Renewable Energy and Grid Innovation at the Local Level
Case Studies from Scotland

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Community Energy Scotland

A Decentralised Electricity System – Myths and Facts
Brussels, 21st April 2015
Outline

- Introduction to CES
- Drivers for grid innovation
- Potential benefits to communities
- Case Studies:
  - Community microgrids
  - Demand Side Management
  - Energy storage
Our Mission

“To build confidence, resilience and wealth at community level in Scotland through sustainable energy development”
Community Energy Scotland

- Independent Scottish charity
- 19 FT staff spread across Scotland, inc Orkney and WI
- Over 400 members—mostly non-profit distributing community groups.
- Over 600 community energy installations > 35MW capacity
- Income and affordable energy for Local people >> £5 million per year
Drivers for Innovation

1. Transmission & Distribution

Constrains

- Lead time for major transmission upgrade in Scotland is c. 7 years
- Reinforcement only triggered when generators willing to pay upfront cost
- Small generators can’t afford reinforcement costs
- 1 phase limited to 90kW generation connections
- Difficult to upgrade due to cost (c. 10 million km of single phase OHL)
Drivers for Innovation

2. Feed in Tariff Degression

Wind FIT Degression April 2010 - March 2015

- Wind < 1.5kW
- Wind 1.5kW - 15kW
- Wind 15kW - 100kW
- Wind 100kW - 500kW
- Wind 500kW - 1.5MW
- Wind > 1.5MW

FIT rate (p/kWh)

- 1 April 2010 to 31 March 2012
- 1 April 2012 to 30 November 2012
- 1 December 2012 to 31 March 2014
- 1 April 2014 to 31 March 2015
- 1 April 2013 to 31 March 2014
Drivers for Innovation

3. Rising Fuel Costs

2014 prices

Heating Oil (£/1000 L)

Consumers’ Expenditure on Energy

2011 prices

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Solid fuels</td>
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<tr>
<td>Gas</td>
<td>28%</td>
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<tr>
<td>Electricity</td>
<td>20%</td>
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<tr>
<td>Vehicle fuels &amp; lubricants</td>
<td>49%</td>
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<tr>
<td>Liquid fuels</td>
<td>3%</td>
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</tbody>
</table>
Local Energy Economies - Concept

- Local generation
- Local supply
- Local demand
- National Grid
- Local Finance (community ownership)

Cash flow:
1. Energy from wind turbine
2. Local supply
3. Local demand
4. Energy to vehicle
5. National Grid

H₂
Potential benefits of grid innovation

1. Accelerate grid access
2. Increase value of renewable generation
3. Create new fuels for affordable heat and transport
4. Increase local economic benefits
Grid Innovation Demonstration Projects
Community microgrid
Applecross District Heating

Community Hydro-Scheme
90kW

Smart Heating Control
Communication Link

Community Owned Distribution Network

Power Flow

Network Constraint

Public Distribution Network

Smart Heating Demand

Smart Heating Control

Community
Owned
Distribution
Network
Demand Side Management
Orkney Electric Vehicles

900kW

900kW (non-firm)

Energy Generation

Network Constraint

Power Flow

Controllable Energy Demand
It works!

Curtailment Signal and EV Charging Dispatch
Orkney October 6, 2014

EV Charging activated in response to signal from wind turbine
Energy storage

Gigha Battery

- Energy Generation: 330kW
- 225kW Vanadium Flow battery: 1.26MWh
- Network Constraint
- Power Flow

- Captures Constrained Energy
- Allows Gigha to run as a μgrid
- Provides Stabilization for local Wind Turbines
Energy storage: H₂
Orkney ‘Surf and Turf’

Goals:
✓ Integrate Wind Power (Eday Community) with Tidal Power (EMEC)
✓ Shore Supply at Kirkwall Pier: A H₂ Fuel cell will produce electricity for ships & local grid
✓ H₂ transported on mobile stores between Electroliser (EMEC) and Pier

Benefits:
✓ A self-sustaining credible local H₂ supply chain/use
✓ A world first, integrating (curtailed) wind & tide for H₂ production
✓ Reduce local authority CO₂ emissions immediately
✓ Unique research & training facility: marine H₂ handling
Conclusions

1. Innovative grid solutions are a practical requirement for increasing community energy generation.

2. Policy integration and wider regulatory change is required to implement more widely.

3. Local grid ownership and management boost development, community empowerment and innovation.
Contact

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