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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

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'

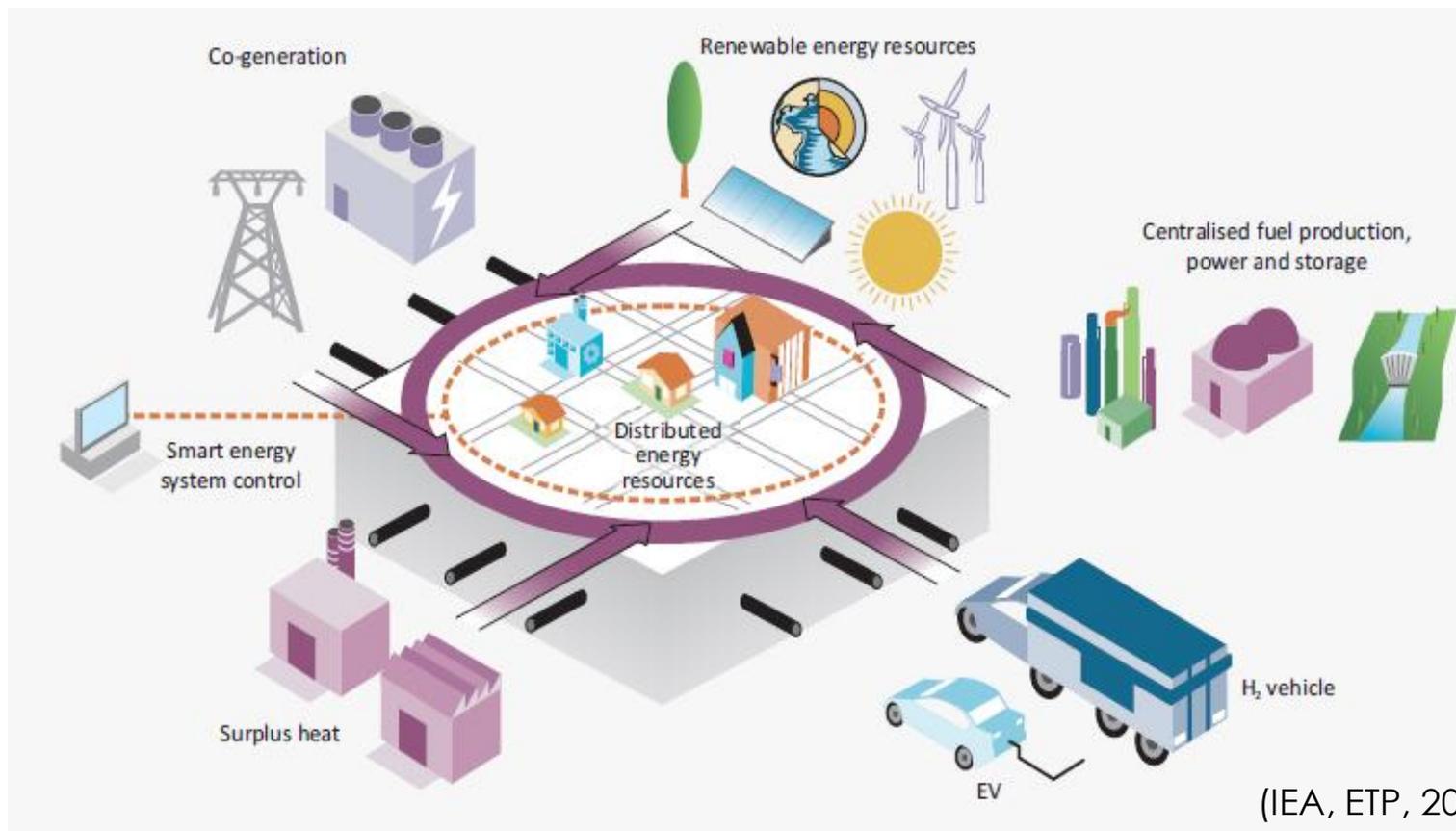
Some notes on methods

- 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?



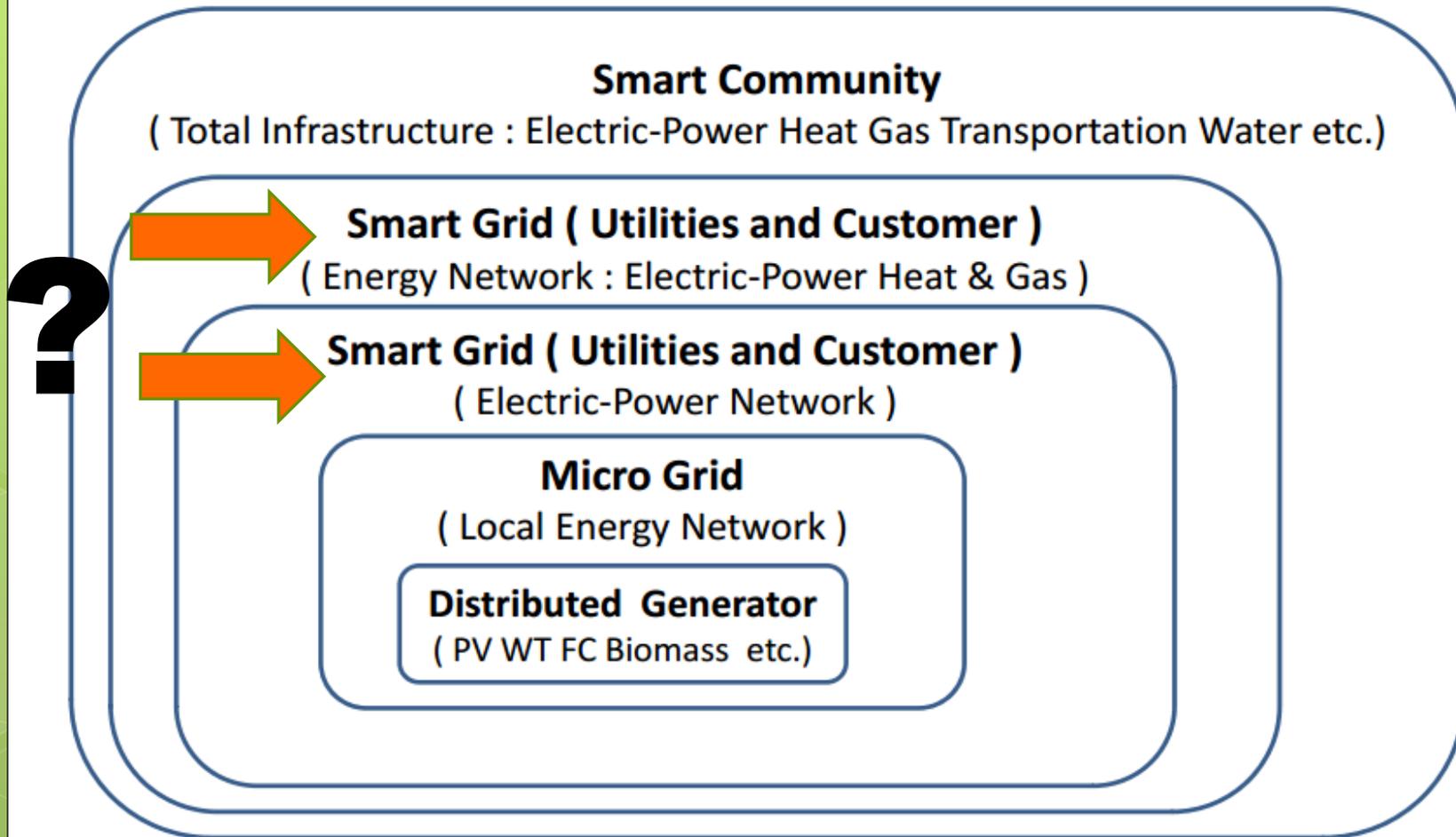
(IEA, ETP, 2012)

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 (3rd in world)
 - natural gas (3rd in world)
 - crude oil (6th in world)
 - nuclear power (7th 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,
customer engagement

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*closely
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'larger'*

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*significantly
different
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grid issues*

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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• wise.uwaterloo.ca/sen/blogs/announcingtheappointmentofsmartenergynetworkssenadvisorypanel