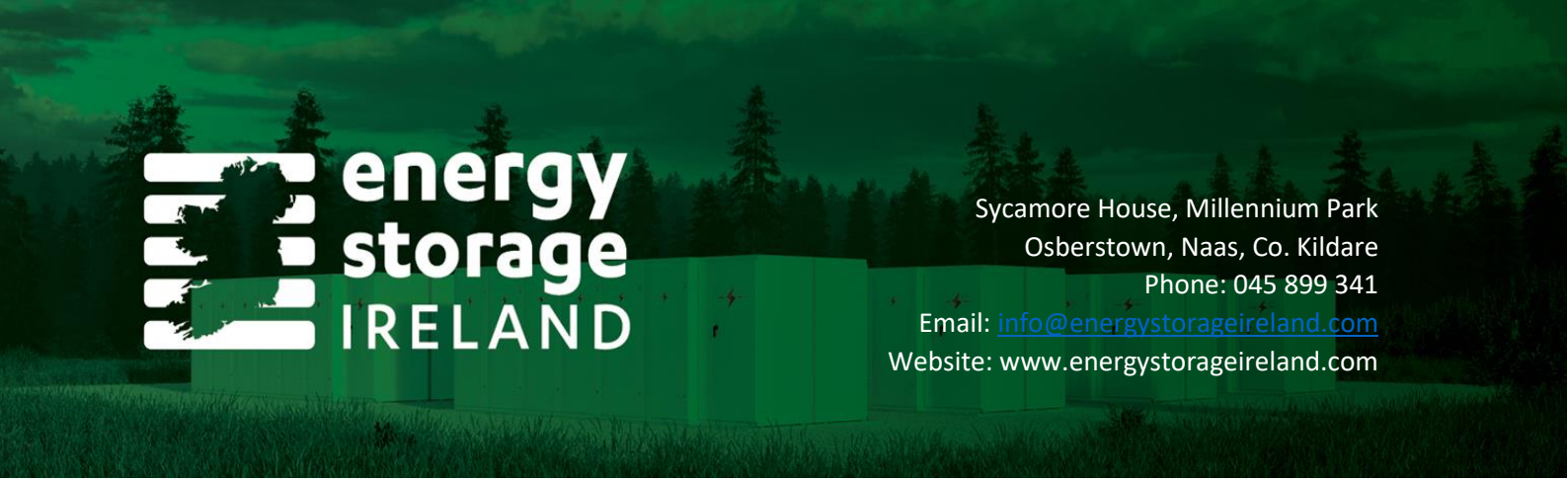

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Behind-the-Meter Storage

An Energy Solution for Ireland

An Energy Storage Ireland White Paper

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Foreword

Energy Storage Ireland (ESI) is a representative association for those interested and active in the development of energy storage in Ireland and Northern Ireland.

We work together to promote the benefits of energy storage to decarbonising Ireland's energy system and engage with policy makers to support and facilitate the development of energy storage on the island.

Energy storage will play a significant role in facilitating higher levels of renewable generation on the power system and in helping to achieve national carbon emission reduction targets.[1][2] Storage systems can act in the energy, capacity, and system services markets to deliver a wide range of benefits such as wholesale energy price reductions, reduced CO2 emissions and flexible system support services to help manage the grid with higher levels of renewables. Energy storage can also make a significant contribution to security of supply, replacing the need for fossil fuel generation.

Behind-the-meter storage refers to any type of storage that is connected directly into a customer's site, on the customer's side of the meter. This White Paper sets the scene for behind-the-meter storage in Ireland, explains the technologies involved and the various benefits it can offer. Although behind-the-meter has not yet experienced major uptake across Ireland, its potential is vast and can offer significant benefits to consumers and Ireland as a whole. The document finishes by discussing behind-the-meter's interaction with current national policy, and how certain barriers should be addressed to further incentivize investment in such technologies.

[1] Climate Action Plan
[2] Northern Ireland Energy Strategy

Introduction – What is Behind-the-Meter Storage?

Behind-the-Meter (BtM) is a particular type of energy storage which receives its name through the manner by which it is connected to the electricity grid. BtM refers to any type of energy storage that is directly connected into the customer's site, or neighbouring site, and therefore connected to the grid on the customer's side of their electricity meter. While BtM is possible at the residential level, for the purposes of this White Paper, the definition and scope will primarily be presenting information related to storage above residential level (e.g., above 100kW).

The primary reason(s) for installing a BtM unit can vary; some customers may wish to have access to such storage to provide energy support however this is usually ancillary to the customer's primary site activities and thus acts as a backup and provides resilience to grid supplied energy. Some customers may be more concerned with the energy cost savings that a BtM unit can bring whilst other investors may seek to install BtM storage to complement a renewable-generation project or engage in aggregated demand-side response (all explained below). It should be noted that whilst the primary reason for installing a BtM unit may vary, the benefits provided are not separate to each other, but rather complementary.

The most common form of a BtM unit is a battery energy storage system, or BESS[3], with the primary and most cost-effective technology used at present being that of lithium-ion batteries. Lithium-ion batteries have been widely used for the last 50 years in different applications and are more commonly known for their use in smartphones and electric cars. In addition to their relatively low cost, lithium-ion technologies offer energy density (i.e., they can hold a large amount of energy relative to their size), hold their charge relatively well and can handle hundreds of charging cycles, thus making them an ideal technology to use for energy storage. As the energy storage industry develops we may see the take up of other types of storage technologies for BtM applications. The policy areas explored in this paper can apply to different storage technologies as they mature and potentially see entry into the market.

Level of Investment in Ireland today

There is approximately 692 MW front-of-meter battery storage with an average duration of less than one hour operational on the island of Ireland. ESI's 2022 pipeline survey shows that there is a further 3.5 GW of front-of-meter storage projects with planning permission, with over 1.7 GW of this in the connection offer process to indicate a strong stream of projects coming through the development process.

BtM-explicit statistics are significantly more difficult to come by, given the nature of their connection. BtM is at a nascent stage however, the industry has significant investment potential and projections for its uptake are strong. As more figures are made available in the coming years, ESI will include these in future publications.

[3] NREL - Behind-The-Meter Battery Energy Storage

What Benefits can Behind-the-Meter Storage Offer?

There are several benefits that BtM can offer customers, each of which is discussed below. It should be noted that these advantages are not exclusive to different types of BtM units, and customers can often reap the rewards from different combinations of the benefit streams below.

1. **Energy Cost Savings** – BtM units allow owners to engage in what is known as energy arbitrage, essentially buying energy and charging the battery when the electricity price is low and then later using the stored energy onsite to avoid times of higher electricity prices. Not exclusive to BtM but rather a common benefit of all storage units, this allows consumers to save money on energy bills as it reduces their demand for electricity during peak price hours (also known as 'peak shifting'). The operation of a BtM unit is often made the responsibility of a third-party who will optimize the use of the system over its lifetime for a small fee.

2. **Grid Resilience** – In the event of a fault, BtM units can provide valuable back-up power to consumers through its stored energy. The typical duration of a BtM unit in use in Ireland today is two hours, which means that a consumer would have access to two hours of uninterrupted power even when a power outage in the wider grid occurs. BtM storage also allows commercial customers to use their BESS unit for critical services. Critical services refer to back-up power however the power is only used to serve site equipment that is essential to always remain in operation. Additionally, as uptake in heat pumps and electric vehicle charging of cars, forklifts, and other suitable vehicles increases in the coming years, BtM units can support this transition by providing energy during periods of higher-than-expected demand on the grid and a customer's site.

3. **Export Trading Revenue** – If BtM units have excess energy stored, owners have the option to export this electricity back onto the grid and earn revenue from selling this power, especially during times of peak electricity prices. This is most easily done through an aggregator of BtM units who will optimize this export, again for a small fee, but the opportunity offers customers access to an additional revenue stream as part of their investment.

4. **Demand Side Flexibility** - Demand-side flexibility (also known as demand-side response or management) involves users of electricity having the capability to change their usage from their normal or current consumption patterns.[4] The action taken by the user of electricity (BtM customers included) is done in response to a signal from the electricity grid operator (EirGrid or ESBN in Ireland's and SONI or NIEN in Northern Ireland's case) and helps these state bodies in managing the power system efficiently; including accommodating increased renewable electricity generation and providing enhanced capacity. This need for flexibility is becoming increasingly important as Ireland and Northern Ireland increase the amount of wind and solar energy on its system. For instance, Ireland's Climate Action Plan 2023 outlines the need for 25-30% of Ireland's demand to be 'flexible' by 2030. The key point here is that BtM storage can contribute to a significant proportion of this. With many cases of BtM already situated within a demand-side unit (DSU) on the island, there is massive potential for BtM to play an increased

[4] EirGrid - Demand-Side Management

role in the DSU fleet while also decarbonising existing assets and assisting the transmission system in times of peak demand or system alerts.

5. **Increased Environmental Performance** – On a customer's site, BtM units can displace a fossil-fuel based generator that would otherwise have been purchased to provide similar back-up power services, providing a quick and cost-effective solution to support Ireland's transition toward a net-zero economy. This use of a BtM system in place of a fossil-fuel based generator avoids the release of harmful emissions into the environment and has benefits for local air quality.

6. **Complementarity for renewable generation** - Where a customer has already installed a renewable generation system on their premises, a BtM unit can significantly improve the gain accrued to such system owners. For example, a BtM unit can complement a Solar PV system by storing the energy generated by the solar panels until such a time when the customer needs it and renewable output is lower, potentially at times of higher energy prices. This allows customers to reduce their exposure to peak prices and make more optimal use of the clean energy being generated on their site.

Interactions with National Government Policy

The overarching national targets for Ireland which concern BtM storage are those found in the Climate Action Plan (CAP). CAP 2023 now sets a key target for Demand Side Flexibility of 15%-20% by 2025 increasing to 20%-30% by 2030. The overall plan continues to set out how Ireland can accelerate towards decarbonisation with the accompanying Annex of Actions outlining specific actions required to meet the targets set in the CAP. Some of the key BtM-related actions can be found in Appendix 1 of this paper, along with some notes on how ESI intend to contribute to the delivery of these goals.

Northern Ireland's Energy Strategy Action Plan 2022[5] sets an action for DfE and NIAUR to "Prepare a Northern Ireland Smart Systems and Flexibility Plan" which should consider key issues such as flexibility opportunities and barriers for consumers and networks, as well as digitalisation needs and future markets for flexibility. This will present opportunities for BtM storage and ESI will be engaging with this plan once it is developed.

It should also be noted that the benefits discussed so far are those which directly affect the customer however, there is a further benefit of increased uptake in BtM storage to help achieve national targets that should not go unnoticed, and one that is of national significance. As greater levels of BtM storage are deployed across Ireland, efficient use of such systems can ensure that Ireland's electricity grid is able to handle higher levels of renewable energy and reduce our use of fossil fuels. At times of high renewable penetration, BtM storage units can collectively or individually soak up this energy for use on a customer's site at a later time, or indeed for later re-injection into the electricity grid when there may not be as much renewable generation. Customers benefit from low energy prices by using energy at times of high renewable penetration and may also be able to earn revenue by later exporting and selling power back to the grid. As Ireland moves towards a 2030 target of an 80% renewable energy share in its electricity system, such synergies between renewables and BtM storage can bring significant benefits.

The benefits of BTM Storage are further underpinned by EU publications and regulations and most recently the EU Commission's recommendation that BTM 'can help consumers, both households and industries, to maximise self-consumption of self-produced renewable energy, making it possible for these consumers to reduce their energy bills'[6].

However, in order to fully realise such shared benefits, it is important that the barriers BTM faces today are addressed. These barriers are not all unique to BtM, but rather are indicative of the wider barriers that the storage industry faces in Ireland, and include:

- **Grid Connection Barriers** - As discussed, BtM customers may seek to export excess electricity from their unit back onto the grid and earn revenue from this activity. However, to receive an export license, BtM projects must go through the Enduring Connection Policy (ECP)[7] process which adds lengthy delays to project timelines, as well as added cost. Although the ECP process has been successful to date in providing grid connections for front-of-meter wind, solar and other forms of storage, its rulesets are not suitable for BtM as there is no specific pathway for these units. Allowing BtM units to secure a grid connection export license with

[5] NI Energy Strategy Action Plan 2022
[6] Energy Storage – Underpinning a decarbonised and secure EU energy system
[7] ESB Networks - Enduring Connection Policy (ECP).

less difficulty and even with certain conditions attached would allow for the realization of benefits of BtM units, address capacity issues, and improve the financial viability of projects.

- **Inability to Share MEC** - Maximum Export Capacity, or MEC, refers to the maximum amount of electricity that a generation unit or project can export onto the grid at any given time. Currently, if there are two types of technologies on a site, for example solar and a battery, the MEC assigned to this site cannot be shared across the two technologies. Instead, the solar and battery units are treated as two separate systems and the customer is required to submit two applications for separate MEC licenses which again adds extra costs and time delays to projects. This barrier of hybrid-type connections has long been identified as an issue for Irish policy makers to address and would certainly benefit BtM units that are seeking to complement an existing renewable generation unit on a site.

- **Tariff Structure Issues** - Tariffs are the rates that customers pay suppliers for the electricity that they consume. For BtM units, tariffs are applied at the same rate at which the customer demands electricity for their regular site activities, however a tailored programme would incentivize greater investment across the country. The current absence of a clear and adequate tariff structure has prevented widespread uptake in BtM units, insufficiently rewarded energy arbitrage opportunities, and led to inefficient use of systems.

  To incentivize uptake in BtM storage from an early stage, the feasibility of fixed price import tariffs for BtM units should be studied in greater detail and discussed with suppliers, aggregators, and system operators. Done most effectively through an aggregator, fixed pricing arbitrage essentially fixes a price for all electricity bought and stored in BtM storage systems and can be used as an effective tool in reducing uncertainty around energy savings for potential investors as well as targeting any information asymmetry issues.

- **Existing Market System Limitations** - As things stand, all storage projects are not able to participate fully in the energy market due to limitations in the Transmission Systems Operator's (TSO) market systems. This prevents storage assets from selling the energy they store into the wholesale market and competing with other market participants. These current limitations harm the business case for existing and new storage investments and also mean that consumers cannot avail of this valuable service that storage can provide. Upgrades to TSO market systems are in progress but clear timelines and milestone are needed so industry has certainty that these issues will be resolved.

- **Low-carbon Discounts** – In terms of reducing electricity sector emissions as soon as possible, there are many storage technologies which are already proven and available and could be deployed in the near term. By absorbing grid power during off-peak, low carbon intensity periods and using it during high intensity peak periods, a carbon arbitrage function is served by BtM storage. Deployed at sufficient scale, a meaningful contribution to decarbonisation is achievable. This valuable function should naturally be rewarded however, such low-carbon incentive schemes do not exist in Ireland. One initiative that could be introduced is reduced use-of-system charges (fees that are paid for the transmission of electricity across the grid) to incentivize the demand of electricity during low-carbon intensity times which would better reward BtM storage for acting as an offtake mechanism.

- **Planning** - Considering the multiple benefit streams that BtM can bring, it is crucial that lengthy planning timelines do not restrict the wider rollout of such technologies. Streamlined applications will be necessary to prevent bottlenecks and ensure that BtM can fulfil its potential without delay. One solution to increase uptake in BtM would be to allow for a planning permission exemption for BtM units up to a threshold limit, for example 2MW. Similar solutions have been put in place for the deployment of Solar PV for onsite use.

Appendix 1 – Climate Action Plan 2023 Annex of Actions

Ref.	Description	ESI Contribution
RE/23/11	Stimulate research, development and demonstration projects across industry and enterprise sectors with a focus on accelerating energy decarbonisation e.g., innovative approaches to decarbonising heat and electricity, energy storage solutions, renewable energy and energy efficiency solutions	ESI and GreenTech Skillnet have commissioned KPMG to undertake an assessment of the investment and employment potential in the Irish energy storage sector from the short-term out to the longer-term. Report will be made publicly available
EL/23/22	Publish a policy framework for electricity storage based on electricity system needs	Submitted a lengthy response to the associated public consultation and have engaged further with the relevant state bodies on particular issues
EL/23/23	Review the regulatory treatment of storage including licensing, charging and market incentives	Conducting an internal review of the suitability of network tariffs for storage in Ireland and will aim to present these findings to the state bodies to stimulate discussion around implementing changes
EL/23/24	Complete and publish Electricity Demand Side Strategy and Implementation Plan	To respond with the organization's views when published
EL/23/25	Establish Smart Energy Services Working Group to support consumer participation in energy market and flexible demand management services	Will seek ESI representation on this working group when established to act as the industry voice during discussions