I would like to start by thanking the Joint Oireachtas Committee for the opportunity to attend this meeting and contribute to a scrutiny of the proposed Microgeneration Support Scheme Bill.

Research around the topics concerning microgeneration is very rich. In general and in the context of smarter energy environments, there is a recognition that for low-voltage (LV) prosumers and other distributed sources (such as electric vehicles) to derive benefits the challenge is network architecture flexibility. This architecture needs to be sufficiently flexible to support a market for prosumers but also sufficiently robust to accommodate the technical implications arising from their network contributions. Notwithstanding the research available, it is still very difficult to say definitively whether the measures being proposed by the Bill will work for the Irish national interest(s). The landscape today has changed significantly since the last microgeneration incentivised scheme. What is definitive, is that in comparison with Northern Ireland, the take-up in micro-generation across the Republic of Ireland is much less and the likely reason for this is the lack of incentive available.

It should be noted at the outset, that in avoiding CO$_2$ emissions, there are cheaper alternatives to microgeneration. However it is appropriate for policy decisions to acknowledge microgeneration as a contributor as well as the environmental benefits created by the social awareness of the technologies involved. Focus should therefore be on designing something that is economically efficient and socially equitable. With that in mind, my statement will examine some of the specifics proposed by the Bill, namely minimum price tariff considerations, supplier obligations, community based projects and the technical implications associated with increased microgeneration proliferation. Further consideration will also be offered around the importance of information and the resolution of other barriers relevant to the uptake of microgeneration. I have discussed the proposed Bill with colleagues / principal investigators at TU Dublin and my contribution to this meeting is reflective of research being undertaken at the Dublin Energy Lab (DEL), the Electrical Power Research Centre (EPRC) and the Community Grid Project and Demonstrator (cPAD) project.

**Minimum price tariff (‘kWh payment’)***

The price per kWh will be important in respect to how many and what types of households will be incentivised to invest in the scheme. Our research has shown that larger households with larger demand (and likely to have higher incomes) will benefit more from this scheme. From the point of view of both economic efficiency and equity it would be worth considering multiple feed in tariffs (kWh) based on level of demand or the staged introduction of tariffs, increasing over time. There is also the potential to use smart electricity meter data to design individualised tariff regimes (Ayompe and Duffy, 2013).

It is generally acknowledged that lower (capital) cost of renewable energy systems is a requirement in making them more attractive to LV consumers. For instance, and in respect to photo-voltaic (PV) systems, the reduction in price of PV modules, coupled with improvements in efficiency, increasing lifespan of the associated systems and the support policies for PV technology, have fostered market competition and growth. Such advancements are likely to continue contributing to lowering prices further in the future. Decreases in solar PV levelised cost of energy (LCOE) is particularly reflective of these advancements. Ultimately any economic analysis needs to be cognisant of the changing cost environment and future subsidy opportunities. It should also be pointed out that while the Bill considers a range of microgeneration technologies, the dominant technology (from a wider social-demographic appeal) is currently solar PV. Wind energy has seen technological improvements (leading to performance enhancements), but when planning restrictions and practical limitations are considered, this form of energy harvesting is challenging and its deployment is restricted to outside of population densities.
Supplier Obligations
In the context of supplier obligations, how the ‘5 per cent of their electricity from microgeneration by 2025’ is to be calculated needs to be carefully considered. In other words (and in acknowledgement that the 5% is representative of whatever target might eventually be agreed), will it be on the basis of connected capacity (the number of households/installations) or in respect to the quantity of electricity generated? If it is the latter, what level of generation capacity will be considered (i.e. will it have a time of use and/or seasonal consideration)?

Another relevant question concerns the energy quantification (metering) of the electricity produced. If the aggregated meter data reflects the electricity produced but does not account for any additional electricity produced and self-consumed on-site, should the 5% be calculated on what the meter shows and compliance determined based on what is exported, or should it be calculated inclusive of what was consumed, with compliance determined based on what was produced? Perhaps the latter is fairer and avoids market distortion (including loss of Distribution Use of System (DUoS) by the network operator (ESBN)), but this requires smart metering which not only meters import and export, but also on-site production. Other countries such as UK, Netherlands, Germany and Italy already do this; Ireland does not.

Community based projects
The addition of communities in the Bill is welcomed. Communities organising themselves into energy communities to produce electricity can not only improve the return on investment through economies of scale, it will also make microgeneration more manageable for the electricity market as a whole. TU Dublin refers to such organised communities as Community Grids. It is imperative however that the combined financial net benefits to the Community Grid is sufficiently larger than the combined benefits if each member was to invest individually. A mechanism should be found that values and assigns to the Community Grid the benefits that they bring to the electricity market.

Technical implications associated with microgeneration power
System impacts
The Bill has the potential for significant technical implications. The widespread deployment of embedded microgeneration could cause significant fluctuations in the demand for electricity at a national system level. This will be happening at the same time as we continue to promote large-scale generation using intermittent renewable energy technologies such as wind energy. This could lead to greater risks to system instability and possible power quality problems or even brown outs/black outs. Work will need to be undertaken to ensure that the necessary knowledge and systems are in place to adapt to this new challenge.

As Mr. (Michael) Manley eluded to at the committee meeting on 05 March, there will be a significant amount of ‘evidence-based analysis and assessment’ involved. Indeed, as Mr. Gannon of SEAI outlined in his opening statement at that meeting, accommodating 2-6GW of microgeneration on the low-voltage network by 2025 is not (currently) well understood. These challenges are research opportunities. Indeed, the research required to fully appreciate the implications of increased microgeneration includes

- **Network resilience to the modern day consumer requirements.** The research undertaken during the time of the last microgeneration scheme considered a consumer demand (after diversity maximum demand (ADMD)) significantly less than what is likely to be involved today, particularly with the increased proliferation of electrical vehicles is included
- **The complementarity (potentially) of Electric Vehicles.** Strategies to match (charging) demand in respect to microgeneration support (including the employment of battery technology)
• **Demand-side response/management systems.** Again, complementarity (and supportive) processes where ‘smart’ systems can be included to organise load and generation for effective prosumer engagement

• **Resource appreciation/understanding.** This includes enhanced models for solar PV and wind energy harvesting for domestic scales where modelling of insolation patterns, cloud cover and wind energy mapping should be available for resource assessment purposes

• **Network support mechanisms.** These initiatives would include storage options and network voltage support requirements.

### Environmental benefits

The net life cycle benefits of the microgeneration technologies chosen for the support scheme should also be assessed at the outset from an environmental perspective and inappropriate technologies screened out. For example, a recent study (Conroy *et al.*, 2019) of household-level gas-fired micro-CHP found that some technologies result in increased emissions when replacing conventional gas boilers. It is unclear why micro-CHP is being supported when these almost always use non-renewable fossil fuels.

Indeed, marginal abatement cost assessments should be carried out on the preferred microgeneration technologies so that those which reduce emissions at lowest cost are prioritised for support.

### Information

Not all microgeneration technologies are suitable for deployment in all situations and many will significantly underperform both economically and in terms of carbon emissions abatement if they are not matched to the correct dwelling type and location. For example, micro-wind turbines sited in urban environments are likely to perform very poorly. Carefully thought-out guidelines matching technologies/design with end use/siting is therefore required – in a manner that is accessible to the wider population while at the same time informing of the technical capabilities and performance inhibitors.

It is imperative that the necessary information for end user decision making is available and widely disseminated to optimise transaction costs and lower complexity. This might include, for example: payback calculators for the dwellings; online forms/agreements; approved contractors etc. Included in this should be information around the input resource (such as wind and solar radiation) so that the public can be informed in terms of how dependent the microgeneration systems are in terms of their location, orientation and how the input resource is affected by their local geography. The LCOE associated with the different renewable technologies for example is dependent on the appropriateness of the installation and how readily harvestable the primary energy is (Sunderland *et al.*, 2016).

### Other barriers

Economic performance is not the only barrier to uptake of microgeneration technologies. For example, a study undertaken by Claudy *et al.* (2010) established that home owners:

• worry about the reliability of microgeneration;
• are concerned about the disruption caused by fitting technologies into their dwellings; and
• have technology-specific concerns – e.g. reaction of neighbours and local residents regarding wind turbines.

Moreover, there are process and management logistics involved. With the level of microgeneration advocated by the Bill, what about grid access/connectivity and the logistics/competency issues? To connect to the network, registered electrical contractors perform what is termed ‘controlled works’
and certification of the installation is required. While this is a technical requirement, there are regulation considerations and financial burdens involved. Furthermore, the process is governed by an ‘inform-and-fit’ connection process, managed by ESBN. Should there be a significant proliferation of microgeneration, there will be logistical implications for the network operator to manage. These administrative issues while not insurmountable in their own right, are relevant to the management of the technical implications that will become manifest and as such will require a more stringent management processes - at least until smart meters become mainstream.

In summary therefore,

- Microgeneration contributes to wider environmental benefits but it is not the cheapest form of CO₂ emission avoidance
- Multiple feed-in tariffs based on level of demand or a staged introduction of tariffs should be considered
- More consideration is warranted in respect to the supplier obligation piece and how this is to be equitably apportioned
- Community based initiatives are welcomed in general but consideration is required to ensure net benefits are available to the community grid
- There will be a number of technical considerations with increased microgeneration proliferation and they should be conflated with current issues concerning E-mobility and demand-side management
- It is imperative that relevant and accessible information is widely available and that it covers the spectrum of considerations involved.
- The barriers to microgeneration (including societal and logistical) need further consideration in terms of a synergetic microgeneration scheme to be transparent and equitable

These concerns described above should be considered when assessing the likely success of the scheme and the likelihood of meeting policy targets.
References


