

Community Ownership of Renewable Energy Projects

Energy Transition towards a Cellular Smart Grid

Community – Grid Edge – Flexibility & Power Quality

United to break through the barriers to:-

- Bring the Digital Energy Revolution to Communities
- Empower Energy Citizens
- Build Regulated Smart Community Energy
- Enable higher-levels of Stable Renewable Energy (RE) Penetration
- Enable local small-scale Inertia-rich Flexible Plant
- Develop, from Small-scale, Cellular Smart Grid Systems
- Provide Structured Test Beds for Community Energy Advancement

**Building the Smart Grid - Smart Cell by Smart Cell:
Through Smart Community & Local Energy Balancing
and Community-based Grid Support Systems**



Presented By:
Dudley Stewart C. Eng.



July 5, 2016

Thank You for the Invite to Speak

Who are **we**?

Why should **we** speak for Community Energy?



The Tallaght Smart Micro Energy Test Bed

Driven By:

1. South Dublin County Council
2. Tallaght Test Bed Technology Group
3. **Micro Electricity Generation Association (MEGA)**
4. Local Community Groups
5. Enterprise Ireland (EI)
6. Sustainable Energy Authority of Ireland (SEAI)
7. Eirgrid (TSO) – Smart Grid innovation Hub

Although it is the policy of the E.U. to advance Active Energy Citizens through Community Energy Projects. Renewable Energy Communities continue to face huge challenges. Our first job has been to demystify the “Energy–Community Axis”. Our findings were predictable



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Communities in Energy have become powerful in the empowerment of Active Energy Citizenship, Energy Saving & Production, Public Awareness and, sometimes, Active Proponents of large-scale Energy Infrastructure.



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- | | |
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|--|---|------------------------|
| | — | Enersol - Power Eng. |
| | — | Smart M Power - CEUCo. |
| | — | Endeco - Aggregator |
| | — | Crowley Eng. - Biomass |
| | — | Sunstream - Solar/Wind |
| | — | Turmec Eng. - Waste |

Nonetheless virtually all Community Energy Projects suffer from Economy of Scale and Investment Challenges – These are High Barriers.



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SIEMENS - Microsoft

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Unregulated Distributed Generation can cause disturbances in the Distribution Network and Grid Stability Issues – this curtails advancement.



Our Mission is to unite all willing forces to develop and equip communities with the means to play the central role in the Future De-carbonisation of Energy – Flexibility and Balancing:

- The **Community Energy Utility** will enable communities to radically improve **local Power Quality** and increasing **Renewable Energy Production** while **supporting Grid Stability**.
- The Community holds the secret to Energy Security and Stability – **Flexibility & Balancing Power** – **more valuable than energy itself** – Community Market Power made possible through intermeshed local **Smart Grid Cells** powered by the Digital Energy Revolution.
- **Urban Centres, Cities and Local Authorities** are the key enablers of this Community Energy Revolution.



Tallaght Smart Grid Test Bed Dublin 24 - Ireland

Strategic Location Silicone Valley Model



Vision for Common Community Action

1. Develop Test & Certify the Tallaght Smart Grid Framework, through openness to all viable Collaborations, & the growth in Number and Size of intermeshing Smart Micro Energy Clusters embedded in LV System with one Super Cluster as the Hub.
2. Spread to 30 new Test Beds across Ireland:
 - Future Local Community-Owned Smart Grid Framework Systems
 - Candidate Smart Grid Hardened Nodes

Smart Micro Energy Test Bed



Early Cellular Smart Grid

- Replication of Smart Grid Test Bed into 30 additional locations across Ireland.
- Automation by one shared Transactive Energy Services Trading Platform
- Aggregating Power Balancing & Flexibility Services on a National Level
- Directly connected to the System Operators providing intelligent distributed data and forecasting information in real-time – Advanced Data Analytics.

2050 – Near Zero Carbon Energy

Is there a Community Solution?

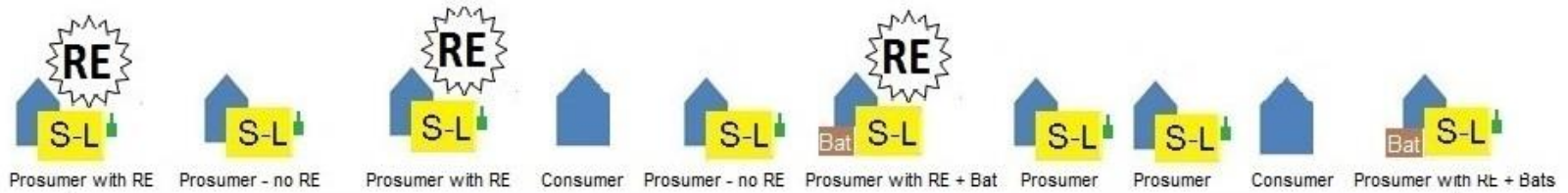
Can Communities create the Secret
Ingredients to Tip the Balance in
favor of Success?



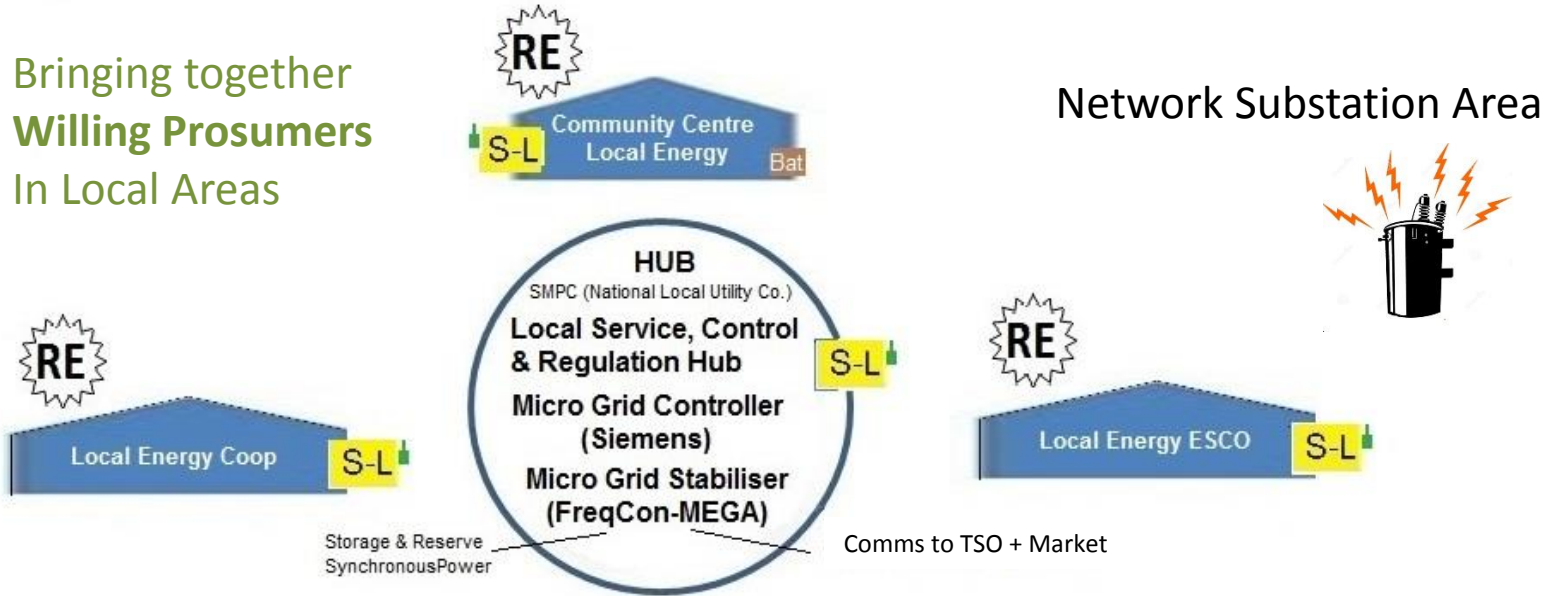
The Situation Today in Ireland

- Ireland, like many other countries, is facing into a period of severe Renewable Energy related Power Quality & Capacity Complications.
- Complications which will see Growth in Renewable Energy causing severe problems for the Grid.
- Connections are getting harder to obtain and more costly.
- Demand Response is advancing to optimize RE utilization.
- Demand Response is itself curtailed by congestion problems.
- The time has come for more intelligence-driven solutions.
- Through Regulated Community Action local Generation can be power matched locally – moving to higher levels of optimization.
- Prosumer groups are being equipped, on the Test Bed, with advanced digital metering, microprocessor and other devices to enable concerted real-time action as stabilized Smart Grid Cells – now the race is on to refine and go to scale – increasing interoperability and open API Access are key goals.
- Much of the gear is there already – but can they talk to each other.

Smart Micro Energy Cluster

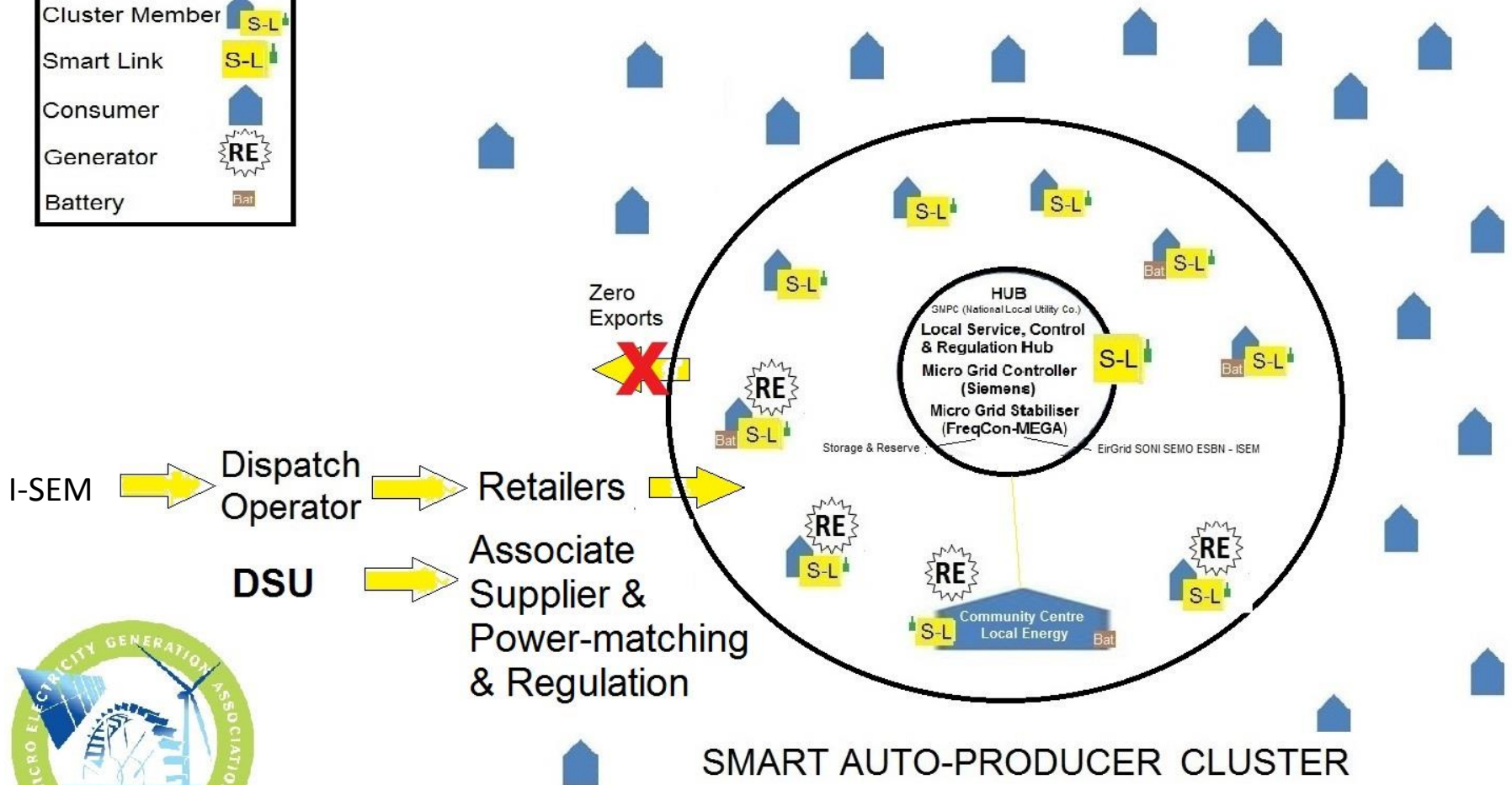
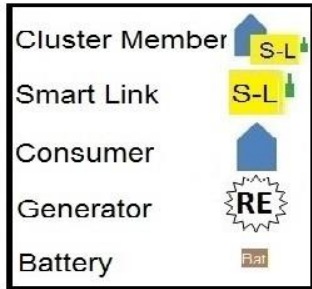


Bringing together
Willing Prosumers
In Local Areas



Behind-the-Meter (Grid-Edge) – **Communities of Willing Prosumers** – Interconnected by Internet protocol Prosumer Smart Meter I/O Power Matching Controller Units enabling Smart Real-Time Local Electricity Power Matching – Local Consumption/Recycling of Local Clean Electricity in Real-time – Forming Intelligent Smart Micro Energy Cells intermeshed nationally – providing valuable Grid Support & Rapid Response.

Micro-Energy Working with the Market

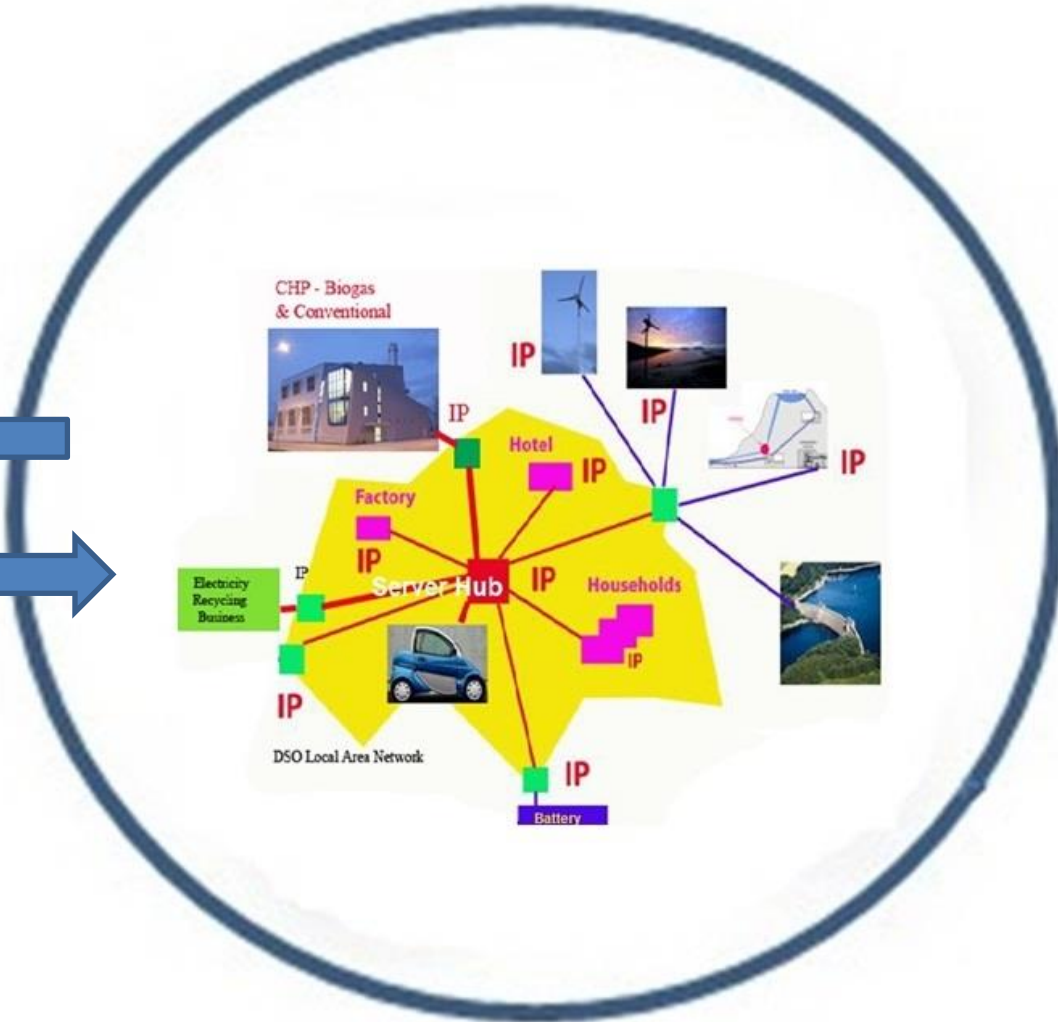


Smart Micro Energy Clusters

Power
Matched
Balancing
No
Exports



SEM



Local Community Auto-Producer (own-needs) Groups – Regulated by Contract

Smart Micro Energy Clusters



Local Community Auto-Producer (own-needs) Groups – Regulated by Contract

Phase 1 WIP
Jobstown-Bawnlea D24
2 Community Centres
Education Centre
Leisure Centre
31 Prosumers

Designated Smart City - Tallaght, Dublin 24, Ireland

Super Smart Micro Energy Cluster
Serving a Growing Number of Local Clusters
And
Smart Operation Hub



SMEC 1



WIP 2015
Perrystown D24
Community Centre

Micro Grid Stabiliser

Day Ahead Generation Forecast
Grid Stabilization Needs



Tallaght City Centre



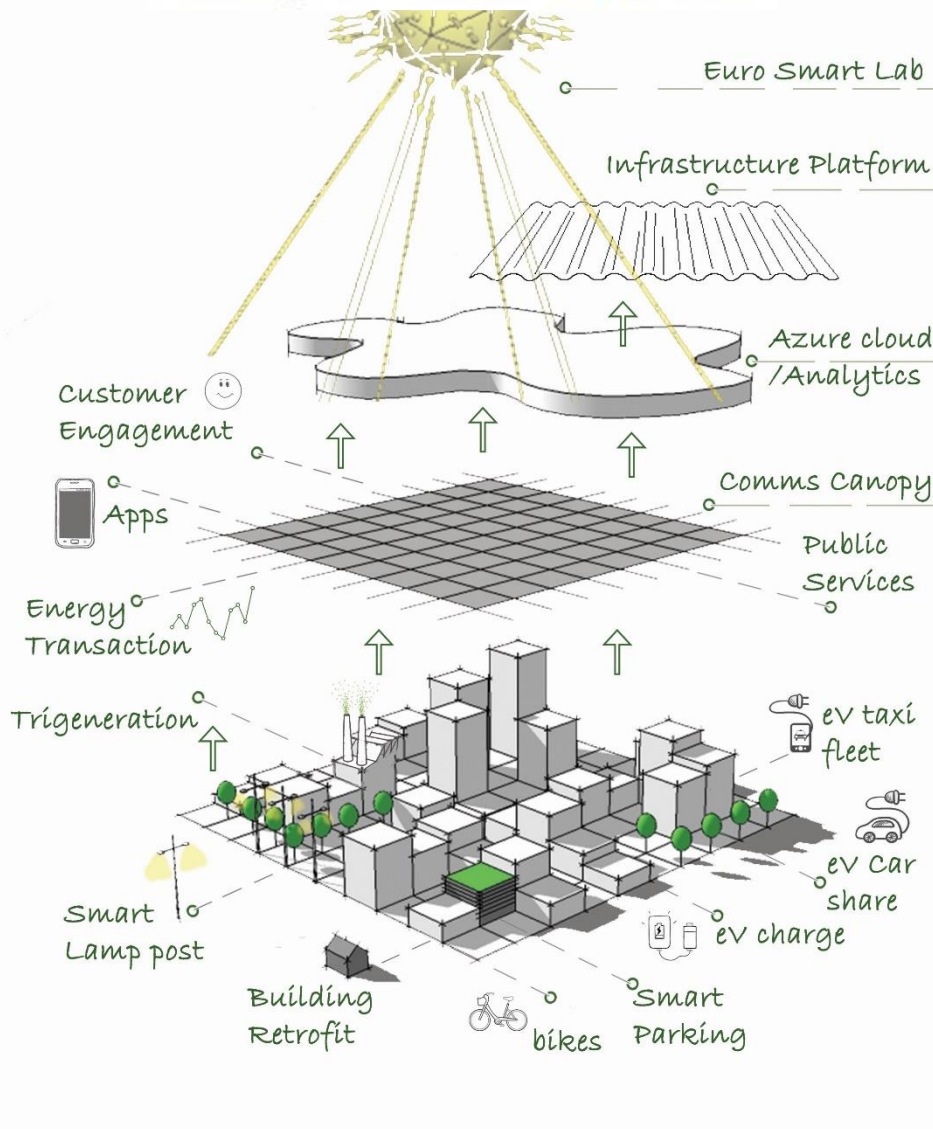
Phase 2 WIP
Oldbawn D24
Community Centre
GAA Club
NS School
19 Prosumers



WIP 2015
Whitechurch D24
Community Centre
Library
57 Prosumers

MEGA & South Dublin County Council Partnership Project

Tallaght Smart GRID



Balanced Energy Digital District

MODEL CITY 2016

Tallaght South Dublin

Model Community Energy Utility

Smart Grid Cell Clusters

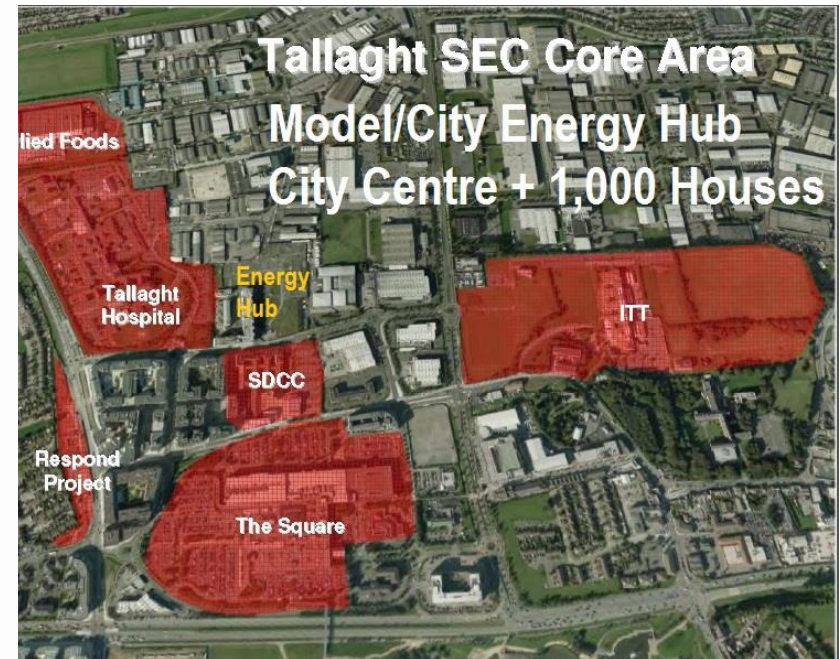
Migro Grid Stabilisers

Community System Services

Automated Energy Services Trading Platform

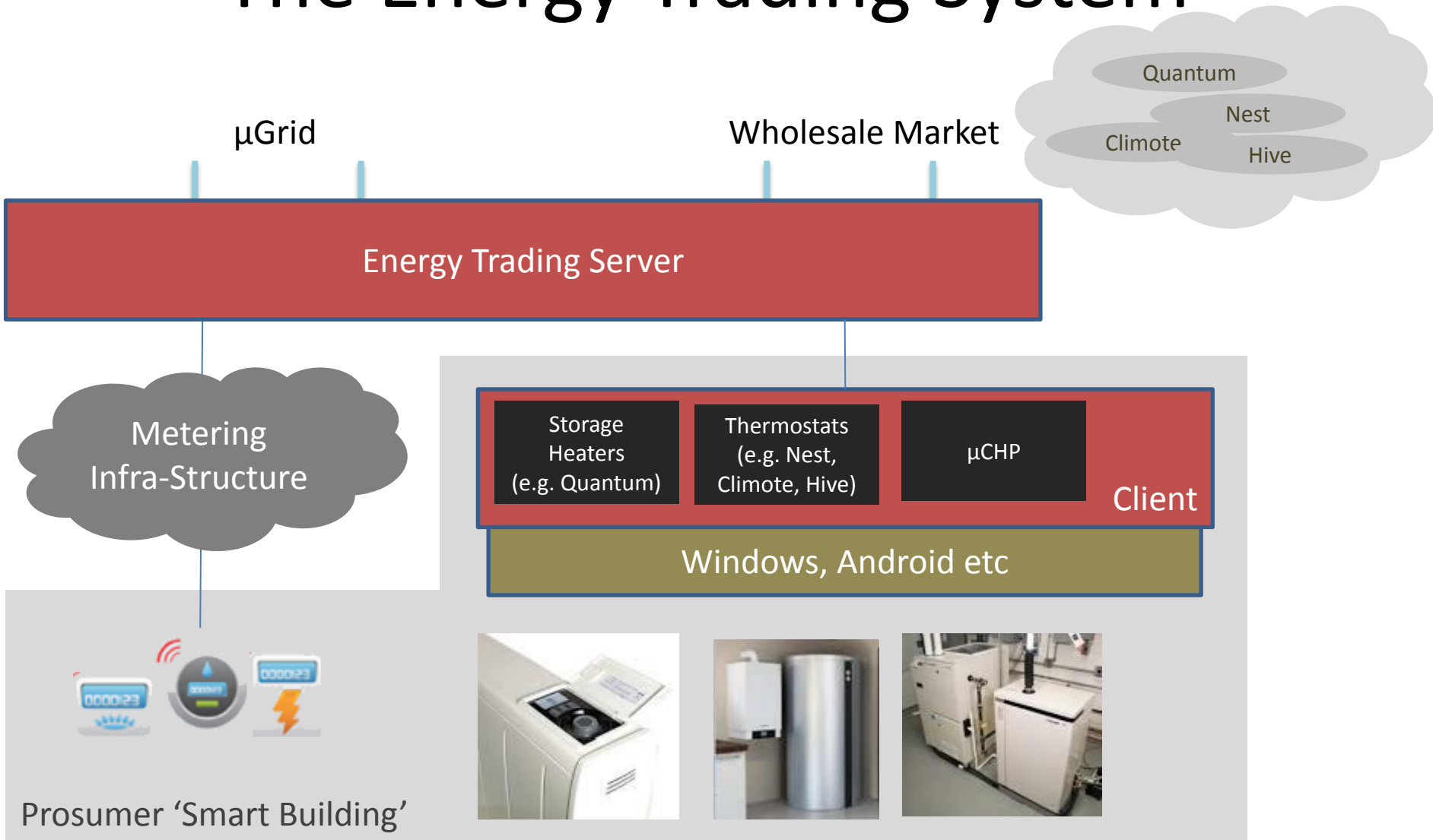
Biomass CHP District Heating, Solar PV, Fuel

Cell + Energy Storage & Recycling

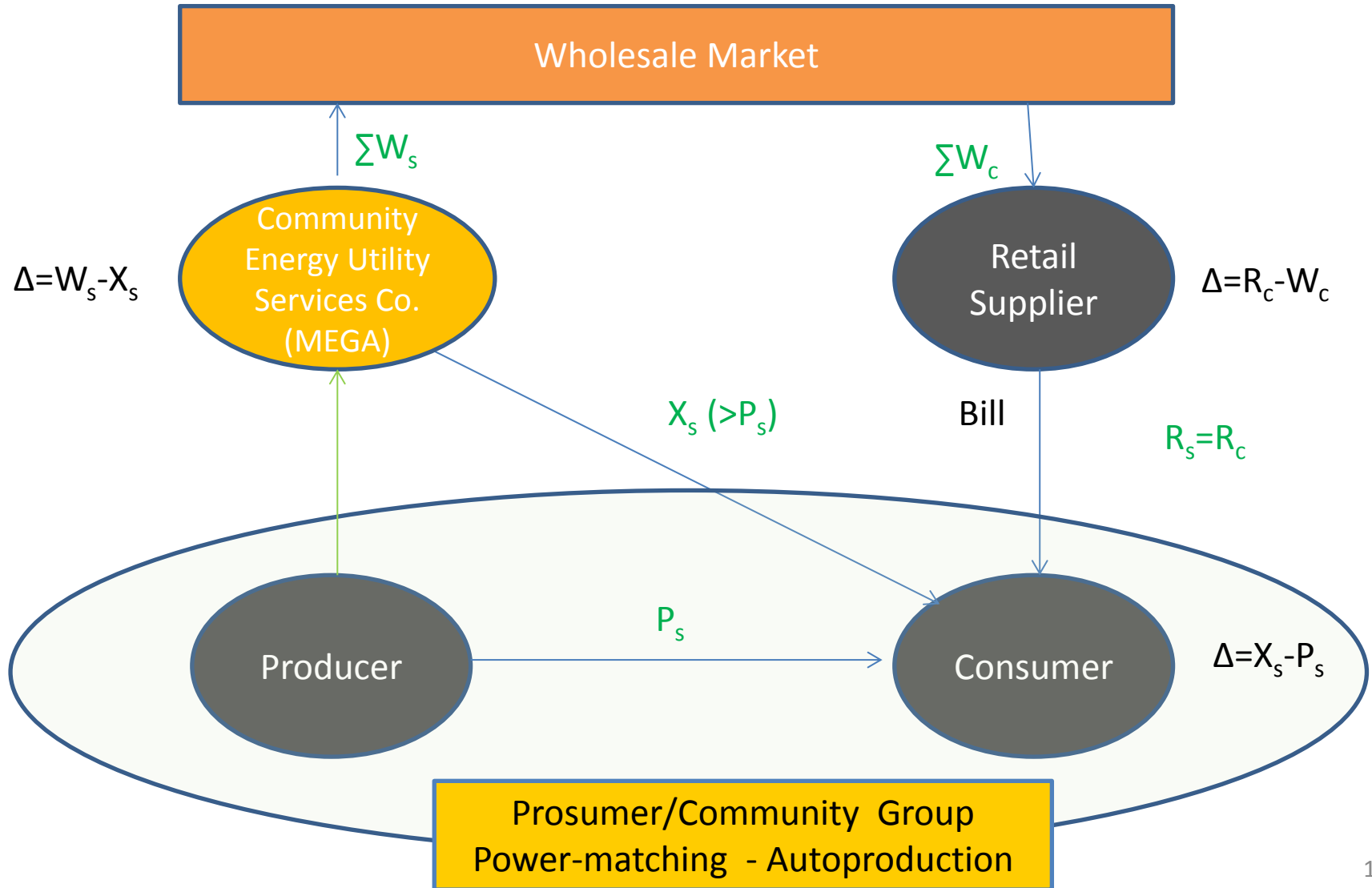


Tallaght SEC Core Area
Model/City Energy Hub
City Centre + 1,000 Houses

The Energy Trading System



Power Matching Trade

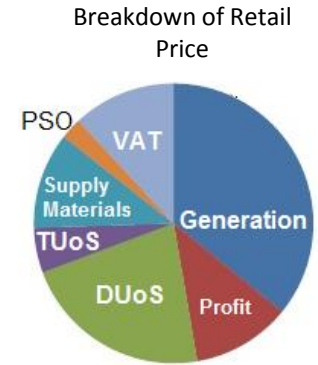


Settlement

Flexibility & Balancing
Market



MPOWER



$$\Sigma W_s$$

$$\Sigma W_c$$

$$\Sigma (X_s - P_s)$$

$$\Sigma R_s = \Sigma R_c$$

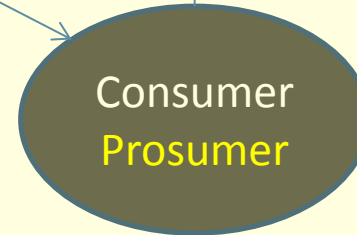
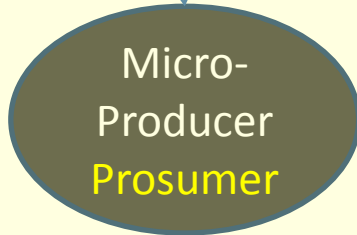
$$\Sigma P_s$$

Retail Bill

Payment Cheque

Payment Cheque

Local Power
Balancing Services



Prosumer/Community Group
Power-matching - Autoproduction

Sustainable Community Ownership

Community Energy Grid Support Services – is the Key to Grid Resiliency - future Near-Zero Carbon Energy system:

1. Focus on the **Highest Value Service** that Community Renewable Energy can offer – **Flexibility**.
2. Develop Community-driven Grid & Network **Balancing Services to overcome Economy of Scale and Connection Issues**.
3. With statutory, regulatory and public funding support it can happen on time. It is worthy of full concerted support because it is the fair and sustainable way forward for Communities.



Thank You

Micro Electricity Generation Association (MEGA)

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www.megamicro.org

FLEXIBILITY

“Discovering the hidden value of energy flexibility - To help address these issues, grid operators are developing smart grid strategies. An important part of this is engaging the help of energy consumers to dynamically match their demand against available grid capacity. This energy flexibility is a valuable resource for both you and your energy supplier.”

Schneider 2016

“As power systems evolve to incorporate more renewable energy and responsive demand, regulators and system operators are recognizing that flexibility across all elements of power systems must be addressed by ensuring:

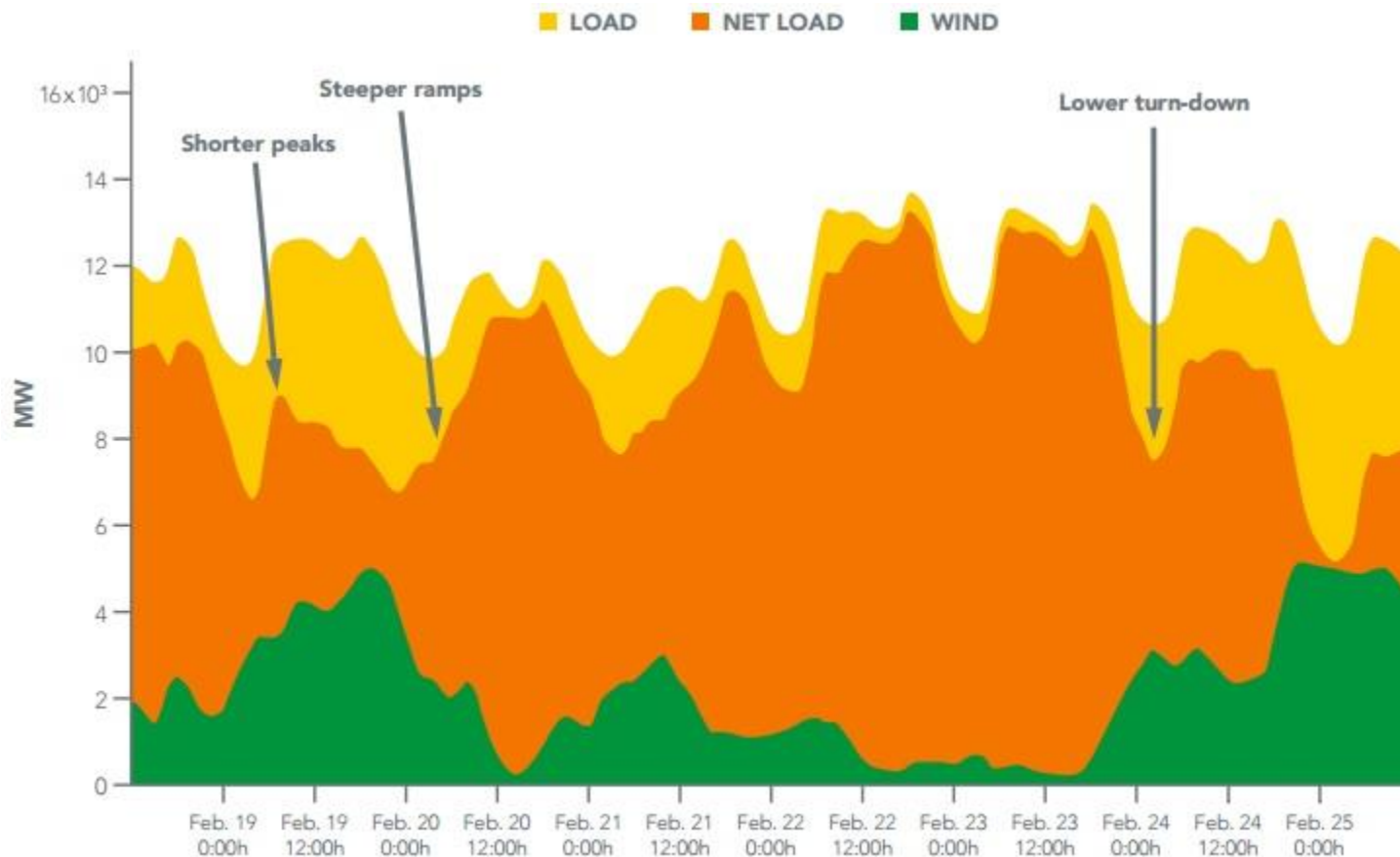
- Flexible generation: power plants that can ramp up and down quickly and efficiently and run at low output levels (i.e., deep turn-downs)*
- Flexible transmission: transmission networks with limited bottlenecks and sufficient capacity to access a broad range of balancing resources, including sharing between neighbouring power systems, and with smart network technologies that better optimize transmission usage*
- Flexible demand-side resources: incorporation of smart grids to enable demand response, storage, responsive distributed generation, and other means for customers to respond to market signals or direct load control”*

Power Partnership

2016

GROWING NEED FOR ELECTRICITY SYSTEM FLEXIBILITY

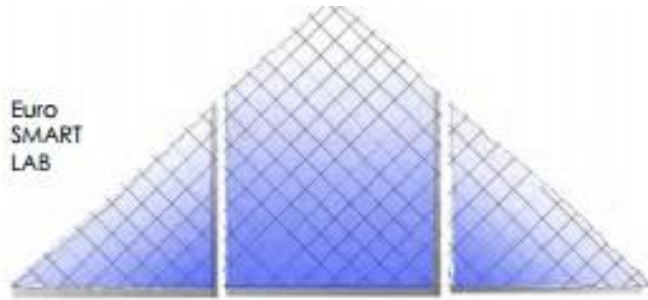
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Solving Flexibility Growth Challenge

TEXT BOX 3: Key Messages for Policymakers about Power System Flexibility

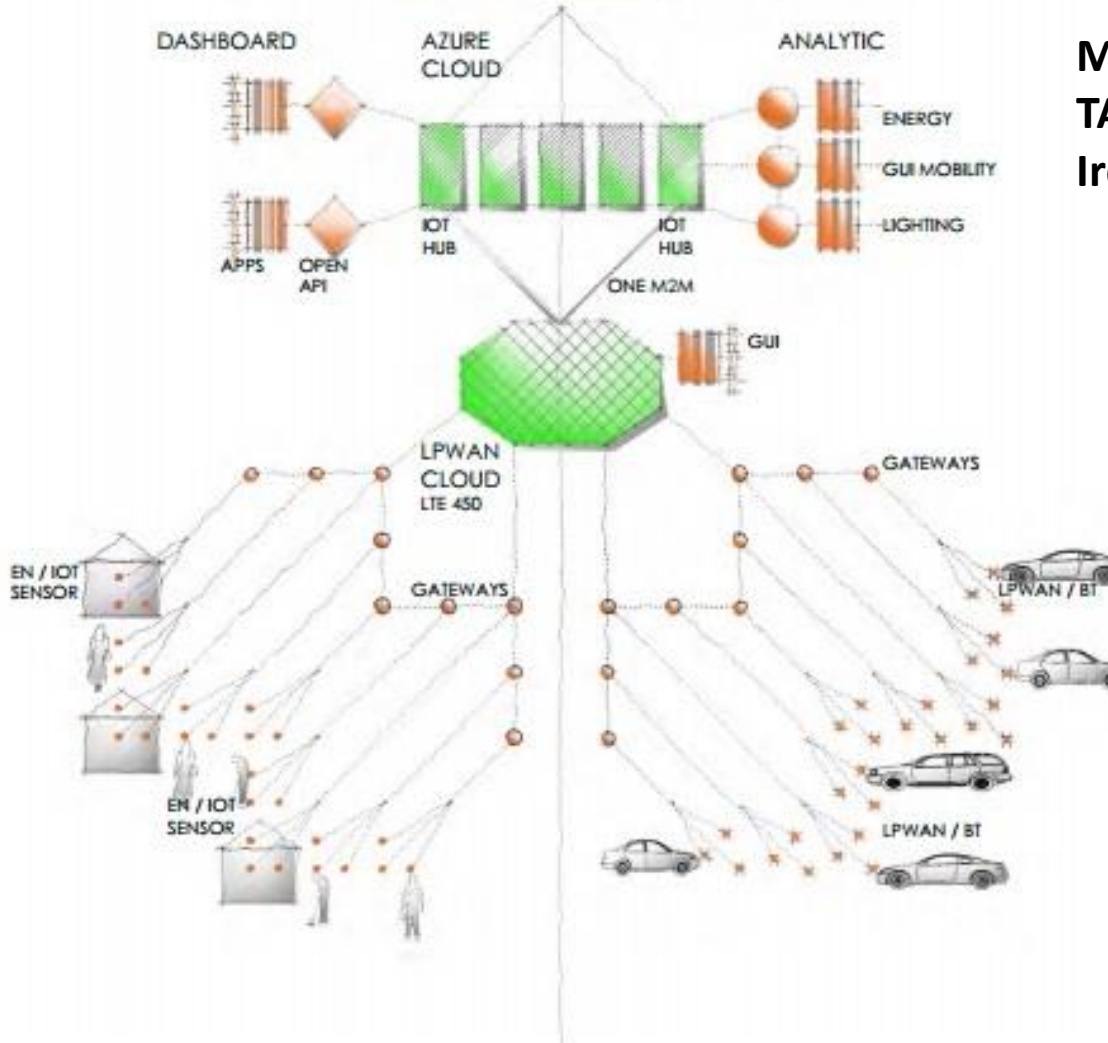
- Power systems are already flexible, designed to accommodate variable and uncertain load.
- In many power systems, sufficient flexibility exists to integrate additional variability, but this flexibility may not be fully accessible without changes to power system operations or other institutional factors.
- In sufficient quantities, renewable energy will change the shape of dispatch requirements so that system flexibility must be reassessed, and increases in the levels of renewable energy may require increasing levels of flexibility.
- A wide range of power system elements impact system flexibility, ranging from transmission assets to generation characteristics and operational practices.
- While there are many emerging flexibility metrics and assessment methods, there is no standard metric for measuring flexibility to date, and metrics continue to evolve.
- There are several approaches to improving grid flexibility, including improving ramping capabilities of the dispatchable generation fleet, increasing demand-side and distribution-level participation, and increasing coordination across multiple markets or balancing areas.
- Finding the optimal investment level requires consideration not only of short-term operational requirements, but long-term viability to recover costs. Uncertainty regarding the level, timing, and type of renewable energy deployment will complicate the problem of finding the optimal levels of investments.
- Based on investment needs independent of variable renewable energy and smart grids, power systems in developed and emerging economies may take very different paths to increasing flexibility.
- Flexibility considerations can be integrated into the design of procurement policies for new renewable energy generation (e.g., feed-in tariffs, subsidies), for example, by basing support on location of generation, provision of frequency support, alignment with demand, and/or integration into dispatch optimization.
- Policy incentives can be designed to anticipate flexibility needs and support system flexibility.



IOT ENERGY CANOPY

Smart Cities & Communities

Horizon 20 20 - 2016



MODEL CITY

TALLAGHT

Ireland