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Tomorrow's Energy Scenarios 2023

Plain English Summary

Introduction

Welcome to the Plain English version of Tomorrow's Energy Scenarios (TES) 2023. This document aims to provide a clear, concise summary of the full Tomorrow's Energy Scenarios report, which explores different scenarios for enabling a cleaner energy system based on renewables.

Meeting the energy demands of tomorrow presents many complex challenges and moving towards a more sustainable future, requires significant transformation, that goes beyond the grid.

In TES, we present what SONI sees as plausible routes for solving these challenges based on in-depth research, investigation, modelling and analysis.

In November 2023, we consulted on the draft TES 2023 which we received comprehensive feedback on from a wide range of stakeholders from across Northern Ireland.

We want to thank everyone who took part and shared their insights. We have since reviewed the feedback and used this to inform the final results of our study for TES 2023.

What are the challenges?

As the transmission system operator for Northern Ireland, SONI has a unique role to play in transforming our power system to meet the needs of today as well as the future. As we continue working towards obtaining 80% of our energy from renewable sources by 2030, we are also working towards meeting the national climate objectives in the run up to 2050.

Meeting government decarbonisation targets, while providing a secure electricity supply will be very challenging and means we will need to redefine the way our energy systems work.

In order to meet the energy demands of tomorrow, we will need to identify solutions that are able to account for aspects such as:

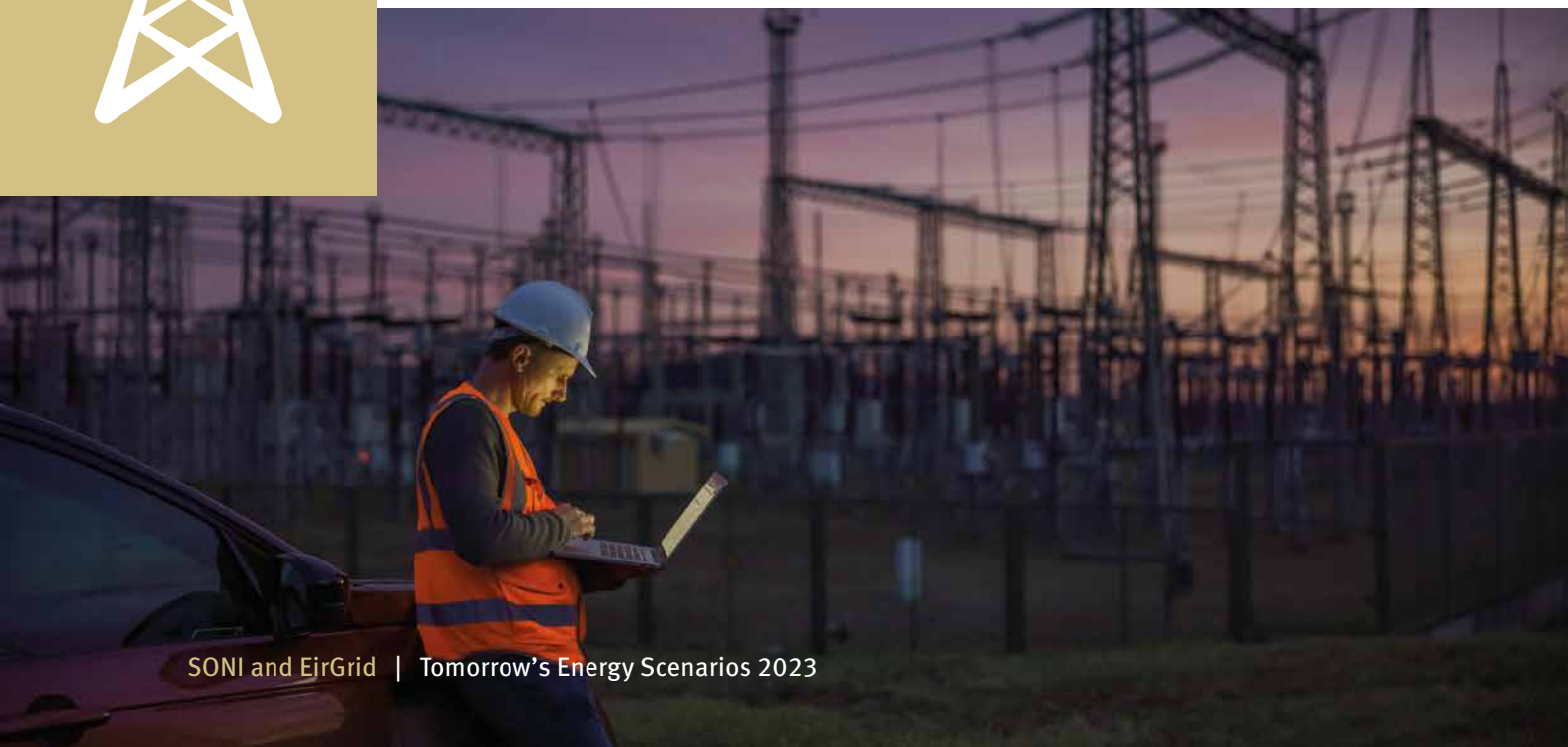
- Increasing demand for electricity – decarbonising means we will need to electrify our energy demands changing the way we travel as well as heat our homes and workplaces.
- Powering our economy by an energy system led by renewables such as wind and solar.
- Building a stronger transmission grid, both onshore and offshore, that can support renewables and increasing demand for electricity.
- Improving our energy security by investing in low-carbon domestic generation capacity.
- Putting in place energy storage and interconnections with other countries to complement our system when renewable generation is lower because of changes in the weather.

How are we planning for the future?

In the energy sector, we are exploring how we best meet society's needs for energy security while taking positive action to help decarbonise our power supply. In 2023, SONI published an update to Shaping Our Electricity Future (SOEF) which was first published in November 2021. SOEF is a detailed roadmap that profiles the work which needs to be carried out to transform network infrastructure planning, public and industry engagement, electricity system operation and electricity markets, to reach the government's 2030 climate targets.

While SOEF specifies the steps we need to take to meet the 2030 targets, Tomorrow's Energy Scenarios 2023 (TES 2023) is a high-level exploration that uses scenario planning to understand how much electricity we might need and how it can be provided, beyond 2030, up to 2050.

We will use the findings in this report to guide our strategic planning of the electricity system, in determining what we need to prioritise to enable a sustainable and secure energy transition for Northern Ireland. They will also enable SONI to continue to support Governments and Regulatory Authorities in the development of energy policy and market design development required to decarbonise the power system.



Our scenarios explained

A key role for SONI is to plan the development of the electricity transmission grid to meet the future needs of society. We use scenario planning to consider a range of possible ways that electricity supply and consumption may change in the future, given the long-term uncertainty over economic and technological developments.

We then consider the common threads across the different scenarios studied, so the grid can be developed to accommodate a variety of possible futures. These common threads make up the key insights, which are detailed below.

Future iterations of Tomorrow's Energy Scenarios will reflect any changes to government policy in Northern Ireland and advances in technology.

How do we identify the scenarios?

To create the scenarios, we've drawn on multiple factors. These include aspects such as government and EU policy as well as our own experience of developing the transmission grid.

The scenarios are deliberately distinct from each other to give us the opportunity to explore a wide variety of approaches at this early stage.

It's likely that the actual route that we take is a combination of the scenarios explored.

How do we model each scenario?

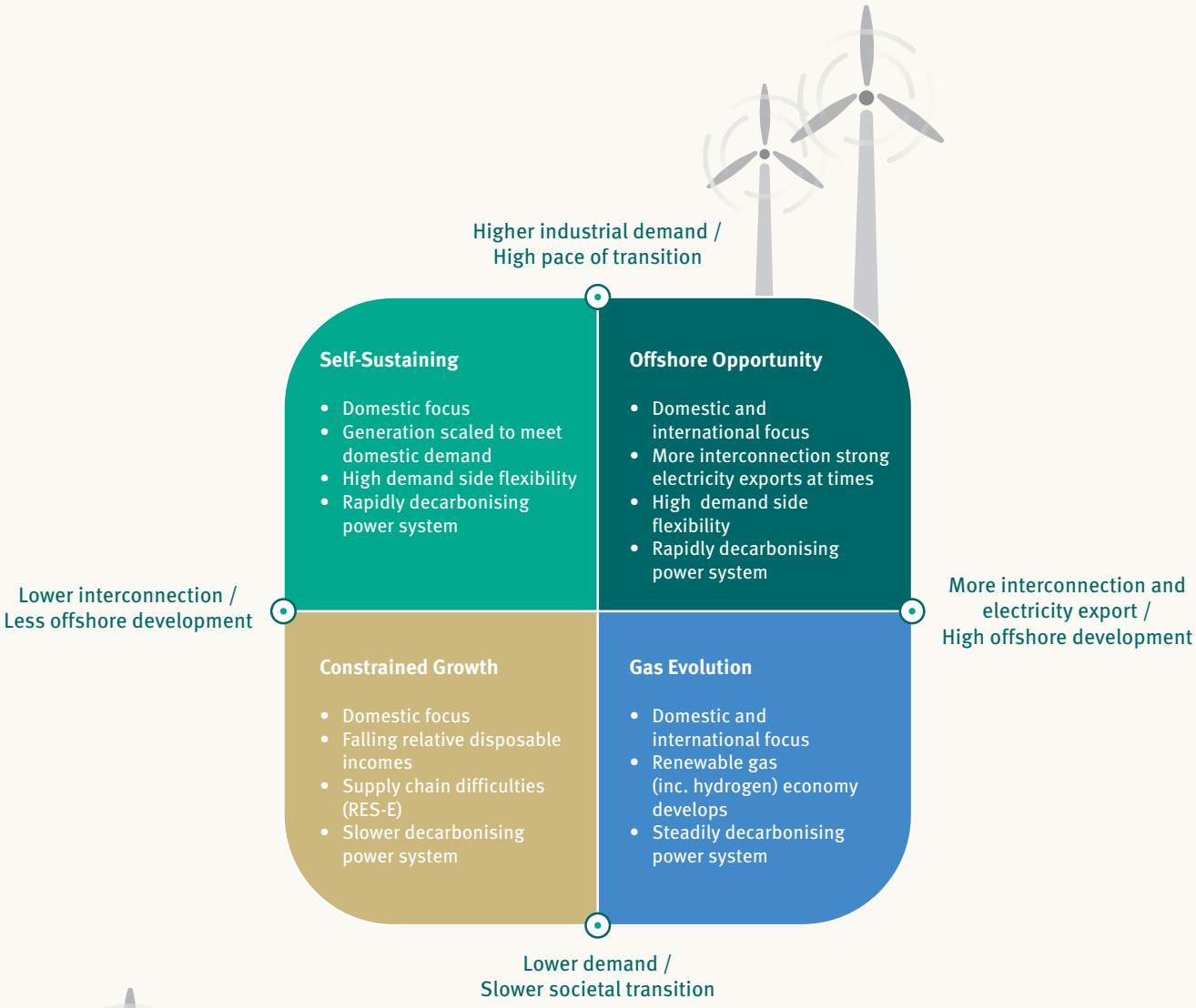
After identifying each scenario, we then needed to explore the direction each scenario might take, depending on a range of variables. The variables that we use to inform our modelling include:

- Changes to electricity demand from society and all sectors of the economy.
- The range of renewable generation technologies that are available.
- Non-carbon emitting generation technologies.
- The role of flexible and renewable fuel-ready, thermal generators in a decarbonised power system.
- Interconnection with other countries enabling both electricity imports and exports.
- The importance of energy storage through batteries and other technologies.
- Ensuring electricity supplies meet demand, even during long periods of cold weather with little or no available wind or solar resource.

The four energy scenarios have been analysed using economic expansion modelling software. The results presented in this report show how our forecasts for electricity demand can best be met in each scenario.

The scenarios

Tomorrow's Energy Scenarios 2023 details four energy scenarios. Each scenario considers a different pathway to decarbonise our power system, the pace of change and how we might achieve the energy transition in terms of energy demand, transmission and generation. They are detailed below:



The four scenarios explained

Self-Sustaining

Self-Sustaining follows a fast-paced transition away from fossil fuels to electrification in all sectors. This scenario is focused on meeting Northern Ireland's domestic electricity needs, increasingly through renewable generation supported by other technologies such as battery storage and carbon capture and storage. Self-Sustaining shows a net zero power system from 2040.

Constrained Growth

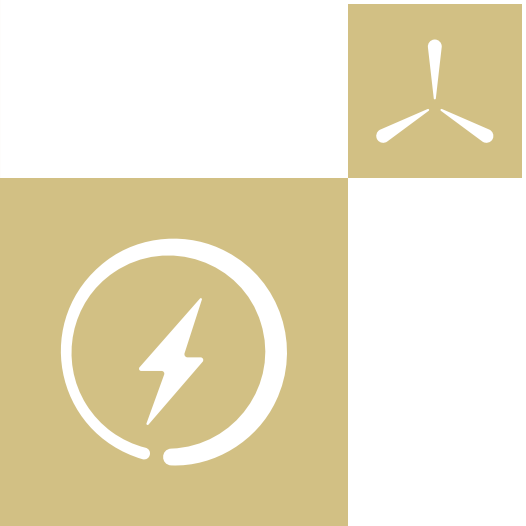
Constrained Growth is the slowest of the four scenarios to decarbonise. This speed in development relates to both the rate of electrification of demand and the development of decarbonised generation capacity. With slower development of renewable generating capacity, it shows greater reliance on electricity imports when domestic supplies are not sufficient to meet demand. Constrained Growth shows a net zero power system from 2050.

Offshore Opportunity

Offshore Opportunity also follows a fast-paced transition to a decarbonised power system. This scenario sees a faster and larger development of offshore wind and results in the power system becoming a significant net electricity exporter through interconnection. Offshore Opportunity also shows a net zero power system from 2040.

Gas Evolution

Gas Evolution follows a steadier pace of energy transition with electrification supported by increasing demand for green hydrogen in some sectors. The scenario includes significant renewable generation capacity to produce both electricity and power electrolysis plants to produce green hydrogen. Gas Evolution shows a net zero power system from 2045.



Key insights

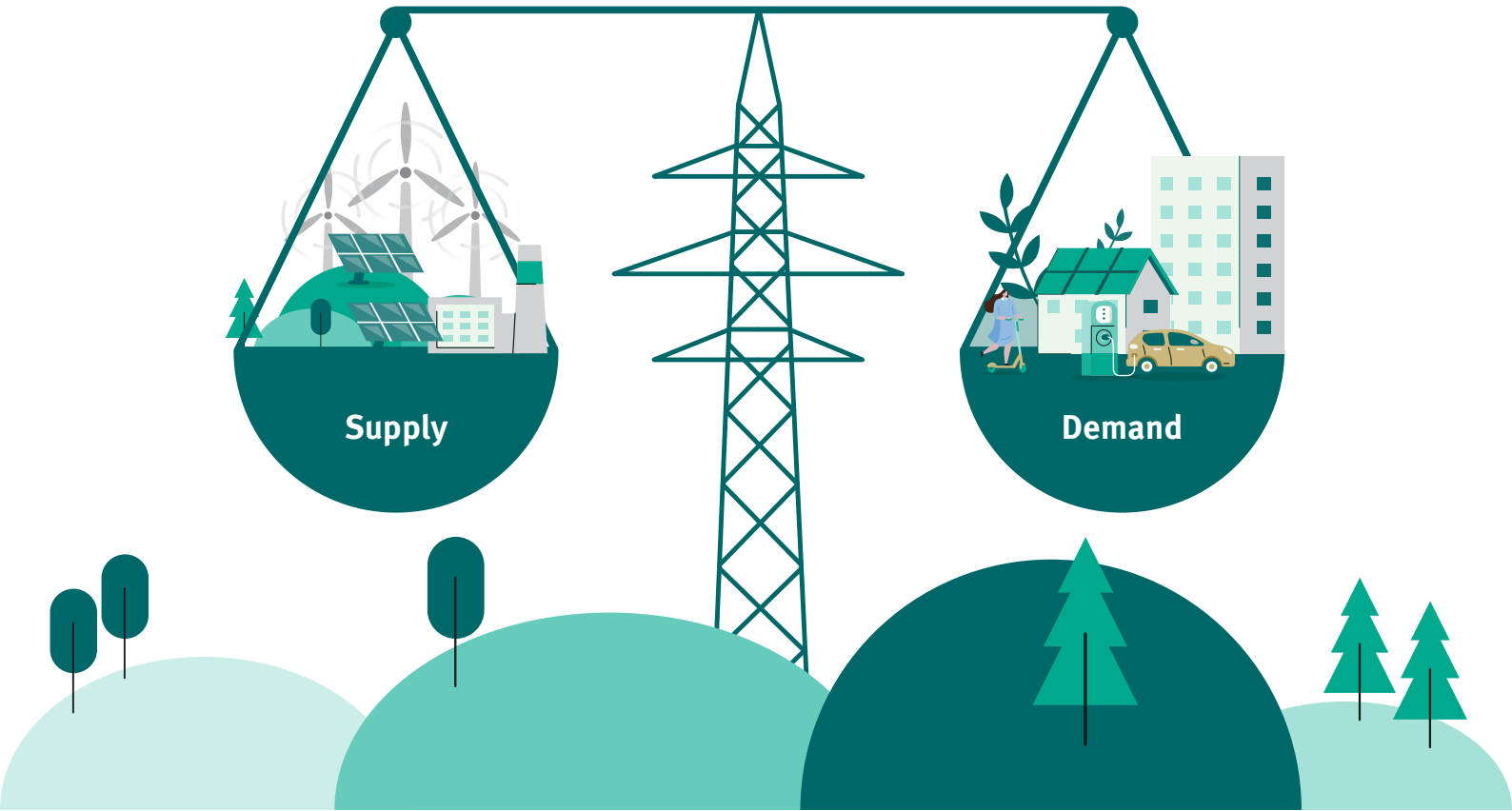
Through in-depth modelling of each scenario, we've identified a set of key insights. These are the consistent outcomes that we have been able to draw from all of our scenarios. We've listed these insights below.

1. TES 2023 analysis shows electricity demand more than doubling by 2050

Electricity demand is forecast to increase significantly due to a growing population and increasing electrification in all sectors of the economy, as per Northern Ireland's Climate Change Act. With electricity increasingly being supplied from renewable sources, this will lead to a reduction in demand for fossil fuels. We also expect to see an overall increase in energy efficiency. However, meeting the increased demand for electricity, will mean we need to significantly develop our power system.

2. There will be an increasing need for efficiency and demand flexibility

In a renewables-dominated power system, demand will need to be sufficiently flexible to account for fluctuations in renewable generation. This means, when there is less energy available from natural sources such as wind or sun, we need ways of managing this, particularly during times of peak demand. Measures to improve energy efficiency and demand flexibility will be vital to help manage peak loads on the power system.



3. Our scenarios show a net zero power system for Northern Ireland being achieved between 2040–2050

Achieving a net zero power system requires significant development of the entire electricity sector. This is because we will need to shift from a grid based around large fossil fuel-powered generators to a system led by renewables located across our island and our seas. Due to the complexities involved for the whole energy system, we expect this transformation to be achieved no earlier than 2040.

4. We will need a balanced portfolio of generation technologies, led by renewables and supported by energy storage, firm dispatchable capacity and interconnection

Decarbonising the electricity system will require:

- A large and rapid rollout of renewable generation capacity, particularly offshore wind as well as utility-scale and domestic solar PV.
- Significant increases in electricity interconnection to continental Europe and Great Britain.
- A massive growth of energy storage capacity, including short, medium and long duration forms of storage.
- The acceleration of green fuels (hydrogen, biomass and biomethane) to offer reliability and flexibility to the power system.
- Negative emissions technologies to capture and store carbon and balance emissions from remaining conventional plants.

5. Renewable fuels, such as green hydrogen, offer an opportunity to reduce dependence on fossil fuel imports and support increasing energy security

As we move away from fossil fuels, green hydrogen has the potential to play an important future role in the power system, especially when supplies from wind and solar are not sufficient to meet electricity demand. Our green hydrogen dispatch modelling shows how we might incorporate green hydrogen – which is relatively new to the power system – via renewable generators, electrolysers (to extract hydrogen from water) and green hydrogen storage.

This is important because our analysis shows that the grid will need renewables to be supported by firm dispatchable low-carbon power generation. This is energy that can help balance electricity supply and demand and can be turned off when it is not required, for example, when there is sufficient wind or sun to meet our energy needs.

6. A whole energy system transition

Following the development of TES 2023, SONI has benefited from significant contributions from a number of key stakeholders across Northern Ireland. Their support has been essential to the quality of the TES 2023 analysis and the insights we are able to draw. Consultation feedback emphasised the need for further strategic planning to consider critical interdependencies across the whole energy system. Future studies provide an opportunity for energy system stakeholders to collaborate in strategic planning for our energy transition.

Summary

Going forward, Tomorrow's Energy Scenarios 2023 provides a solid foundation to inform our planning for the energy transition in Northern Ireland.

We hope you find this report useful, and that our valuable insights can support decision-makers in the development of current and future energy policy.

For SONI, the next stage is our System Needs Assessment (TESNA) which will follow in 2024. We will be using the results from TES 2023 and TESNA to shape our thinking about more detailed planning for the electricity system and what this means across our networks.

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