Smart Grids,
IEA Dublin 2012
Looking to the Future

ESB Networks
About ESB Networks

- Distribution for Republic of Ireland
  - Supplying every home in the country
- Asset Owner Transmission & Distribution
- Part of ESB Group (€12Bn Inc. Northern Ireland Electricity)
- €7Bn ROI Network Assets

<table>
<thead>
<tr>
<th></th>
<th>IRELAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>POPULATION (Million)</td>
<td>4.1</td>
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<tr>
<td>ELECTRICITY CUSTOMERS (Million)</td>
<td>2.24</td>
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<tr>
<td>PEAK DEMAND (GW)</td>
<td>5,090</td>
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<tr>
<td>TOTAL NETWORK (kW)</td>
<td>177,000</td>
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<tr>
<td>TRANSFORMER POPULATION</td>
<td>249,00</td>
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<tr>
<td>Average DOMESTIC USE (kWh)</td>
<td>5500</td>
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The Journey To Date

ESB NETWORKS TIMELINE

- Rural Electrification
- Turlough Hill
- Telecoms Development
- DCC Scada
- Network Renewal

- 1950’s
- 1960’s
- 1970’s
- 1980’s
- Late 1990’s
- 2000’s

National Refurbishment Programme
Modernisation of The National Electricity Network

- Renewal of 90,000KM of MV Network
- Conversion of 40,000km to 20kv Operation
- Remote visibility & Control of Network is essential and expanding
- These devices are a real stepping stone to a Smart Electricity Network
Underpinned by Comprehensive IT & Asset Management Systems

Achieved the PASS 55 accreditation – international reference standard for the optimal management of physical assets, providing the definition of good practice in the whole life management of assets.
Extensive telecommunications network built up.
- Fibre:
  - 2,500Km (24-288 cores)
- Microwave Radio
  - Over 100 links
- Polling Radio
  - >500 Sites

Developments Underway
- Fibre extension,
- Microwave Upgrade

Research & Development Planned
- IP Operational Network Migration
Drivers of Change in Electricity Distribution

EU Targets on Energy Efficiency
- 20% reduction in greenhouse gas
- 20% improvement in Energy Efficiency,
- 20% increase in Renewable Energy
- EU Directives -> Smart Metering

Implications for Ireland’s Electricity Sector
- 40% Renewables,
- 10% Vehicles fuelled by Electricity,
- Smart Meter programme
- Network Losses reduction

ESB Strategy
- World Class Sustainable Networks
- A Renewable Business of Scale
- Best Practice Generation Portfolio
- Customer Focused Supply Business
- Significant International Business

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ESB Strategy
World Class Sustainable Networks
A Renewable Business of Scale
Best Practice Generation Portfolio
Customer Focused Supply Business
Significant International Business
Developing Smart Networks for 2025

- Define the ultimate goals
- Provide a focused R&D path
- Enable long term planning
- Ensure value of smart investment
- Consider participants and provide for inclusion
- Define and enable KPIs
- A living plan delivering a better tomorrow!
Key Enablers towards 2025

- Integrating Renewables
- Enabling Customers & New Technologies
- Working effectively with Industry Partners
- Delivering on Regulation Cost and Price control
- R&D Network Innovation

Network 2025
Wind Connections MW 2012

System Demand 2020

Connected: 1672 MW
Contracted: 1048 MW
Gate 3: 3990 MW
Connected Post Gate 3: 6700 MW
ESBN Wind R&D
Projects Completed

- Exploration of Voltage/VAr control on Distribution-connected windfarms
- Use of voltage regulators to limit voltage rise
- Single/Fewer transformer cluster stations for windfarms
Integrating Renewables

- Minimise generation connection costs through innovative but secure connections
- Minimise the impact of renewables on voltage quality using the dynamic reactive capabilities of wind farms
- Facilitate active management of DSO System to vary system configuration and operation to maximise hosting capacity
- Facilitate maximum levels of active Customer Load Management, matching flexible customer loads to variable Generation
- Target is 5000 MW by 2025

- enable over 5,000 MW of wind Generation capacity to supply the Irish grid – with over 2500 MW on the Distribution System
- help industry meet Irish targets of 500 MW Ocean and 200 MW of Tidal Energy by 2020, enabling technology development, connection and demonstration
Key Enablers towards 2025

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Collaborative Research
Focused on Common Goals

Department of Communications,
Energy and Natural Resources

Loa

IBM

Intel

ESB

TSO

CER

Gov

DCENR

SEAI

In Tune
Networks

Industry Partners

Smart Grid
Innovation

2025

SEAI

DCENR

SEAI

IBM
ESB Networks will work with:

- The CER to ensure the best interest of all Irish electricity customers and users are met.
- The TSO to manage more complex distribution and transmission system interdependence.
- The Irish Government and SEAI to develop environmental strategy.
- Academia and Industry to progress Innovation.
- The Irish Wind Energy Association and other key stakeholders.
- Suppliers to facilitate new products and services.
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Smart Meter Customer Behaviour Trial
Results

- Overall reduction
- Shift of Peak Load
- Behaviour
- In-house display customers achieved peak shift

2¼%
8.8%
Sustained
+11%
**Enabling Customers & New Technologies – Smart Metering**

**Energy Measurement**
- Half-hourly profile data
- Different tariffs and registers including Import, export and watt-less

**Condition monitoring**
- Power outages and voltage
- Tamper alerts

**Operations**
- Remotely and locally operable switch
- Controllable circuit for storage heating

**Technology**
- Integrated Communications module will provide and manage a Home area network and act as a hub for gas
- Strong Encryption and Security mechanisms
We will have one of the most ambitious roll outs in Europe

- IHD for all
- Embedded HAN
- Integrated with Gas Meter
  Consumption available to home
- Daily profile reading
- Automatic Meter Reading
  Continuity mgt support
  Remote meter operation
  Event monitoring
  Remote tariff configuration

We have some of the greatest telecoms challenges
**Ecar Ireland Programme**

- **Ev targets 2020:**
  - 10% of all vehicles electric
  - 10% of all road energy transport will be renewable
- **Supply of electric cars**
  - MOU signed with Renault-Nissan
  - MOU signed with Mitsubishi
  - MOU signed with PSA
  - MOU signed with Toyota
  - Other MOUs in the pipeline
- **Government incentives**
  - €5000 grant
  - Zero VRT
  - Lowest road tax band
  - Accelerated Capital Allowance (Businesses)
- **ESB is rolling out the infrastructure**
Charging infrastructure

- **Home charging**
- **Public charging**
- **Workplace charging**
- **Fast charging**
Commercial Hosting Locations

- Service Stations
  - Topaz
  - Maxol
  - Gulf Oil
  - Great Gas 24
  - Texaco
- Retailers
- Retail Parks
- Park and Ride
- Business Parks
- Commuter Stations
Charge Point Status

160 + Public Charge Points
100 + designed, awaiting delivery
270 Home / Workplace Charge Points

➢ 400+ TOTAL TO DATE

➢ 1500 Public Charge Point Target
Other Project Partnerships

- EPRI Smart Grids
  - EV on Distribution Network
- Northern Ireland Plugged-in-Places
- Green eMotion
  - Largest European project
- Enevate
  - Fleets
- Mobi.Europe
  - ICT
  - Ireland, Amsterdam, Portugal, Spain
- Plus others
Enabling Customers & New Technologies – Electric Vehicles

- Electricity Faults
- Traffic
- Weather
- Personal Diary
- Real Time Electricity Prices

Cloud

HEMS

Smart EVSE

Car CANbus
Electric Vehicle Field Trials

- Impact Assessment on existing residential LV distribution network
  - 1 Feeder with 72 Customers

- Most testing network conditions

- Simulation Tools being developed
Vehicle Charging Times
Customers & New Technology

Delivered by:

- Working with the CER and the Industry & customers to design a Smart Metering solution that meets Ireland’s needs
- Learning from other countries Smart Meter Implementations
- Delivering a well managed and efficient Smart Meter Roll out programme
- Enabling Electric Vehicles though delivering charge points to facilitate their introduction
- Delivering R&D to deliver solutions to minimise the Network Investment and maximise the benefits of Electric Cars

Install over 2.2 Million Smart Meters in all Irish homes and businesses by 2018

Helped Irish customers reduce consumption by 2.8% by using Smart Meters real time information

Government target of EV penetration by 2020 10% 250,000 vehicles
Key Enablers towards 2025

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- R&D Network Innovation

Network 2025
Summary of R&D projects Focus to date

- Self Healing Network – Automation
- Closed Loop Pilots
- Dynamic Sectionalising
- Voltage Conservation Reduction
- Low Loss Transformers
- 20kV Conversion
- Innovative Protection and Fault Diagnostics
- Power Check App
- Wireless Telecoms Trials
Innovative Network Operations

Customer power loss due to faults will be reduced to less than 100 minutes per year – 80% reduction on 2001-2005 levels

99% of Networks will be within Voltage Standard

Through Innovation and Excellence in Operations, electricity consumption will be reduced by up to 3% independent of customer action

Delivered by:

- Increased Remote Operational Sensors from 2,000 to 13,000
- Developing a Communications Infrastructure to enable Dynamic Control
- Nationwide deployment of Self Healing Network
- Reducing load by 3% through Innovation and excellence in Operation
- Efficiently integrating data from 2.2m smart meters to benefit operation optimisation
Asset Management Changes
- Vastly increased no. of assets and sensors to manage
- Impacts on SAP, Scada, OMS, GIS etc.

SAP IS-U Changes
- Distributed Generation will impact Meter Configuration and ultimately Market Settlement processes

New Mobile Solutions

SAP IS-U Changes
- Upgrade Enhancement Pack 6
- Switch on AMI Functionality
- Meter Asset Management
- Meter Reading Processes
- Change DUoS Billing Tariffs
- Market Message Changes
- Market Settlement Changes

IT System Landscape post Smart

Big Data and Implications
- New Systems
- New Processes
- New Data Repository
- Event Management
- SAP BW Status
- End Game – collection and interrogation of all “Smart Data” to enable Smart Grid Benefits to be delivered

SAP Process Integration

Supplier Web Portal

Meter Data Management

Charge Point Payment and Management Systems

SAP Business Objects Toolsets
Key Enablers towards 2025

- Integrating Renewables
- Network Innovation & ICT
- Enabling Customers & New Technologies
- Working effectively with Industry Partners
- Delivering on Regulation Cost and Price control

Network 2025
Delivering Efficiently within & Regulation targets

Deliver on Service
- Top Quality Electricity Infrastructure
- Deliver R&D to enable the implementation of fully researched initiatives.
- Continually reduce the number and duration of customer supply interruptions

Deliver For Customers

Deliver Investment Efficiently
- Delivering on a Comprehensive 5 year Plans –
- Continual improvements and R&D

Environmental Directives

Build Network Efficiently
Leverage new initiatives
Facilitate Renewables

Service
Price

ESB Networks 2025
Developing Smart Networks for 2025

- Integrating Renewable Generation
- Partnership Across The Industry
- Smart Operations And Telecoms
- Customers And New Technology
- Delivering On Price And Regulation
Thank You