

## Spotlight on Technology Services

We are a specialist electrical engineering and grid advisor within the renewable and low carbon sectors covering a broad range of work including power system studies, electrical system design, cable system engineering, consenting, procurement, construction, operation, code compliance and code amendment, political and regulatory matters, strategic advice and commercial negotiations. This article take a closer look at some of our key services, in demand from our clients in the UK and internationally.

### Onshore and Offshore Cable System Engineering

We have significant experience of work related to electrical cable system design associated with both onshore and offshore renewable projects. We have conducted design studies at concept to FEED level for export and array cable systems for offshore renewables, including conducting thermal rating studies, developing cable designs, inspection and test plans and system capital expenditure models allowing comparative analysis in optioneering exercises.

We also support onshore developers with challenging connections including the provision of cable thermal studies and routing studies in complex environments with existing power and telecoms infrastructure.

### Dynamic Cable Rating Studies

**Subsea cables have traditionally been designed assuming that the cables operate at full load with a conductor temperature at the maximum permissible level for the lifespan of the cable system. Steady state thermal rating therefore delivers a conservative thermal rating that fails to optimise the cable asset over its service life often limiting the potential power transmission. In addition, the IEC algorithms do not take into consideration the time taken to heat the thermal mass of the installed environment assuming instead a worst-case scenario of steady state temperature. There is an industry need to bridge the gap between conservative steady state ratings and dynamic in-service thermal ratings, monitored in real time.**

In response to this industry need, we developed a series of dynamic rating digital tools to address the need to model the thermal performance of cables in service more accurately and therefore offering the opportunity to lower cost. The methodology combines established IEC principles and leading academic research on modelling thermal performance of cable systems with intermittent generation. The combination of a familiar steady state baseline and an iterative algorithm to reflect constant output change from offshore wind turbines has been developed into an [effective digital tool](#) by ITPnergised. This approach has been used in real projects in the UK and Asia Pacific, with typical benefits including **capex savings in £10's millions and delivering material LCOE, IRR, NPV and payback year benefits**. This digital tool is only available and accessible with our cable consulting services.

### Wide Area Network (WAN) Studies

Another one of our specialist areas is Wide Area Network Studies (WAN) for developers. A critical area for the **success of new generation assets is the ability to connect the generating asset to a grid connection or private wire, to ensure that generated power can be exported**. This element of a project is key to determining the commercial viability of any proposed project.



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As a leader in all major grid regulatory developments in Great Britain over the last ten years, we are well positioned to advise on this. On WAN studies, **our team can perform an analysis of all substations within the chosen area of search which may present viable connection opportunities for projects at a pre-determined scale.** We undertake these studies on a DNO-by-DNO region basis, then undertake a full data-driven GIS analysis of the DNO region. The analysis process is largely informed by our internal knowledge base and assessment of publicly available documentation. The assessment of each substation's status will be based on known issues/ timeframes from recent work we have undertaken, some further research and possible discussions with National Grid Electricity System Operator (NGESO) and the relevant DNO/TO as applicable. We will endeavour to find robust or electrically firm connections, where available, for new generation/storage sites.

The analysis will present the results in a 'Red-Amber-Green' (RAG) format, and we can carry out this assessment on a number of different criteria, such as the following;

- **Overload protection scheme (uncompensated):** An overload protection scheme has a variety of different names dependent on the network operator; they may be known as Active Network Management (ANM) or Load Management Schemes (LMS). These schemes if they are in place would allow the network operator to turndown/turn off generators within a region to counteract certain events; examples of these may be thermal limits being exceeded, voltage level issues or fault level issues occurring. In any case, in these events, the generation site would be uncompensated for their downtime.
- **Generator substation:** Substations that are embedded in the network that have been constructed to support another generation site but may present spare capacity opportunities.
- **Fault level issues:** substations that are identified as having potential fault level issues or may trigger such issues if additional generation of the scale specified is connected.

**The deliverable is a strategic heat map and accompanying data files showing the RAG status of each substation site.** In each case dependent on the area selected we will seek to determine the best connection type for your proposed project scale and identify connections that would best suit this. We can offer an estimate on connection costs. This will be a generic cost, as a £/MW value for connection to a generic substation and will be based on in house data and information provided by the DNO to further aid in developing an area of search.

### Power Systems Modelling

**We have deep expertise in undertaking power systems modelling and analysis of renewable projects and the wider electrical systems into which they are integrated.**

The power systems team can support all phases of a project from feasibility to as built compliance, ongoing compliance and support of assets. The team has substantial depth of knowledge of power systems design and grid code compliance requirements supported by capability with major power systems analysis tools including: **DigSilent Power Factory, PSS/E, PSCAD, MATLAB, Python.**



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The team use power systems models to develop high level project design concepts, undertake detailed project design, define equipment specifications and demonstrate grid code compliance. The team can advise regarding electrical system design considering, harmonics, losses, availability, redundancy and operational considerations. The team has substantial experience implementing dynamic and EMT models including building models from scratch as well as working with OEM turbine and equipment models.

On renewable generation grid connection services for onshore, offshore and hybrid renewables we offer:

- Load flow studies
- Reactive power capability, compensation equipment specification and optimization
- Short circuit (fault level), equipment rating
- Network strength requirements (weak grid and SCR assessments)
- Electrical losses (and design optimization of electrical losses)
- Transformer specification
- Harmonics including filter specification
- Resonance including sub synchronous control interaction (SSCI)
- Transient (EMT)/ dynamic analysis (fault ride through, inrush, voltage control, frequency response)
- Design reliability
- Grid code compliance tests, studies and model validation
- Cable rating, including offshore dynamic cable rating

On grid network and renewable integration we offer:

- Contingency analysis and identification of reinforcements requirements and constraints
- Generator and network dynamic stability

### TNUoS Charges Prediction

TNUoS charges recover the cost of installing and maintaining the transmission system in England, Wales, Scotland and offshore. **These charges vary considerably and can comprise the majority of Opex in north of GB or be a revenue stream in other areas.** The charges form a crucial part of strategy in portfolio development and in Financial Investment Decision for transmission connected renewable projects, and in ongoing budget forecasting for operational projects. **We have built a [Digital Twin](#) of the GB grid based on the National Grid model which has been updated for the last few years. This is unique to us in the market.**

Access to this model is not included but the results from it are. We have additionally built a commercial layer on top of this using the [National Grid Future Energy Scenarios](#) to help predict TNUoS charging to 2050 in 5 yearly increments across all relevant zones in the system. Users can choose reports for 1-14 zones and will receive an explanatory report along with the predicted wider TNUoS charges.



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### Regulatory Monitoring

We have been working as a grid advisor providing regulatory consultancy services to clients within the renewables and low carbon sectors since 2006 and we have extensive experience in engaging with the development of grid policy and regulation in Scotland and throughout Great Britain.

**Regulatory Monitoring and identification of consultations** – As part of the regulatory services, our team monitors and provides monthly briefings that identify and track key workstreams, events, consultations and publications to the client as required. The monthly reporting cycle monitors regulatory and policy activity, with the aim of identifying opportunities or risks and outlining what each issue or topic is, what it means, what the impact will be for the client and how the client should engage or otherwise. We maintain active engagement with key industry forums through memberships and regular attendance of industry groups and forums.

**Responding to consultations** – Where there are opportunities to respond to and influence consultations, we flag these up in order to allow the maximum opportunity for the client to consider and respond to the consultation. We prepare draft consultation responses, tailored to the client's key objectives.

**Provision of ad hoc advice** – We provide ad hoc advice and intelligence on any other developments related to regulatory and policy activity and respond to any ad hoc requests for advice, support, engagement with key stakeholders, workshop facilitation etc.

Examples of ad hoc advice include:

- [TNUoS](#) charge estimates (short and long-term)
- Review of embedded benefits and future revenue forecasts
- Constraint payments
- Embedded benefits and service-related benefits
- Underwriting reviews
- Event attendance and debrief
- Disputes and determinations (with Ofgem)

Maintaining active engagement with key industry bodies and a close communication with the client, our team manages to track high priority issues and to support the client in achieving their key objectives.

**The key to success for navigating the grid is working with a trusted advisor with deep knowledge of the network developed over decades of experience. We believe we are optimally positioned to help you navigate the increasingly constrained GB grid and for grid connection work globally which we believe will become increasingly “make or break” for determining the viability of proposed development projects that can help take us to net zero.**

For more information, please contact Brian Branney, Head of Technology Services at [brian.branney@itpennergised.com](mailto:brian.branney@itpennergised.com)

