The role of Energy Storage and Demand Side Management in Smart Grid Optimisation:
Community led projects in the Scottish Islands

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Outline

• Introduction to CES
• The Scottish Island context
• Identifying DSM opportunities
• Types of grid connection
• Types of DSM solutions
• Lessons and opportunities
• Q&A
Our Mission

Increase community benefit and ownership of low carbon energy in Scotland
Community Energy Scotland

- Independent Scottish charity
- 16 FT staff spread across Scotland, including Orkney and Western Isles
- **Over 400 members** - mostly non-profit distributing community groups
- Supported **over 600 community energy installations** across Scotland, totalling 37MW capacity
- Our projects provide income and affordable energy worth over **£5 million per year** to local people
What is driving innovation?

- Grid connection delays and high costs
- Subsidies are being rapidly reduced
- Need to increase direct benefits to local communities
- Energy costs are rising unsustainably
The Scottish Island context

- **High levels of renewable potential** - 80TWh/year
- **Limited grid capacity** - most networks <50kW max
- **Off gas grid** - most heating is oil, electric or solid fuel (coal/Wood)
- **High transport costs** - 10-20% premium vs mainland
- **UK energy policy is focused on mainland UK** - all utilities fully liberalised, DNO/supplier firewall → community leadership required
Community Energy Innovation Projects in Scotland

Controllable demand

Battery Energy Storage

Hydrogen

LEEP

IIF

LEEP & IIF

Electric cars
Typically a DNO can offer 3 types of grid connection to distributed generation:

1. **Full, firm connection**

2. **Export limited firm connection**

3. **Actively managed non-firm connection** (‘smart’ connection)

   - In the case of 2 and 3, generators need to find ways of minimising ‘lost’ output **(no compensation from DNO)**

   - **Matching generation with local energy demand can help**
Identifying network constraints and demand opportunities

Pinch points

Argyll grid network

Argyll island Fuel Mix (2013)
Gigha Battery Storage - Overview

- Community owned island
- 3 operational community wind turbines (3 x 225kW)
- New 4th turbine ‘export limited’ connection
- Projected lost generation of 3GWh
- Flow battery to be installed 2015
Gigha Battery Storage- technology

- 105kW, 1.25MWh
- >10,000 cycles
- Constrained energy recovery with on-peak dispatch
- Ancillary services (STOR, Frequency Response)
- Capital deferral (DNO benefit)
- Standby power (Islanding)
• Sizing of the system in kW/kWh requires consideration of the benefits that will accrue
• Decreasing returns with power and hours
• Energy in MWh range, power in 50-200 kW range
Orkney Demand Side Management projects

• 5x 900kW community owned wind turbines operational
• Connected to ‘Active Network Management’ system (smart grid)
• Output reduced due to network constraints
• ‘New’ flexible demand required to maximise generation
Orkney Electric Vehicles

Energy Generation

900kW

900kW (non-firm)

Network Constraint

Power Flow

Controllable Energy Demand
Orkney Electric Vehicles

- Installing 6 pilot charging points July 2014; 50 in 2015 (target)
- IP based comms link turbine/ charging points
- Complex hardware compatibility (comms/control/plugs)
• Consideration of frequency and duration of electrolyser operation is key for economic optimisation
• Aim is to minimise cycles while maintaining a high utilisation
• Subject to funding, installation 2015
Lessons and opportunities

Lessons

- Identifying and analysing demand is key and requires sufficient time to develop accurate profiles - start early!
- In remote areas, finding sufficient demand to match generation can be challenging
- Increased complexity and risk vs traditional ‘full, firm’ export connection
- Requires new project planning tools - demand mapping and Sustainable Energy Action Plans
- Commercial arrangements are still being developed and UK market does not yet provide full value for DSM at distribution level

Opportunities

- Reduced connection costs for new generators
- Reduced energy costs for ‘right time’ demand
- Direct customer engagement for generators and suppliers
Thanks for listening

Any questions?

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