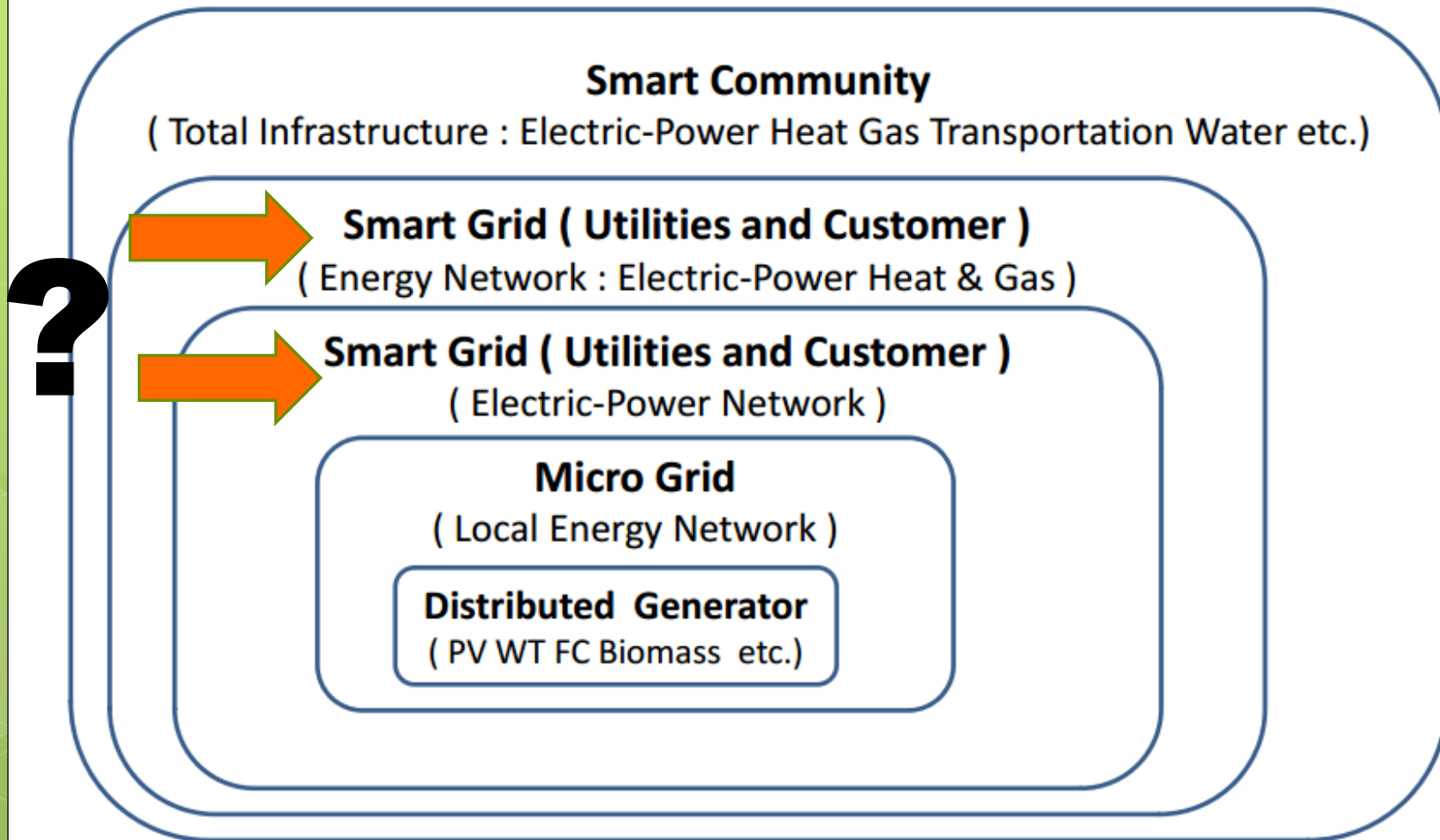


## Is this not SG?

- Smart grid: ICT + electric grid
- SEN: ICT + **X** (multiple fuels)
  
- Semantics and confusion
  - Japan uses “SEN”
  - Europe uses “smart grid” as catchall term



# Definition of Smart Grid and Smart Community



(Goda, 2011)

# Where is this happening?

- SEN projects almost exclusively in OECD
  - Prerequisites: multiple fuels, smart technology (Italy)
  - Hubs: Sweden, Denmark, South Korea, Japan
- SENs as means to an end
  - Coordinating the integration of distributed generation; responding to resource scarcity/trade imbalance; reducing GHG emissions

# What does it look like?

- Example: *EcoGrid EU*, Bornholm, DK
  - Approximately 2,000 participants (of 28,000)
  - Smart appliances, distributed renewables, micro-CHP, heat pumps, electric vehicles, real-time pricing



# SENs in Canada?

- Canadian innovation
  - Summerside, PEI Wind Farm
    - wind-electricity stored as heat in electric thermal storage and electric domestic hot water units
    - during periods of insufficient wind, these systems provide heat to meet demand rather than requiring a backup supply of energy.



# Canadian position

- Resource powerhouse
  - hydropower (3<sup>rd</sup> in world)
  - natural gas (3<sup>rd</sup> in world)
  - crude oil (6<sup>th</sup> in world)
  - nuclear power (7<sup>th</sup> in world)
  - significant land mass → renewables
- ICT competencies
- Impacts; positive or negative?
  - economic, environmental

# Areas of interest

*Exceptionals*: temporal scale, regulation,  
business models

*Expansions*: technical performance,  
multiple actors (privacy, interests, Tragedy  
of the Commons, legacy systems)

*Echoes*: definitions,  
motivations, spatial scale,  
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# Next steps?

- worthy of further consideration (given the potential)
- importance of clarity in definition
- use international experiences to help to generate possible arrangements
  - investigate (through study and practice) applicability to Canada
    - Benefits, (transaction) costs, challenges
- Within this project: Summerside case study to explore consumer engagement and acceptance issues

# Summary

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# Acknowledgements

- The authors acknowledge the helpful input of members of the Smart Energy Network Advisory Panel and the financial support of Union Gas. The contents of this presentation, however, do not necessarily represent the views of any member of the Advisory Panel nor of Union Gas. Instead, the authors are solely responsible for this presentation.

• [wise.uwaterloo.ca/sen/blogs/announcingtheappointmentofsmartenergynetworkssenadvisorypanel](http://wise.uwaterloo.ca/sen/blogs/announcingtheappointmentofsmartenergynetworkssenadvisorypanel)