Introduction

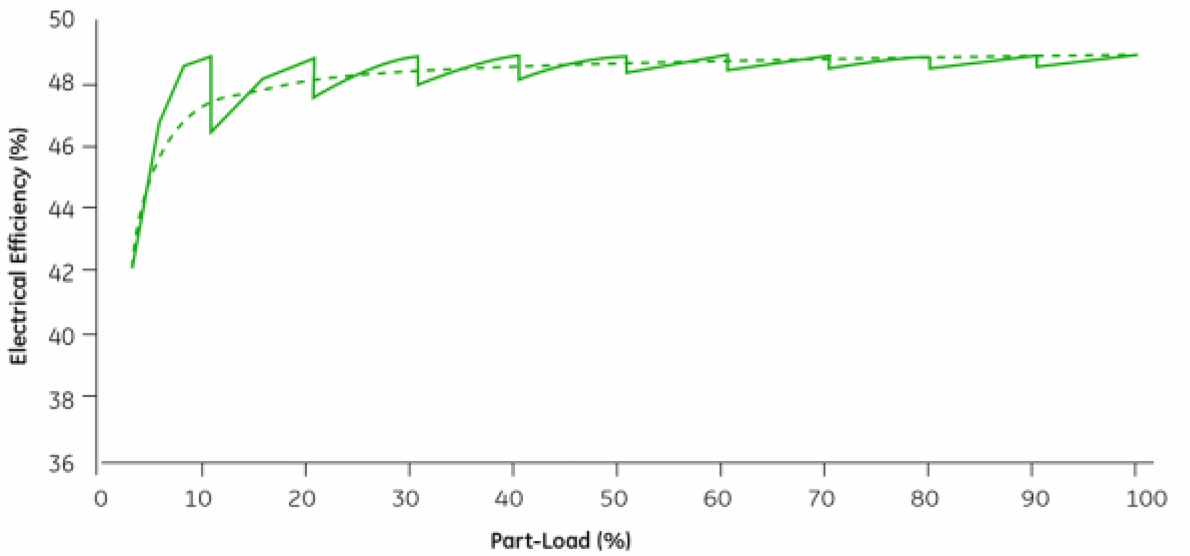
Clarke Energy is the distribution and service partner for Jenbacher and Waukesha gas engines in 28 territories throughout the world including Ireland. The Jenbacher gas engine is specifically designed for onsite generation providing industry leading fuel efficiency and low emissions, through the use of the Jenbacher LeanNOx system and, where required, Specific Catalytic Reduction (SCR) to further reduce NOx and CO emissions. The Jenbacher LeanNOx system is however able to comply with current NOx emission requirements without after treatment of the exhaust gases from the engine.

The Jenbacher gas engine is designed to run on a 24/7 basis and have a proven pedigree providing onsite power generation with heat recovery to satisfy site heat demand when configured for Combined Heat and Power applications.

With the growth of grid connected renewables (wind and solar) there is an increasing need for flexible power generation assets that can provide high simple-cycle electrical efficiency and low emissions through a range of station outputs from 5% to 100%.

Throughout the world this is now being achieved by the use of multiple frames of high efficiency reciprocating gas engines; which due to advances in engine control and electrical control technologies, can be configured to act in support of the grid, particularly in times of low renewable output and during transition of electrical demand from renewable to dispatchable generation assets.

Figure 1 graphically represents typically station efficiency and flexibility curve for a 100MW reciprocating gas engine power station – the so called “Saw Tooth” efficiency curve.



This configuration has been deployed to great effect in capacity markets in GB and across Europe to replace large frame centralised power generation assets. The use of multiple engine frames also spreads the risk of machine failure across several engine frames rather than single large frame machines, increasing site availability.

Data Centre Electrical Infrastructure

The most common configuration of a data centre from an electrical perspective is a 2N electrical supply – where "N" represents the data centre's electrical demand. Typically, the data centre achieves this electrical supply configuration with a grid connection (Mains Electricity) and traditionally, an array of stand-by diesel engines configured for AMF (Automatic Mains Failure) operation – meaning the diesel engines will start and run in the event of Mains Failure to supply the requirements of the Data Centre. Typically, both the Mains supply and the Diesel Supply feed the Data Centre via Uninterruptible Power Supplies (UPS) which work to ensure acceptable power quality and continuity of electrical supply during transitions from Mains supply to stand-by power.

In Ireland, data centres configured in this way are typically limited in the operation of stand-by diesel engines to 500 hours per year due to emission permits. As the diesel engines are normally configured as stand-by units for mains failure scenarios and therefore have limited capability to operate in grid parallel mode.

Increasingly, new build data centres are actively considering the installation of gas engine generation as an alternative to Mains supply in order to provide the data centre with the flexibility to optimise the use of renewable energy including renewable gases such as bio-methane and hydrogen.

Onsite gas engine generation also provides economic insulation from price fluctuation associated with electricity market supply and demand dynamics. Dispatchable, onsite gas engine generation also provides the opportunity to arbitrage between gas and electricity, particularly in electricity markets with limited electrical inter-connection to larger regional electricity markets. In many cases the data centre will continue to install diesel engines for standby purposes – which if configured correctly, could also be utilised to supply the grid during period of high electrical demand and low electricity supply; particularly as the penetration of renewable generation sources increases.

The electrical demand from Data Centres also has benefits for Ireland renewable electricity ambition, as the additional electrical load increases the amount of renewable electricity that can be connected to the grid, whilst maintaining gird stability as measured by SNSP – System Non-Synchronous Penetration.

Consideration should also be made in relation to maximising the utilisation of existing grid connection infrastructure – for example installation of gas engine generation that utilising existing renewable electricity generation grid connections during periods of no generation or reduced output where there is gas available adjacent to the existing renewable electricity generation site.

Flexible gas generation will be a key enabler to achieve the maximisation of renewable electricity ensuring security of electricity supply throughout the year; through all-weather pattens; night and day during this transition period and following the deployment of the currently planned renewable electricity generation capacity by closing the gap between the percentage of electricity demand supplied by renewable electricity generation and the system electricity demand.

Energy storage technologies can also add to the data centre's back-up power requirements. Additionally, as the economic viability of longer-duration systems improves, these storage systems can also provide grid services such as DS3, alongside gas generation plant to ensure that the Data Centre has security of supply, but also that the grid remains stable at all times.,

Other Large Energy Users

Deployment of high efficiency, low emission self-generation by LEU should be encouraged, as it will increase the national stock of generation assets matched to the requirement of the LEU, which will lessen the burden on the replacement of centralised generation assets.

It also provides opportunities for improving primary energy efficiency by utilising useful heat generated by the production of on-site electricity, or the provision of that thermal energy to supply adjacent heat demand. In periods of high availability of renewable electricity these embedded generators have the flexibility to be turned off or utilised to maximise renewable electricity generation connected to the grid.

Conclusions

Today we have the large quantum of onshore renewable generation connected to our electricity grid and, in fact, gas is now and increasingly will become the secondary primary fuel source which enables green electricity production and maximisation.

The flexibility and part load capability of gas engines embedded in the electricity supply network close to the demand load, specifically Data Centres, will further enable the maximisation of renewable generation capacity and improve electricity system reliability. It also improves overall grid efficiency by reducing Transmission and Distribution losses and alleviating power flow constraints on the electricity Grid.

Gas as a primary fuel source will have a place in the generation mix in Ireland for many years to come and hence steps need to be taken to ensure adequate gas capacity is secured and that flexible gas storage infrastructure is developed centrally to ensure security of gas supply.

It is predicted that fossil fuel gas will be replaced by renewable gas from indigenous AD plants supplemented with a percentage of Hydrogen and ultimately a combination of 100% Hydrogen and non-fossil gas.

CRU Consultation Specific Comments

3.1 Do Nothing

In this scenario, the Data Centre Connection Offer Policy and Process (DCCOPP) would continue as is. This will likely result in a situation where demand outstrips available supply at the peak. This will result in load shedding and consumers facing rolling blackouts. This is not an acceptable situation to the CRU.

Comment:
This is not a realistic option and has significant economic and reputational impacts for the entire country.

3.2 Moratorium on Data Centre Connections

In this scenario CRU could issue a Direction to the system operators to cease processing all data centre connection applications (including modifications) and new connection applications for a number of years. The CRU does not consider this appropriate at this time as there are mechanisms that data centres can employ which in the CRUs view can contribute to their overall flexibility.

Comment:
This will have significant impact on the Data Centre community – including Data Centres themselves and the businesses that provide support to this community. In Ireland we have created a Data Centre eco-system that provides access to world class telecoms infrastructure; data latency; DC development, construction and operational expertise. This is an option but an option that will have significant implications for the Data Centre Community and the reputation of Ireland.

3.3 Connection Measures

In this scenario the CRU proposes to Direct EirGrid and ESBN as the system operators to implement the following measures with respect to the terms and conditions it may specify for all connection applications received from data centres (whether inside or outside the greater Dublin region):

(a) EirGrid and ESB Networks shall prioritise the processing of data centre connection applications based on;

- the location of each data centre applicant with respect to whether they are within a constrained or unconstrained region of the electricity system;

  Comment:
  If a data centre is constructed in a constrained region of the system, but mandated to include self-generation (thus becoming an auto-producer) than in relatives that facility could theoretically export power at times of constraint to support the local network. In the same wat that wind if often treated as "negative demand" embedded generation within the data centre can provide voltage stability and relieve congestion in each area.

- the ability of each data centre applicant to bring onsite dispatchable generation (and/or storage) equal to or greater than their demand, which meets appropriate availability and other technical requirements as may be specified by EirGrid, in order to support security of supply;

  Comment:
  The ability of a data centre to bring onsite dispatchable generation will support the security of supply considerably. The two limiting factors to consider here are contributing to fault levels and secondary fuel obligations, both of which can be managed through:
  - installation of neutral earthing contactors and resistors to help minimise fault contribution in times of network instability
  - relieving the secondary fuel obligation would encourage data centre operators to install modern high-efficiency and low emission gas generators that can respond quickly.

- the ability of each data centre applicant to provide flexibility in their demand by reducing consumption when requested to do so by the TSO in times of system constraint through the use of dispatchable on-site generation (and/or storage) which meets appropriate availability and other technical requirements as may be specified by EirGrid, in order to support security of supply;

  Comment:
  Onsite dispatchable generation (including storage) will improve security of supply, as during times of constraint on the system the data centre could run their generation assets to relieve demand on the network.

- the ability of each data centre applicant to provide flexibility in their demand by reducing consumption when requested to do so by the TSO in times of system constraint, in order to support security of supply;

  Comment:
  Data centres, by design, have an inherently stable demand therefore their ability to reduce consumption is limited largely. A hyperscale data centre is more likely to be able to "migrate" it's demand by moving "traffic" to another facility whereas a smaller colocation facility will be less likely to be able to do this. That said, load reduction within indigenous data centres that have some embedded generation capacity could add to reducing demand on the grid.

(b) EirGrid & ESBN shall apply the above prioritisation for data centre connection applications on an Ireland wide basis.

Comment:
To continue to support development of the data centre economy in Ireland, EirGrid and ESBN should encourage prioritisation of the installation of embedded generation within a data centre, then load reduction then constraint management.

The above measures are not currently ranked. Following conclusion of the consultation the CRU may decide to include a prioritisation for the purposes of any Direction. Option 3 "Connection Measures" is intended to allow the data centre community to collaborate with the System Operators and contribute to the mitigation of the spiralling demand and security of supply issues.

Additional Supporting Text:

Gas Fuel Availability

Gas represents the most efficient, lowest emission (e.g. CO, NOx, particulate) fossil fuel per kWh delivered in simple generation and this is vastly improved when gas is used as a fuel for embedded CHP (Combined Heat and Power) plants.

The availability of gas in Europe looks robust into the future both from existing, or in-development European gas supply projects, together with multiple operating LNG terminals which allow movement of gas to Europe from the Middle East and Asia.

The recently completed GNI "Twining" Project has seen the installation of a twin gas supply lines between Moffat and Brighouse Bay in Scotland which now means that the Republic of Ireland has 100% redundancy in respect of gas interconnection capacity with the UK and hence Europe. Each interconnector is capable of supplying Ireland's entire gas demand requirement.

In addition, the Corrib field is currently providing circa 50% of the Republic of Ireland's gas demand. The two gas interconnectors to the Republic of Ireland now represent circa 412km of high-pressure gas pipe. The gas transmission system now consists of circa 2,500km of high-pressure transmission pipeline operated at a pressure of between 50 Bar and 70 Bar depending on flow requirements.

This system alone represents a significant volume of stored gas in the interconnection and transmission systems which, by "Packing" of these systems, a competent system operator will balance peaks and troughs in the national demand profile to always ensure adequate gas flow in the system, a further flexibility in the gas supply system.

In addition, the gas distribution system consists of 11,500 km of distribution pipe across the country.

Neither the gas transmission and distribution system has ever experienced an outage or a pressure reduction event.

National Gas Storage Infrastructure

Development of large-scale (i.e. national scale) gas storage capability, perhaps in the form of LNG using excess renewable electricity to liquefy and store available gas for future use, would be a useful addition to the gas network in Ireland. It would provide further security of gas supply and develop competencies in gas storage and liquification – which will be required for large scale future deployment of Hydrogen as part of the transition to net zero carbon.

Strategic gas storage managed in a similar manner to the National Oil Reserves would ensure security of gas supply achieving Security of Electricity Supply at least from a fuel perspective and hence further support the maximisation of renewable electricity generation.

Such storage would also have usage in relation to the storage of renewable gas (Biomethane) produced from anaerobic digestion (AD) and injected into the gas transmission and distribution networks. In this way ensuring continuous production of renewable gas even in period of high levels of renewable generation.

On our journey to net zero carbon, it will be necessary to use gas as a transitional fuel, it is therefore important to maximise the utilisation of the gas used and ensure the minimum levels of emissions per kWh produced to ensure assist in the achievement of Climate goals.

Given the flexibility and low emissions associated with gas-only engines, together with the ongoing requirement of gas as a primary energy source, for the production of electricity, it could be argued that the CRU under section 28(5) of SI 60 of 2005 should be taking measures to develop gas storage capability as part of the transition to away from liquid fuel - which is less efficient; creates greater emissions and requires great CAPEX and OPEX.

Data Centres

Ireland's position as the largest producer of onshore renewable electricity in Europe together with our open economy and foreign direct investment policies has made Ireland very attractive location for Data Centres.

The growth in Data Centres in Ireland has the potential to lead to the largest electricity demand growth since rural electrification in the 1920s. The Data Centre grid connection policy is driving Data Centres towards the provision of their own embedded gas fuel generation stations, an investment the Data Centre operators are willing to consider.

The use of multiple frame high efficiency, low emission gas engines is the obvious choice for Data Centre operators conscious of their environmental credentials - with the added advantage of reducing onsite fuel storage; fuel condition requirements and the associated supply logistics (truck movements; associated emissions; etc.).

Such embedded multiple frame generation schemes, already in design, allow flexible generation in the range of 2.25MW to 100MW depending on the number of engines deployed. The need for clarity around the requirements of the Secondary Fuel Obligation is stalling investment decisions or worse driving investment decisions – which in an energy centre context are decisions that will have an impact for the next 20 years – towards technologies which are not compatible with climate goals and electricity supply policies e.g. dual fuel engines which increase project CAPAEX and OPEX for the equipment operator.

In the context of Data Centres it should be remembered that they are incremental electricity demand for which the Data Centres want to use renewable electricity and are willing to install their own back-up electricity generation capacity – an investment that should be fit for purpose and future-proofed for the next 20 years. Jenbacher gas engines are Hydrogen ready meaning they have the capability of utilising hydrogen in the future – further improving the investment case.

All large energy users should be encouraged to provide embedded gas engine generation as part of their individual security of electricity supply strategy supporting the maximisation of the renewable generation when available. Such embedded generation can be integrated and controlled using Smart grid technologies in order to optimise grid utilisation; security of supply and stability of voltage and frequency – a distributed generation model which optimises flexibility and has the potential to reduce large shifts in power flows as electricity generation transitions from distributed renewable generators to large-centralised power generators.