HORIZON 2020

CALL FOR COMPETITIVE
LOW CARBON ENERGY

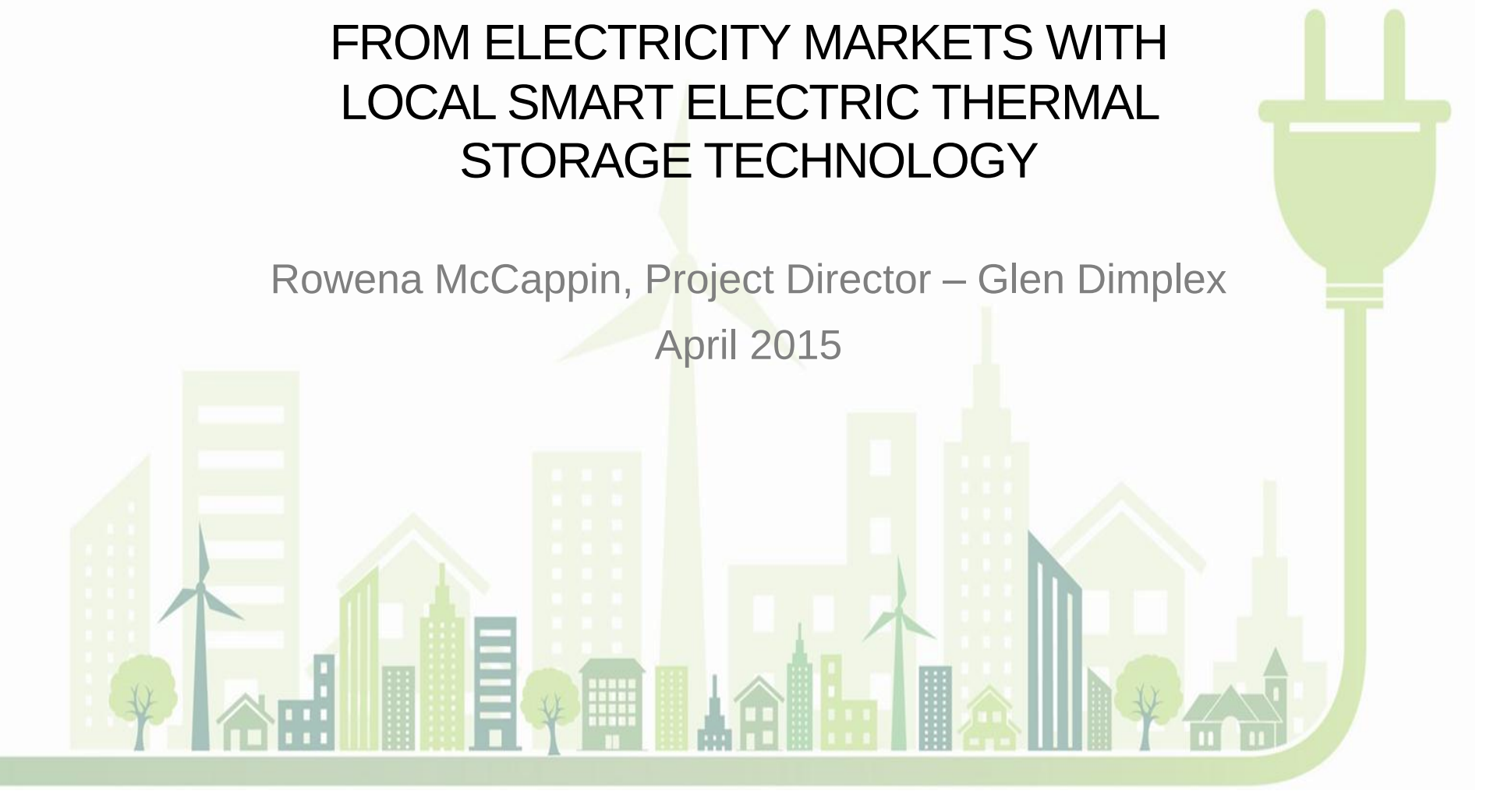
RealValue
UNLOCKING VALUE ACROSS THE EUROPEAN ENERGY CHAIN

REALISING VALUE

FROM ELECTRICITY MARKETS WITH LOCAL SMART ELECTRIC THERMAL STORAGE TECHNOLOGY

Rowena McCappin, Project Director – Glen Dimplex

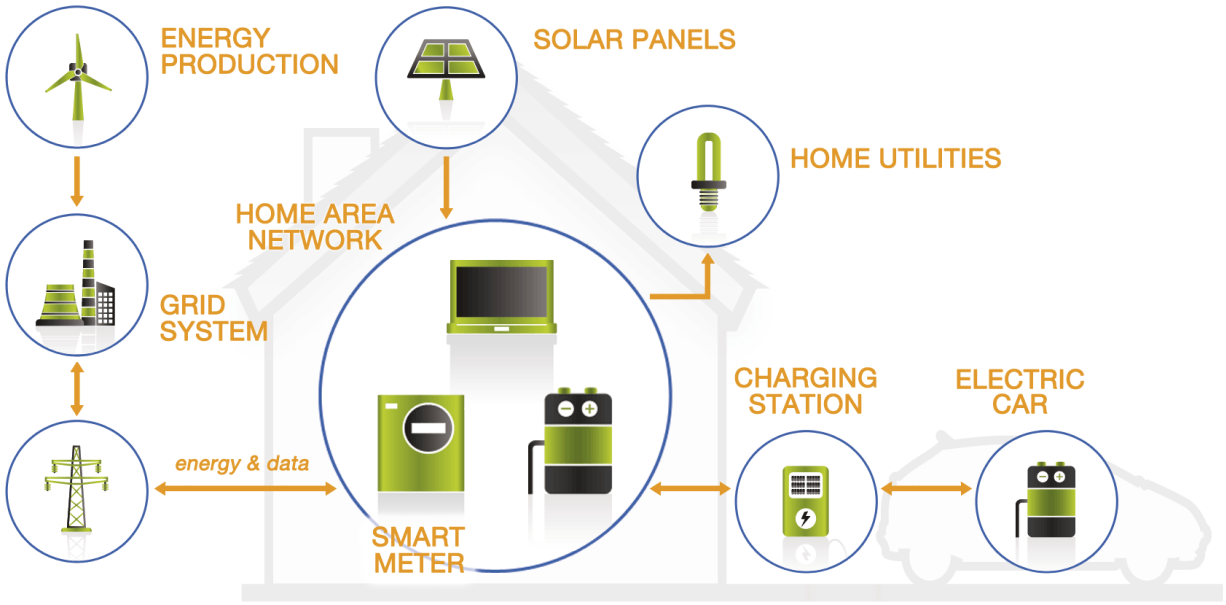
April 2015



The Glen Dimplex Group

- Founded in 1973
- The worlds largest electrical heating business.
- Holds significant market positions in the domestic appliance markets
- Annual turnover €2 billion
- Privately owned
- www.glendimplex.com

Smart Grid Ireland



sgi
smartgridireland

Sustainable Energy Authority of Ireland (SEAI)

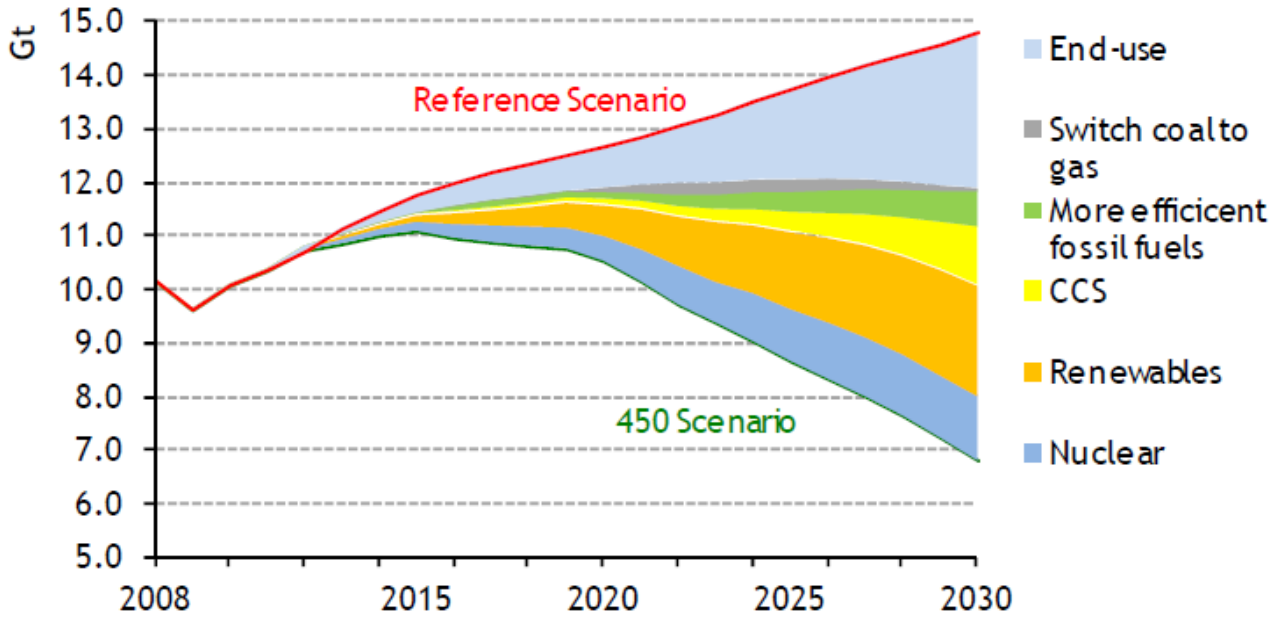
- SEAI's mission is to play a leading role in transforming Ireland into a society based on sustainable energy structures, technologies and practices.

EU 2030 Climate and Energy Goals

- The need to ensure secure, affordable and sustainable energy supplies;
  - A reduction in greenhouse gas emissions by 40% below the 1990 level
  - Target for renewable energy of at least 27%
  - 27% in increase in energy efficiency

Electricity Decarbonisation

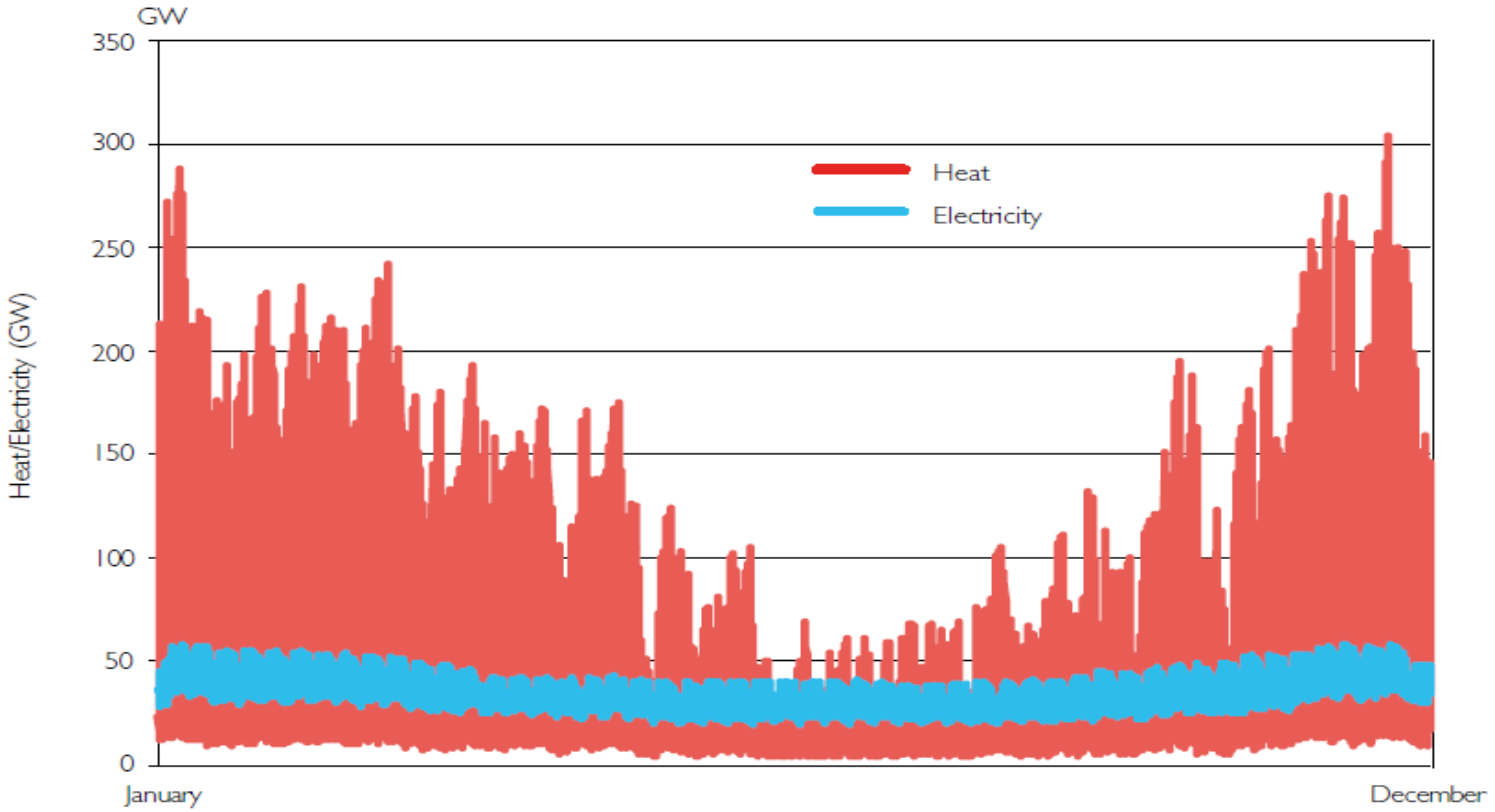
Energy Related CO2 Emissions Abatement from the Electricity Sector of Major Economies



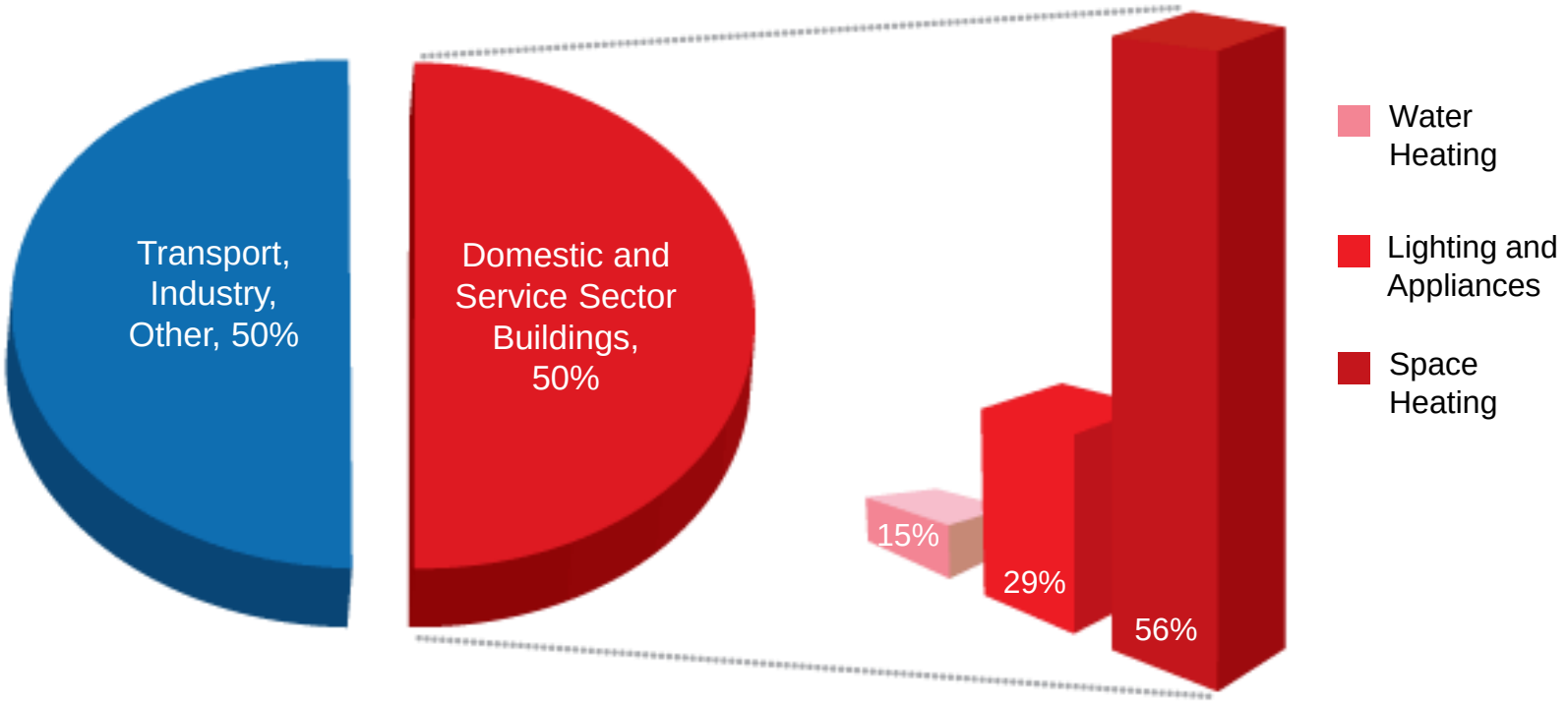
Source: IEA data and analysis.

Electrification of Heat

Comparison of Heat and Electricity Demand Across a Full Year (2010)
Source (UK Government)



Primary Energy Consumption



36% of all primary energy is used for space and water heating in buildings

Source: DECC/UK National Statistics

Glen Dimplex Low Carbon Solutions

Solar PV Electricity Generation

Solar Thermal Water Heating

Mechanical Ventilation and Heat Recovery Systems

QUANTUM Thermal storage space and water heaters

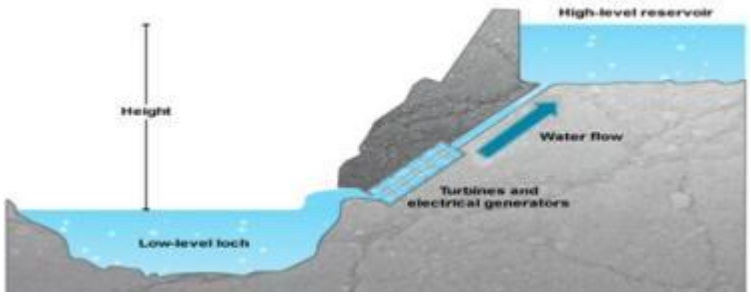
Low temperature Smart Radiators

Ground source, air source and water source heat pumps

Automated Home Energy Management Systems

Existing Energy Storage in Europe

Pumped Hydro Storage



100 GWh

Winter

Summer

Thermal Space and Water Heating Storage

Winter - 400GWh
Summer - 170GWh

Energy Storage Technologies

	Electric Car	Smart Water Heating	Smart Space Heating
			
Typical Energy Stored per Day	10kWh (75km per day)	13kWh (210l per day at 65^0C)	54kWh (80m² home in winter)
Storage Media			
Cost per kWh storage capacity	€300	€0	€15

Smart Electric Thermal storage System (SETS)

Quantum
Water Heater

Quantum
Space Heater

SETS - Key Features

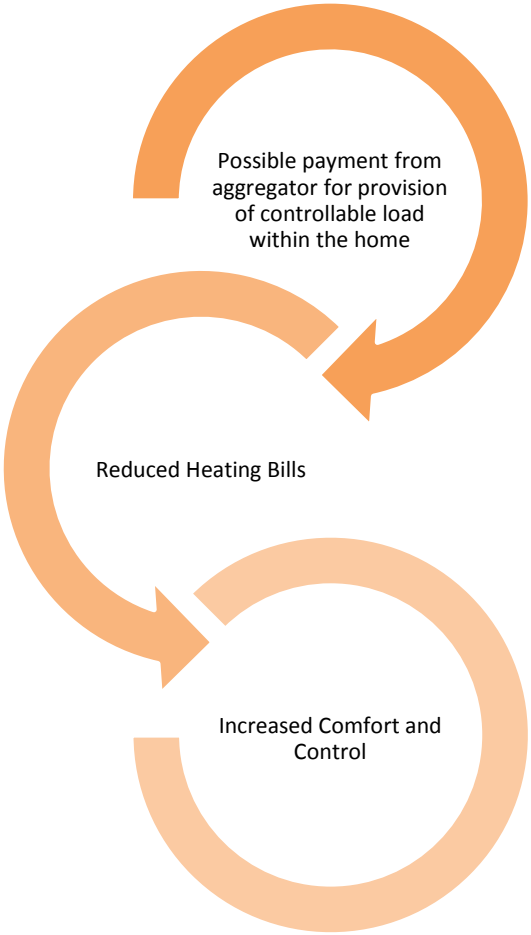
Consumer

- High efficiency energy store – low losses
- Accurate electronic time and temperature control
- Up to 25% reduction in energy bills
- Advanced apps for user interaction and information

Power System

- Overall Demand Reduction
- Reduction of demand during peak periods
- Increased System Flexibility
- Provision of Ancillary Services
- Facilitation of increased renewable electricity generation

Consumer Proposition/Benefits



Horizon 2020

- Biggest EU **Research and Innovation** Programme
- Nearly **€80 billion** of funding
- Over **7 years** (2014-2020)
- Brings together all EU Research and innovation funding into one single programme.
- Horizon 2020's goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

Horizon 2020 - Energy

- H2020 will play a pivotal role in achieving the 2030 climate and energy policies
- EU leaders in RES but not enough – need to develop
- Energy Storage will play a key role.

Horizon 2020 – Energy Storage and Flexibility

- Importance of ES and flexibility can be seen in the funding priorities
- FP& (7 years) - €52M
- H2020 - €70M in the first two years (actually €90M)
- Covers small and large scale storage and development of next generations ES technologies.

Demand Response / Demand Side Management

- DR and DSM will play an increasing role in the future electricity markets, as recognised in the Commission's recent Energy Union Communication.
- Consumer Engagement & DSM has a clear & proven role in enabling EU energy 2020 targets

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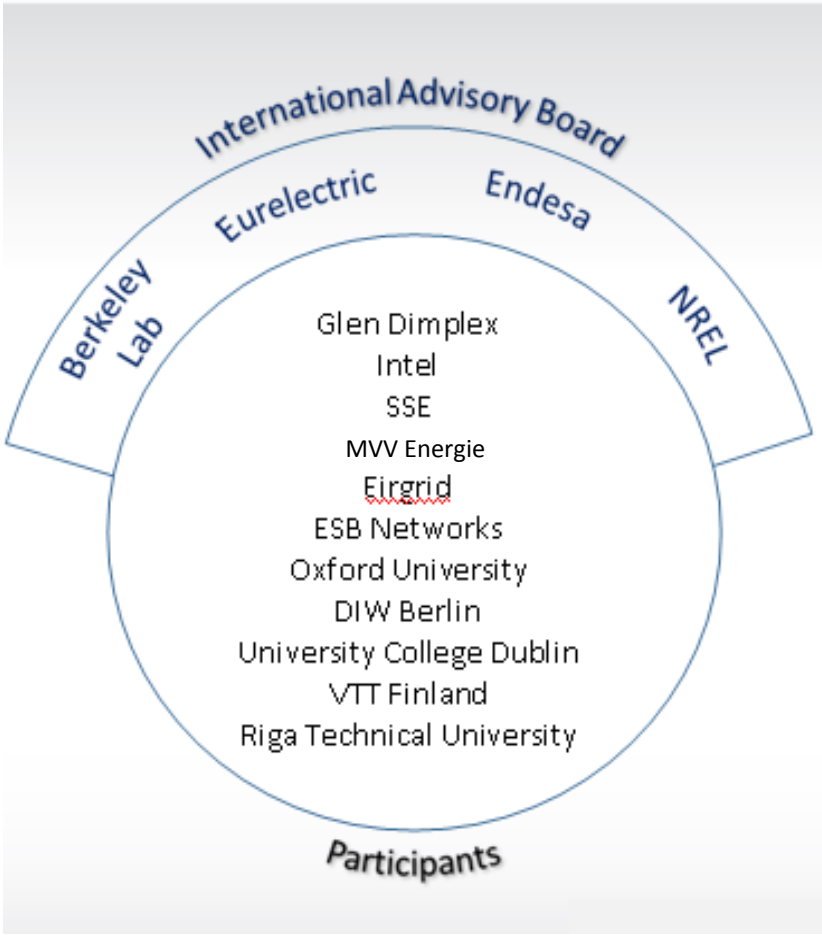

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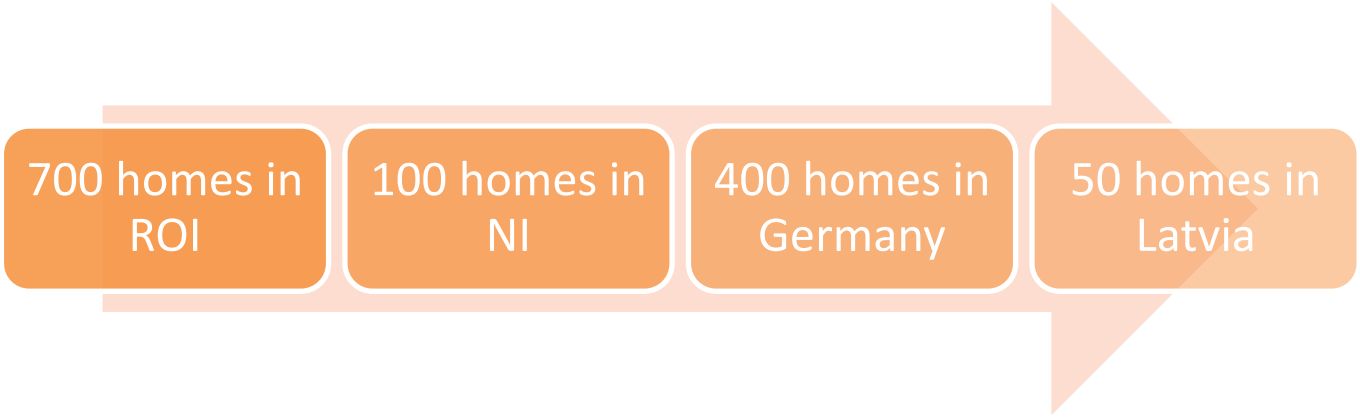
RealValue Introduction

- RealValue will use a combination of physical demonstration and modelling, in order to demonstrate how local small-scale energy storage, optimised across the EU energy system with advanced ICT, could bring benefits to all market participants.
- The expected total project cost is €15.5m (EC contribution approx. €12.0m) lasting 36 months
- The physical demonstration will consist of 1,250 homes in Ireland (circa 10GW installed capacity), Germany (circa 183GW installed capacity) and Latvia (circa 2.65GW installed capacity) . Current thinking:



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RealValue Consortium

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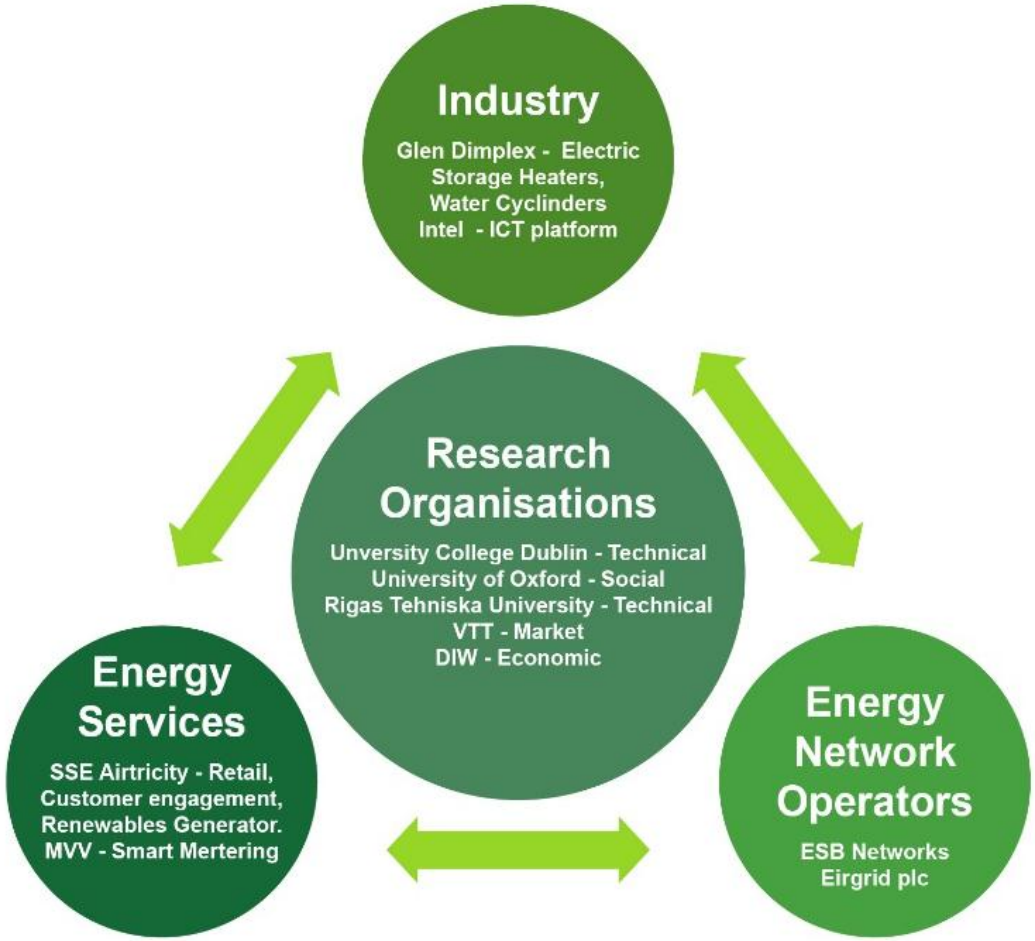
RealValue Partnership



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RealValue Objectives

- Physical demonstrations of a domestic load aggregation platform.
- Refine existing ICT systems and procedures to interface distributed populations of local small-scale thermal storage devices.
- Demonstrate benefit of this aggregation functionality.
- Refine the optimisation techniques and principles required to determine desirable aggregated demand response profiles when participating in overall electricity markets and system services.
- Coordinate the response of the local small-scale storage devices with low and medium voltage electricity distribution network operator requirements.

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RealValue Objectives

- Perform extensive desktop modelling/analysis and virtual demonstration studies.
- Combine the experiences derived from the contemporary physical demonstrations with future projections from the desktop modelling studies.
- Carry out thorough market and regulatory policy investigations.
- Carry out consumer research and behavioural studies.
- Devise robust business models.
- Disseminate the experiences, findings and conclusions of the project.

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RealValue - Overall Concept

- Fundamental premise – population of SETS devices used for space and water heating in consumers homes can be aggregated in order to realise additional value for the electricity system:
  - Energy arbitrage value
  - System services value
  - Network investment deferral value
  - Capacity Value

New Market Arrangements Required

- Two key areas of operational flexibility are:
  - Frequency Response and
  - Ramping Duty
- However the market for such new system service products, and corresponding financial arrangements necessary to provide such services are not yet in place in many countries, including Ireland.

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Smart Electric Thermal Storage System (SETS)

- SETS has a significant cost advantage over other forms of energy storage, typically costing less than 5% of the cost of electro-chemical systems per kilowatt-hour of energy stored.
- With SETS devices, the intra-day scheduling of electric power demand required can be decoupled from the time of thermal energy end-use by the domestic consumer.
- When enabled with advanced communications and aggregate-level control functionality, SETS devices thus constitute an intelligent and responsive form of demand shifting demand side management (DSM).

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Smart Electric Thermal Storage System (SETS)

- The potential value from SETS participation within the EU power system is significant.
- A report by Kema (now DNV GL) has estimated that, based on retrofitting all existing night storage heaters in the EU-27, SETS can potentially;
  - Introduce 55GW of controllable capacity by 2050;
  - Avoid 7.4TWh/annum of heating energy, and
  - Avoid 3Million tonnes of CO2 emissions per year.
  - Potential for Smart Electric Thermal Storage, Contributing to a low carbon energy system.
    - Arnhem, February 2013

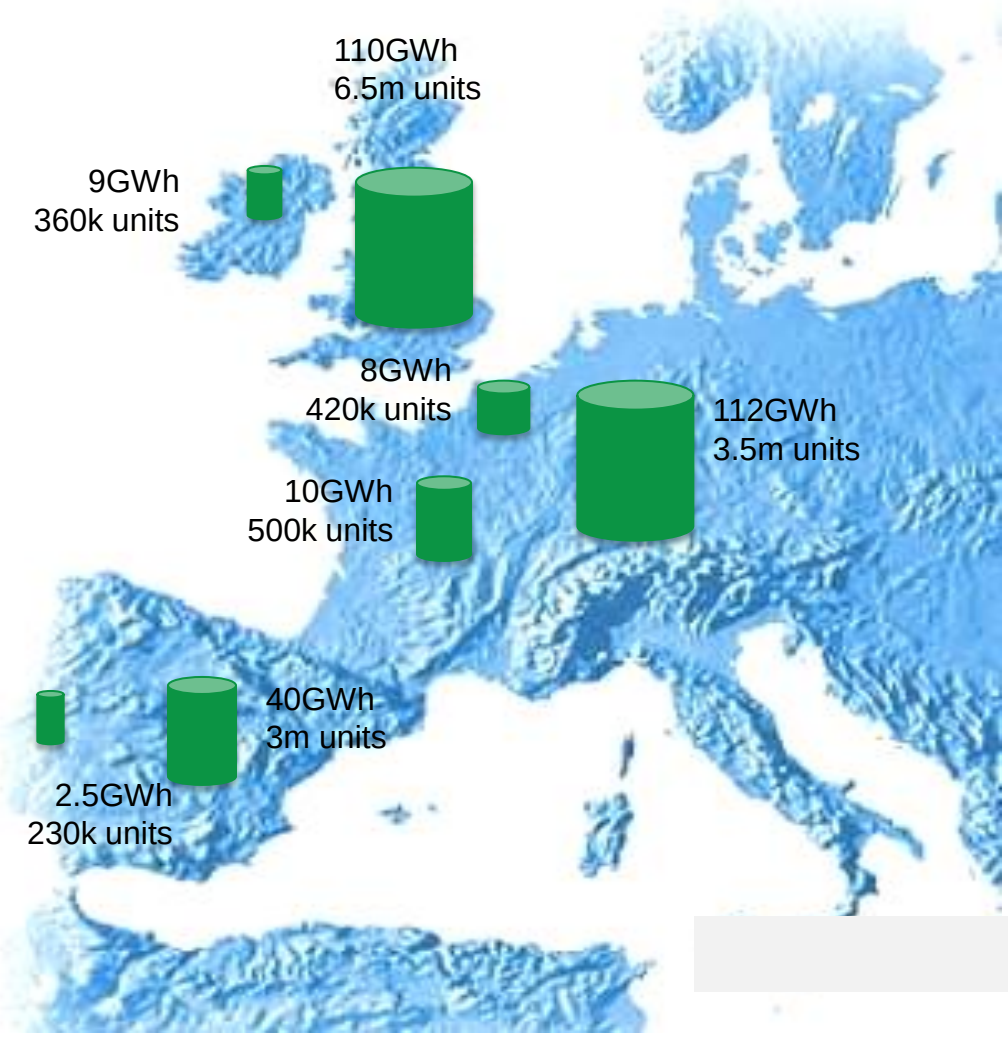
European ETS Daily Storage Capacity

DNV KEMA Energy & Sustainability

Commissioned by
Glen Dimplex and SSE Plc

Potential for Smart Electric Thermal Storage
Contributing to a low carbon energy system

Arnhem, February 15th 2013
Author(s) Jillis Raadschelders, Friso Sikkema, Bart in 't Groen



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Aggregation and System Integration

- The Aggregator will:
  - Apply advanced algorithms to provide data management and control which balances domestic heating and power system requirements;
  - Capture and prioritise individual consumer occupancy patterns, comfort needs and preferences;
  - Forecast heat demand, and
  - Interact with electricity grid control systems at both the aggregate market and local distribution level.

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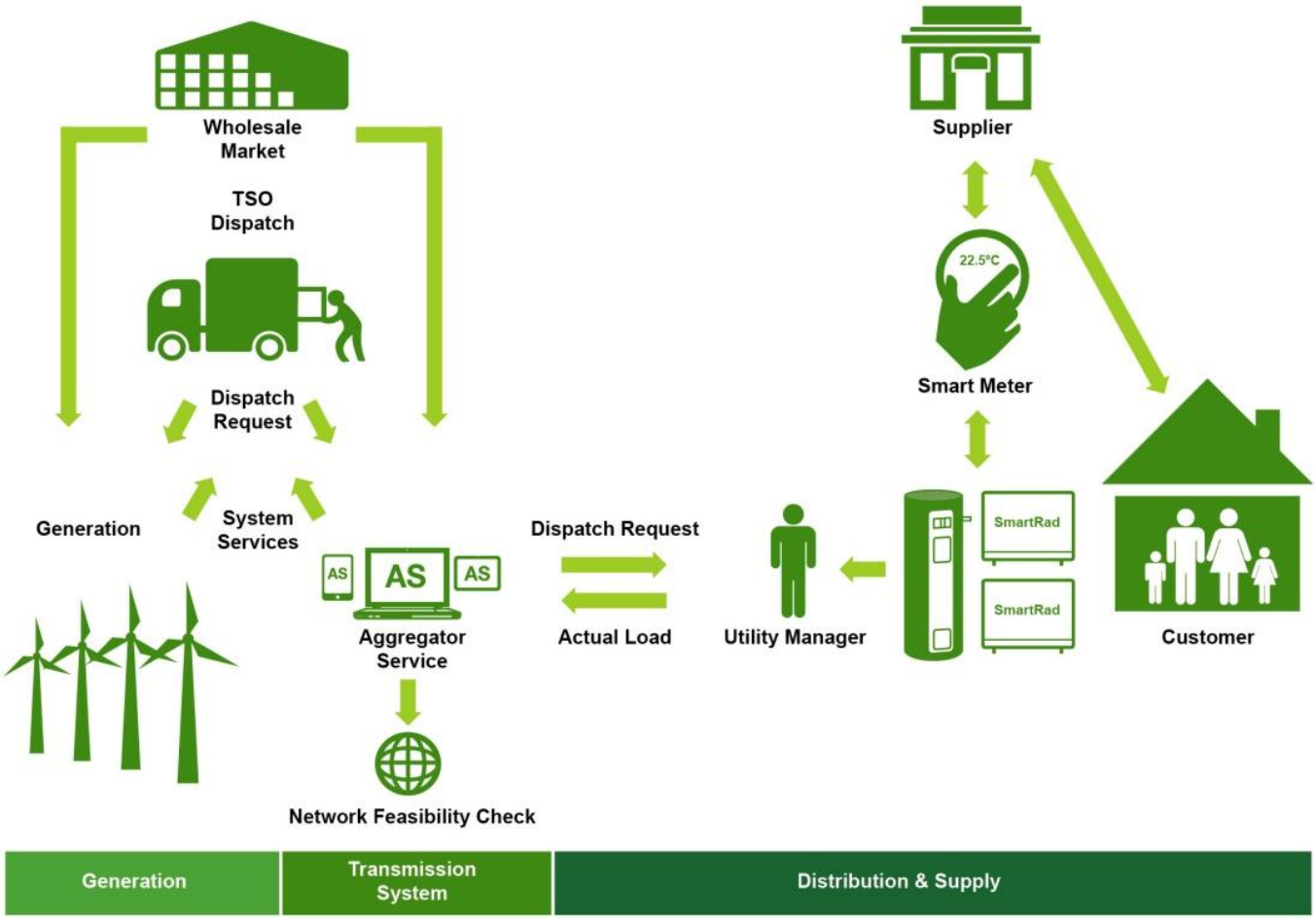
Aggregation and System Integration



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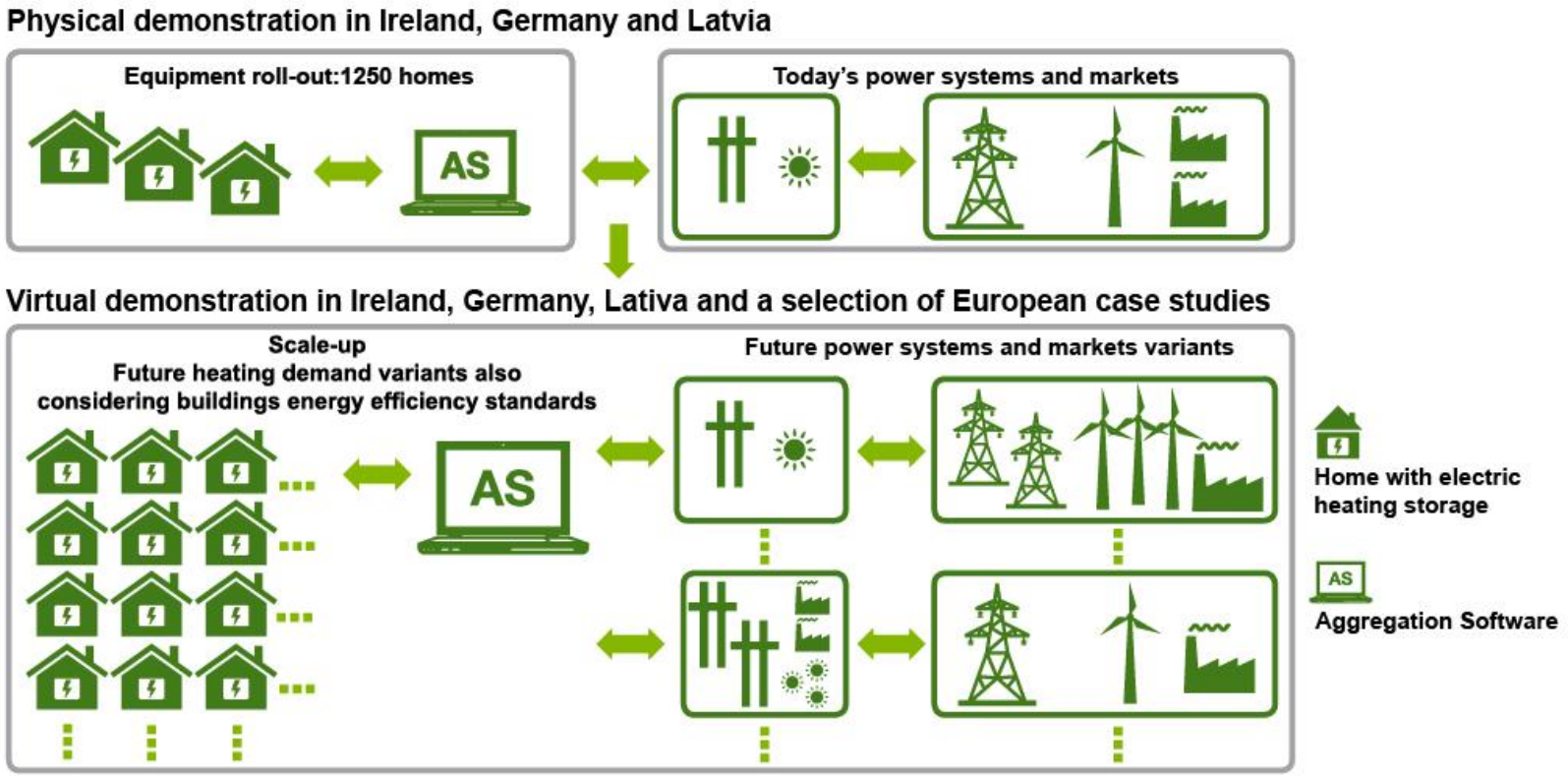
Modelling & Simulation Activities

Modelling and simulation will be used to augment the physical demonstration by considering how the system will operate at even greater scale with increased variability.



Virtual Demonstration and Experiments

RealValue has real added value with this novel ‘virtual demonstration’ process to encapsulate some of the challenges within the testing and performance verification stages of the aggregation and local small-scale storage control tools.

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Cost Benefit Analysis

The modelling aspects of RealValue will perform detailed cost benefit analysis of SETS within all value streams of the co-optimised electricity and heat sectors.

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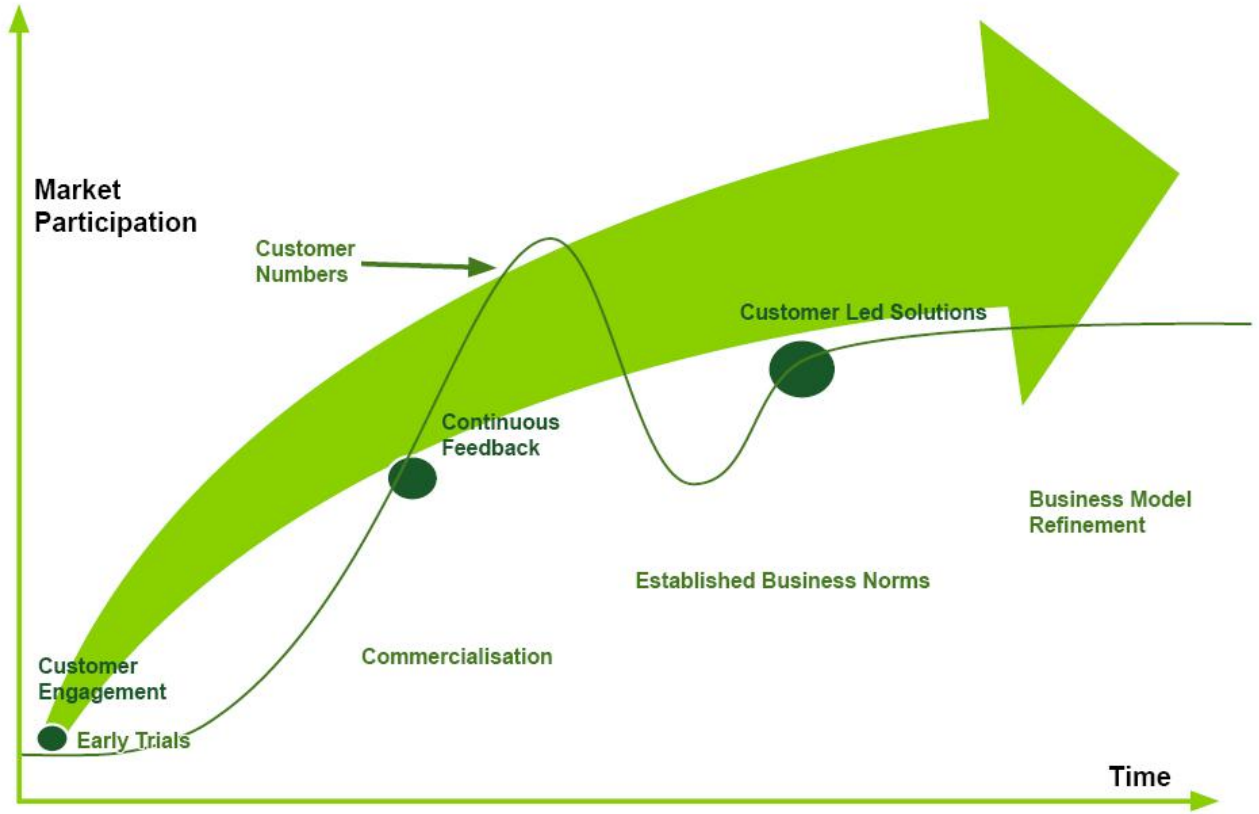
Enhanced Customer Engagement / Behavioural Study

RealValue recognises the important role that customers have to play in the development of distributed energy storage as a viable system tool.



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RealValue – Expected Impact

- RealValue will demonstrate the effect and quantify the benefits of integrated local small-scale thermal energy storage on:
  - Energy balancing
  - Grid security and supply
  - Network congestion management at local level
  - Societal issues
  - Access new revenue streams for suppliers and thus facilitate benefits to flow back to consumers through effective tariff design.
  - Decarbonisation and integration of RES
  - The impact of demand side measures under different market structures and incentive regimes for policy makers and regulators

Innovative new Business Models

RealValue will also develop aggregator/supplier company business models for exploitation of aggregated local small-scale storage. Scalable deployment of technology will increase market share by electrification of key target sectors such as heating.

Dissemination

- RealValue will generate a wealth of information throughout its execution. Dedicated outputs are scheduled to be disseminated in stages to raise awareness of the project within the scientific community and among industry, other stakeholders and the wider publics.
- A detailed dissemination plan will be put in place at the beginning of the project which will outline all dissemination activities throughout the 36 months including:
  - Project website / literature / videos
  - Conferences / exhibtions
  - Publications
  - Press / Media
  - Social media plan
  - Workshops / seminars

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RealValue - Impact across the electricity value chain

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Conclusion

Thank you for listening - any questions?