



# INNOVATION STRATEGY CLOSE-OUT REPORT

PROJECT TITLE	Smart Network - National Radio Access Communications Network
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DATE PROJECT COMPLETED:	Trials concluded September 2019, spectrum awarded November 2019. Detailed planning, procurement and deployment to begin in 2020.

## BRIEF OVERVIEW OF PROJECT & EXPECTED BENEFITS

ESB Networks Telecoms carried out analysis several years ago on the potential benefits of Smart Grid and what it could enable for the business. The high level benefits that industry believe that can be realised from Smart Grid includes the following;

- Enhanced resilience in the electrical network as it enables significantly more monitoring and control on the network
- Enhanced availability, particularly during power outages as it is possible to deploy suitable power backups at transmit high sites
- Longevity of products and support (i.e. more control over the lifecycle of products, not dictated by third party service providers)
- Extensive geographic coverage (including less populated areas)
- Enables stringent latency requirements
- Meets low jitter and synchronous requirements
- Allows for high levels of cybersecurity

Network coverage, cybersecurity and availability of services are extremely important requirements for the mission critical services ESB Networks Telecoms deploys for the business. In order to provide the required telecommunications solution and realise the benefits for a smart grid network it was identified that there was no existing solution deployed or available in the market that would meet the mission critical services in a cost effective manner.

ESB Networks Telecoms identified that dedicated radio spectrum was required and needed to ensure its availability to support a Smart Grid network. Without access to dedicated radio spectrum, it is not possible to deploy a dedicated Smart Grid network and realise all associated requirements and benefits. ESB Networks Telecoms planned to work intensively with the Communications Regulator to ensure that radio spectrum, suitable for a Smart Grid Network, was made available.

ESB Networks Telecoms also needed to ensure that there was suitable telecommunications equipment available to support a Smart Grid network using the proposed radio spectrum. Therefore, a critical part of this project was to carry out a number of trials to test suitable radio equipment both in a lab environment and in a live field environment.

The objective of ESB Networks Telecoms' technical trials and spectrum acquisition was to enable ESB Networks to plan, design, procure and roll out a purpose built Smart Grid network to meet business needs for mission critical telecommunications. The deployment of Smart Grid enables;

- Integration of more renewable generation
- Peak load management
- Electrification of heat and transport
- Fewer faults and potential reduction in duration of outages
- Strategic asset management investment

Successful project delivery would enable ESB Networks to be at the forefront of Smart Grid developments demonstrating Ireland's leadership in innovation for the development of the electricity network to transition to a low carbon economy.

## RESULTS

Networks Telecoms engaged with ComReg to release suitable radio spectrum for Smart Grid. ComReg published its Draft Spectrum Strategy for the 2016 – 2018 period ([ComReg document 15/131](#)) in December 2015. ESB Networks Telecoms made a response to this and encouraged others, stating the significance of releasing spectrum in the 400 MHz band (410 – 414 MHz & 420 – 424 MHz). ComReg understood the arguments and in its finalised Radio Spectrum Management Strategy ([ComReg document 16/50](#)) committed to a consultation on the 400 MHz spectrum.

At this stage it was necessary for ESB Networks Telecoms to validate that the radio spectrum being released by ComReg was suitable for deployment of a Smart Grid, that there was suitable telecommunications equipment available and that the equipment met the business requirements. ESB Networks Telecoms conducted initial trials of applicable technology in 2016 to enable LV substation monitoring. These trials took place in the Portlaoise area. The trial was successful in its operation at the time, however newer available technologies superseded this option.

Networks Telecoms constantly engage with industry regarding innovative technologies and are always open to conducting trials of suitable technology if it has the potential to be deployed into business as usual.



Figure 1: LV monitoring equipment connected to wireless transceiver.



Figure 2: Wireless LV Monitoring device connected to a live substation.

ComReg published its initial consultation on the 400 MHz band in July 2017 ([ComReg document 17/67](#)). ESB Networks Telecoms and 11 others made robust commentary on ComReg's initial consultation. ComReg made some general observations and requested interested parties to inform them of use cases, channel sizes, how much spectrum a use case would need, duration of licences and whether licences should be national, amongst other queries.

ComReg published its response to consultation in December 2017 ([ComReg document 17/105](#)), as well as the non-confidential copy of the 12 responses ([ComReg document 17/105a](#)), inclusive of ESB Networks Telecoms submission.

ComReg published its further consultation on the 400 MHz band ([ComReg document 18/92](#)) on 24<sup>th</sup> October 2018. ComReg acknowledged ESB Networks Telecoms statements of the importance of Smart Grid and proposed to make radio spectrum available exclusively for Smart Grid, with only Utilities (ESB, EirGrid or Ervia) capable of winning Smart Grid spectrum.

In October 2018 when ComReg proposed releasing radio spectrum in the near term and specifically for Smart Grid, this enabled Networks Telecoms to escalate its trials program as ComReg had identified what radio spectrum was being released and technical conditions. ESB Networks Telecoms' engagement with industry resulted in the potential for trials of LTE with two vendors. One offered equipment which operated in Frequency Division Duplexing (FDD) mode, whilst the second offered equipment in Time Division Duplexing (TDD) mode. ESB Networks Telecoms considered it necessary

to evaluate both vendors equipment. This was due to the fact that TDD and FDD technology operate quite differently in practice and they deliver different technical performance. Also, regulators and industry had not chosen a preferred mode of operation.

The second Vendor's equipment began arriving in ESB Networks Telecoms labs in January 2019, testing began towards the end of February 2019. Initial testing was conducted using test laptops and devices used by ESB Networks (e.g. Remote Terminating Units – RTUs) physically connected to their end device Customer Premises Equipment (CPE), which in turn was connected to base station and core network. Thorough testing took place using a wide range of scenarios and configurations. Trials progressed to multiple CPEs wirelessly connected on site with more testing taking place. The trial finished at this point in May 2019.

Equipment from Vendor one arrived in ESB Networks Telecoms labs in May 2019. Testing began in June 2019 in the labs, wireless on site tests in July 2019 with live field tests taking place in August 2019 in Portlaoise and surrounding areas. Extensive testing took place and results documented.



Figure 3: Vendor equipment field trial testing Portlaoise

ESB Networks Telecoms concluded its trials of Long Term Evolution (LTE) technology (both variants) in September 2019. The trials conducted by ESB Networks Telecoms were cutting edge and allow ESB Networks to be at the forefront of Smart Grid developments. At the time the trials took place, ESB Networks Telecoms were not aware of any other Utility who carried out such testing of cutting edge technology.

Networks Telecoms were unique in their trialling of the two variants of LTE (TDD and FDD). The radio spectrum being released by ComReg was not standardised at the time that ESB began testing. However, through Networks Telecoms engagement in various forums (450 Alliance, EUTC and others), the radio spectrum being released by ComReg was standardised as a 3GPP band in Q1 2019. This will in turn ensure that there will be a good ecosystem of equipment when Networks Telecoms goes to tender. This also ensures that in time there will be 5G equipment available in this radio spectrum band should Networks Telecoms consider this in the future.

The results of the trials enabled ESB Networks Telecoms to understand what a nationwide wireless Smart Grid network could look like, with the results of the trials feeding into a business case analysis. This business case was approved on its merits which enabled the participation in ComReg's spectrum award.

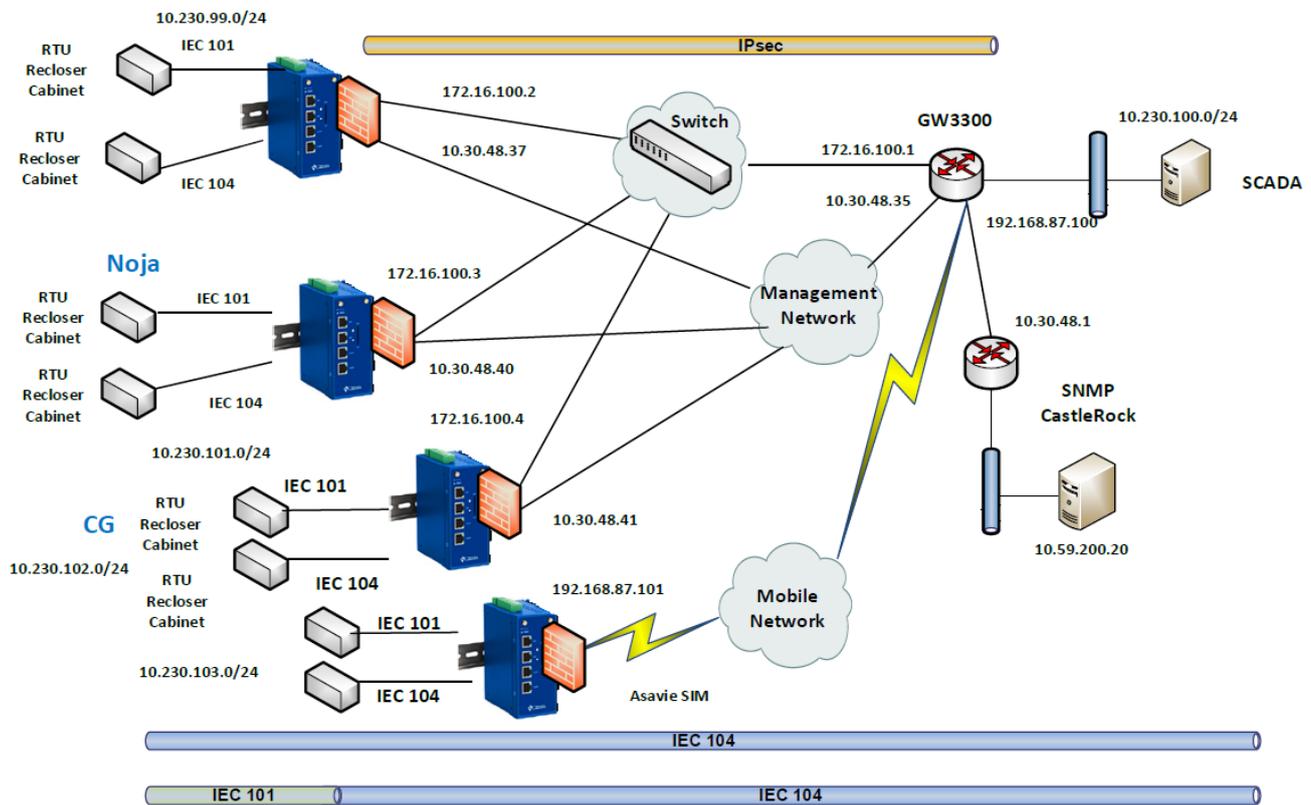


Figure 4: Trial Communications System Diagram

ComReg published its response to consultation document 18/92 and its Draft Decision ([ComReg Document 19/23](#)) in March 2019 and followed this with a Final Decision and Final Information Memorandum in summer 2019. ESB Networks Telecoms were successful in the ComReg Smart Grid spectrum award (see [here](#)). The 15 year spectrum licence began on Monday 18<sup>th</sup> November 2019, it was procured at a cost of €320,000 up front and €52,000 annually. The acquisition of radio spectrum was a significant success for ESB Networks and will facilitate the deployment of a Smart Grid. Detailed planning, designing and procurement exercises are commencing in ESB Networks Telecoms now that a licence has been issued. The initial timelines allow for the beginning of a network being deployed in 2021.

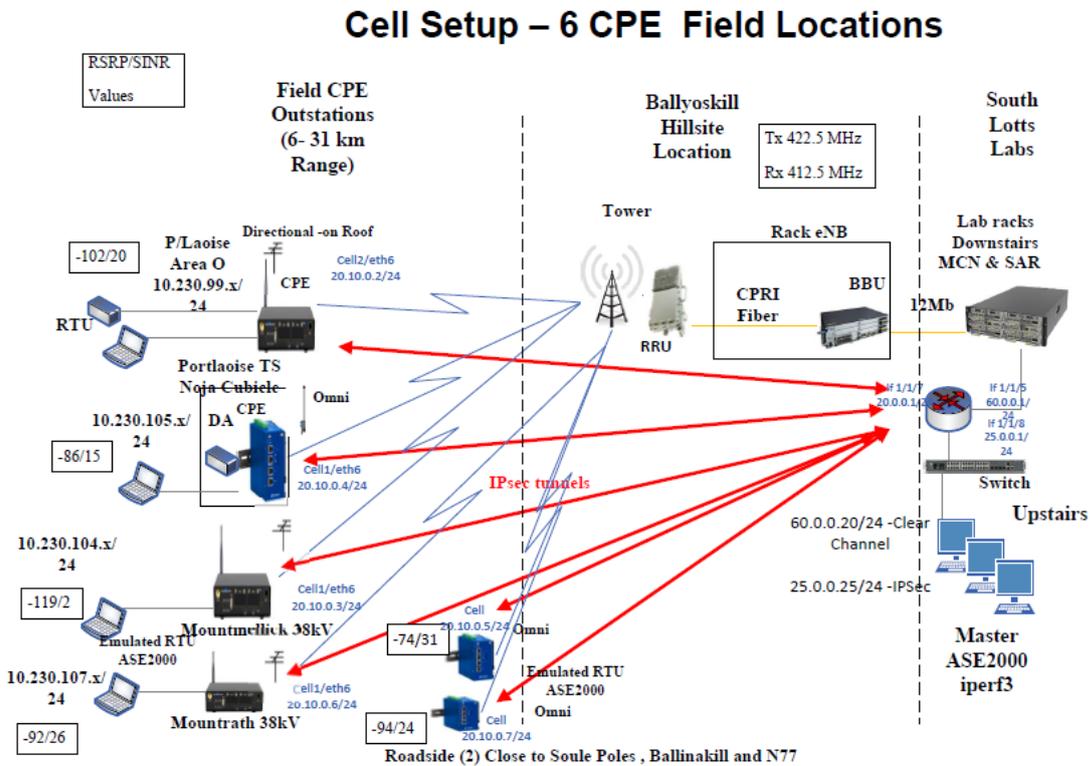


Figure 5: Cell setup - Communications System Diagram for Field Locations

Utilities throughout the world are referencing the trials conducted by ESB Networks Telecoms and also the success in acquiring radio spectrum at a cost effective rate for the deployment of Smart Grid. ESB Networks Telecoms success has encouraged further technology trials (e.g. WPD in the UK) and other regulators to make radio spectrum available for Smart Grid (e.g. Poland).

## LEARNINGS

A wide range of learnings were achieved. ESB Networks Telecoms learnt the technical capabilities of LTE technology (both FDD and TDD), e.g. throughput, latency, propagation distance, impact of cybersecurity measures etc. ESB Networks Telecoms also had learnings around how such technology can interface with ESB Networks applications (e.g. reclosers, RTUs) on a physical and technical level. ESB Networks Telecoms learnt how such technology can be deployed in a live environment. ESB Network Telecoms also learnt how LTE technology can deliver on business requirements and the achievable wireless network utilising optimised available radio sites.

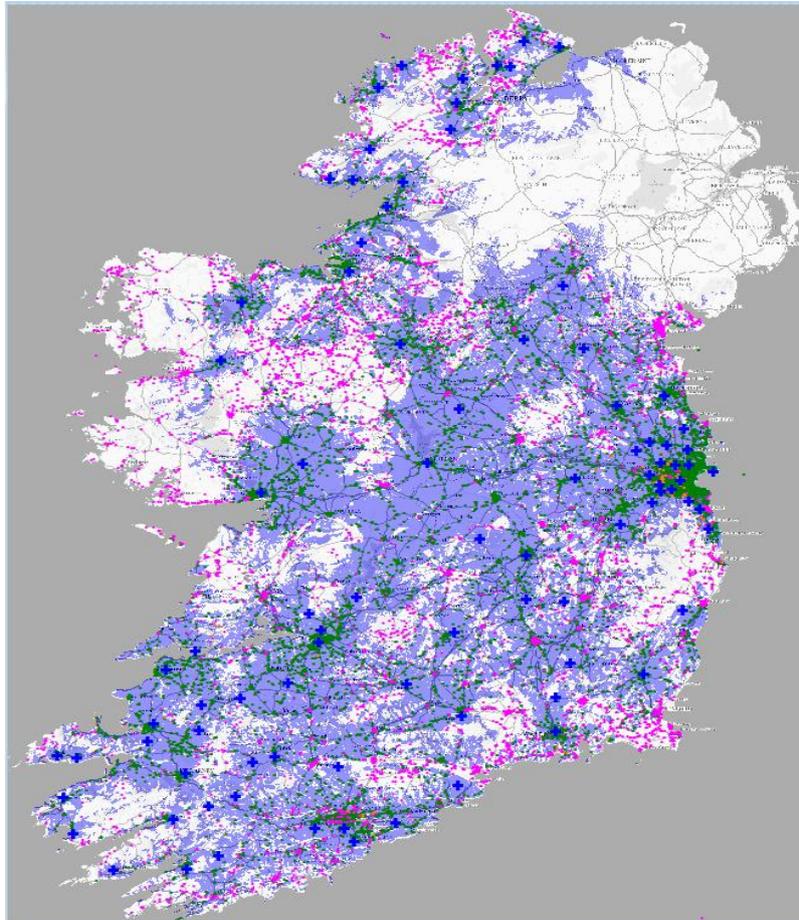


Figure 6. Demand of Telecoms Services & connectivity

## BENEFITS REALISED/VALIDATED

The suitability of LTE technology for a Smart Grid deployment has been verified. The suitability of the specific radio spectrum for ESB Networks Telecoms has been verified with efficient network design given the low frequency band. These learnings fed into the business case which was approved, allowing ESB Networks to successfully acquire the 15 year licence from ComReg. ESB Networks Telecoms are now actively planning next steps (procurement, detailed network planning, roll out plan etc.) to make a nationwide Smart Grid network deployment a reality over the coming years.

The Smart Grid network which is at the start of the planning phase will enable;

- Integration of more renewable generation
- Peak load management and decarbonisation of electrical network
- Electrification of heat and transport
- Fewer faults and potential reduction in duration of outages
- Enhanced resilience in the electrical network, particularly during power outages
- Extensive geographic coverage (tailored for where required)
- High levels of cybersecurity

## NEXT STEPS – BAU, TRANSFER OF OWNERSHIP

ESB Networks Telecoms have a number of next steps to make the Smart Grid BAU;

- Scope of tender to be defined, proposed deployment etc
- Define strategy, implementation plan and financial model for provision of services to third parties
- Detailed design of network to be completed (e.g. define services, network architecture)
- Tendering exercise (including OJEC, PQQ) to take place
- Detailed radio network planning exercise
- Plan and upgrade power and Wireless Access Network (WAN)
- Generating process documents for installations of high site and remote end equipment
- Install equipment

## FINAL TIMELINES (REASONS FOR ANY DELAYS IF THEY OCCURRED)

Spectrum: ESB Networks Telecoms were not in control of when the radio spectrum was made available to support Smart Grid. ESB Networks Telecoms successfully engaged with ComReg for a number of years to make this a reality in the shortest timeframe possible. The radio spectrum licence began in November 2019 with a 15 year span. Early work on the next steps (above) has begun, with the beginning of deployment of Smart Grid services expected in 2021.

Trials: Networks Telecoms engaged 2 vendors to conduct technology trials. Trials began in Jan 2019 and were finished by September 2019 on time and in budget, ready for the expected release of radio spectrum from ComReg.

## FINAL COSTS

Spectrum: €320,000 upfront and annual costs of €52,000 (value expected).

Trials: The project was delivered for just under €320,000 representing a significant efficiency against its €350,000 budget.