

# Our Strategy for the Management of Insulation & Interruption Gases

December 2019

About Us

We are Scottish Hydro Electric Transmission (SHE Transmission), part of the SSE Group, responsible for the electricity transmission network in the north of Scotland. We operate under the name of Scottish and Southern Electricity Networks, together with our sister companies, Scottish Hydro Electric Power Distribution (SHEPD) and Southern Electric Power Distribution (SEPD), who operate the lower voltage distribution networks in the north of Scotland and central southern England.

As the Transmission Owner (TO) we maintain and invest in the high voltage 132kV, 275kV and 400kV electricity transmission network in the north of Scotland. Our network consists of underground cables, overhead lines on wooden poles and steel towers, and electricity substations, extending over a quarter of the UK’s land mass crossing some of its most challenging terrain.

We power our communities by providing a safe and reliable supply of electricity. We do this by taking the electricity from generators and transporting it at high voltages over long distances through our transmission network for distribution to homes and businesses in villages, towns and cities.



Figure 1 - Our Existing and Future Infrastructure

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## Introduction

Sulphur Hexafluoride, or SF<sub>6</sub>, is an Insulation & Interruption Gas, or IIG, and is a very good insulating medium and, at all transmission voltages, forms the basis of the circuit breaker arc interruption system. The use of SF<sub>6</sub> circuit breaker technology has replaced other arc interruption techniques such as the use of bulk oil or air blast circuit breaker technologies.

Whilst SF<sub>6</sub> technology is inherently safer and often more reliable compared to other technologies, it has an environmental impact. SF<sub>6</sub> is one of the four greenhouse gases (GHGs) captured under the Kyoto Protocol. It is a colourless, odourless, non-toxic and non-flammable GHG. However, with a global warming potential (GWP) of c. 23,500 times that of carbon dioxide when leaked to the atmosphere, it is one of the more potent GHGs<sup>1</sup>.

We have a number of obligations with regards to SF<sub>6</sub>, including the obligation to accurately record and report figures for SF<sub>6</sub> leakage. We have set ourselves an ambitious target of reducing our GHG emissions by one-third by the end of RIIO-T2 and our ambitious SF<sub>6</sub> emissions target will play a key part in this. This is in line with the findings of the Committee on Climate Change's

2018 Progress Report and 2019 Net Zero Report<sup>2</sup>. For more information, please see our [Sustainability Strategy](#).

During RIIO-T1 we significantly improved our performance in relation to SF<sub>6</sub> leakages, this step change was made possible through trialling new innovative solutions and engaging with our supply chain by using our network as a test-bed for new solutions; these new solutions are now being implemented as standard in RIIO-T2 displacing almost 20 tonnes of SF<sub>6</sub>. Trialling innovative solutions, such as new IIGs, and engaging with our supply chain, will become part of our business as usual practices during RIIO-T2 to drive further reductions. Despite our projected network growth during RIIO-T2 and in turn the amount of SF<sub>6</sub> on our network (under the [Certain View](#)), we remain committed to improving our SF<sub>6</sub> performance.

**During RIIO-T2 we will continuously improve each stage of our whole asset life cycle to remove SF<sub>6</sub> from our network where it is viable to do so. Even with more SF<sub>6</sub> on our network by the end of RIIO-T2 our ambitious target is to have a leakage rate of 0.15%, with a longer-term ambition of removing SF<sub>6</sub> completely by 2050.**

**This paper outlines our approach to minimise the level of IIG emissions and minimise our overall SF<sub>6</sub> holdings as part of our Business Plan, and is structured as follows:**

- **RIIO-T1 Performance** – our performance over the RIIO-T1 price control, our levels of SF<sub>6</sub> emissions and what action we have taken to reduce these.
- **SF<sub>6</sub> and the Energy Industry** – external influences in this area and how we have risen to the challenges involved.
- **Stakeholder Engagement** – an overview of engagement on SF<sub>6</sub>.
- **Our Strategy** – how we will achieve our planned leakage reduction, the deployment of alternative technologies and our whole lifecycle management of these assets.
- **Reporting Emissions** – this will cover our proposals for how we report our holdings of IIGs and annual emissions, ensuring consistency across the different IIG categories.
- **Setting our Targets** – our ambitious targets for RIIO-T2 and beyond.
- **How will we measure success?** – this section outlines our Key Performance Indicators (KPIs) for our SF<sub>6</sub> figures, as well as our annual leakage as laid out in our [Sustainability Action Plan for RIIO-T2](#).

<sup>1</sup> Recording and reporting the management of SF<sub>6</sub> is controlled by the Fluorinated Greenhouse Gases Regulations 2009.

<sup>2</sup> <https://www.theccc.org.uk/publication/assessment-of-potential-to-reduce-uk-f-gas-emissions-ricardo-and-gluckman-consulting/>

## RIIO-T1 performance

In RIIO-T1 our methodology for measuring leakage was as follows:

$$\begin{array}{rcl}
 \text{Actual Leakage (what mass of SF}_6 \text{ has had to be replaced due to leakage)} & & \\
 + & & \\
 \text{Calculated Leakage (Based on the manufacturers' stated annual leakage rates)} & & \\
 = & & \\
 \text{Total Leakage} & & 
 \end{array}$$

As we are currently focussed on reporting leakage on an annual basis, this is a viable option, as it ensures coverage of all leakage within the year, even where that leakage may not have instigated SF<sub>6</sub> replenishment. However, over the whole life of the asset, this is likely to mean that, for assets which leak, SF<sub>6</sub> leakage is over-recorded. For RIIO-T2, to improve our focus on whole-life asset management, we will amend our methodology, so we are counting actual leakage only. This will better reflect actual performance and will provide a measure in which we can continuously improve. As such, all emissions in this paper are based on actual leakage only<sup>3</sup>.

**Our leakage, both overall and as a percentage of our asset base, has fallen over the course of the T1 price control. These significant performance improvements have been achieved through improved and innovative operational practices, as discussed later in this paper.**

This is best demonstrated when leakage is viewed as a percentage of the asset base, as shown in Figure 2. Leakage, which was 1.01% of our asset base in 2013/14, has been significantly reduced to 0.21% in 2018/19 (current year). Our lowest leakage was 0.14% in 2017/18.

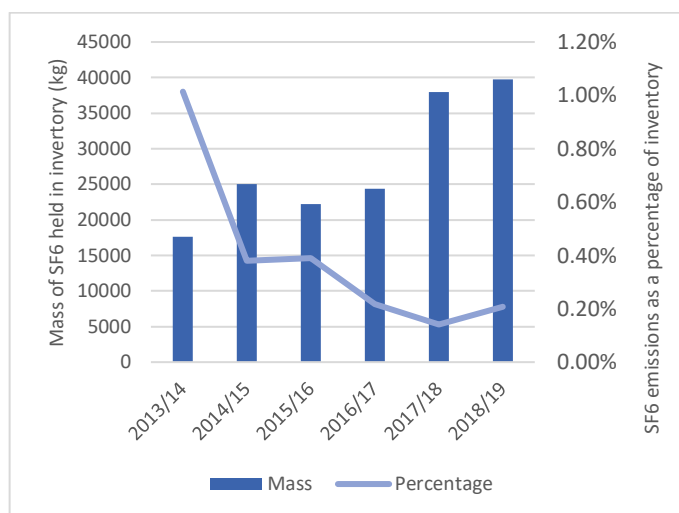


Figure 2 - Leakage against total mass (%)

The step change in operational practices resulted in a steep reduction to our leakage rate over RIIO-T1. For example, when an SF<sub>6</sub> leak has been identified, the source

of leakage is pinpointed using FLIR GF306 infrared cameras. Repairs are then made as soon as practical once a leak has been identified in order to minimise further emissions of SF<sub>6</sub>. The timescale for rectification has improved over RIIO-T1 as part of our operational efficiency planning.

We have also trialled the use of Oxifree, a thermoplastic coating for the protection of metallic components. The trial consisted of applying the coating to leaking assets to temporarily stop the leak and defer the need for capital investment. Whilst the product did work in some cases, immediate intervention to repair the leak was more successful as it resulted in fewer repeat interventions than the Oxifree coating. Therefore, the trial was discontinued.

We expect that as we implement these operational improvements into business as usual further operational improvements are unlikely to offer the same step change in performance.

However, we are committed to a continued reduction in SF<sub>6</sub> leakage. We will, therefore, focus on all areas of the asset lifecycle to achieve reductions. Please see the “Our Strategy” section of this document for more information.

<sup>3</sup> Please note that during RIIO T1 our performance was based on the existing methodology of actual leakage plus projected leakage



# SF<sub>6</sub> and the Energy Industry

## Our Strategic Objective

Since 2010, encompassing the current price control period, our strategic objective has been to enable the transition to the low carbon economy. We believe we have been successful in achieving this objective by working closely with customers and communities and, where cost-effective, using new technologies, deploying new ways of working and instigating industry change. However, the ongoing changes in the energy sector have motivated us to review our objective to ensure it is consistent with the requirements for the transition to low carbon economy for now and in the future. We also wanted to understand if customers’ expectations from the energy networks were changing and, if so, what customers thought we should be focused on.

The outcome of this review has made us reconsider our strategic objective and update it to reflect customers’ views. It now has four themes, as shown in Figure 3.

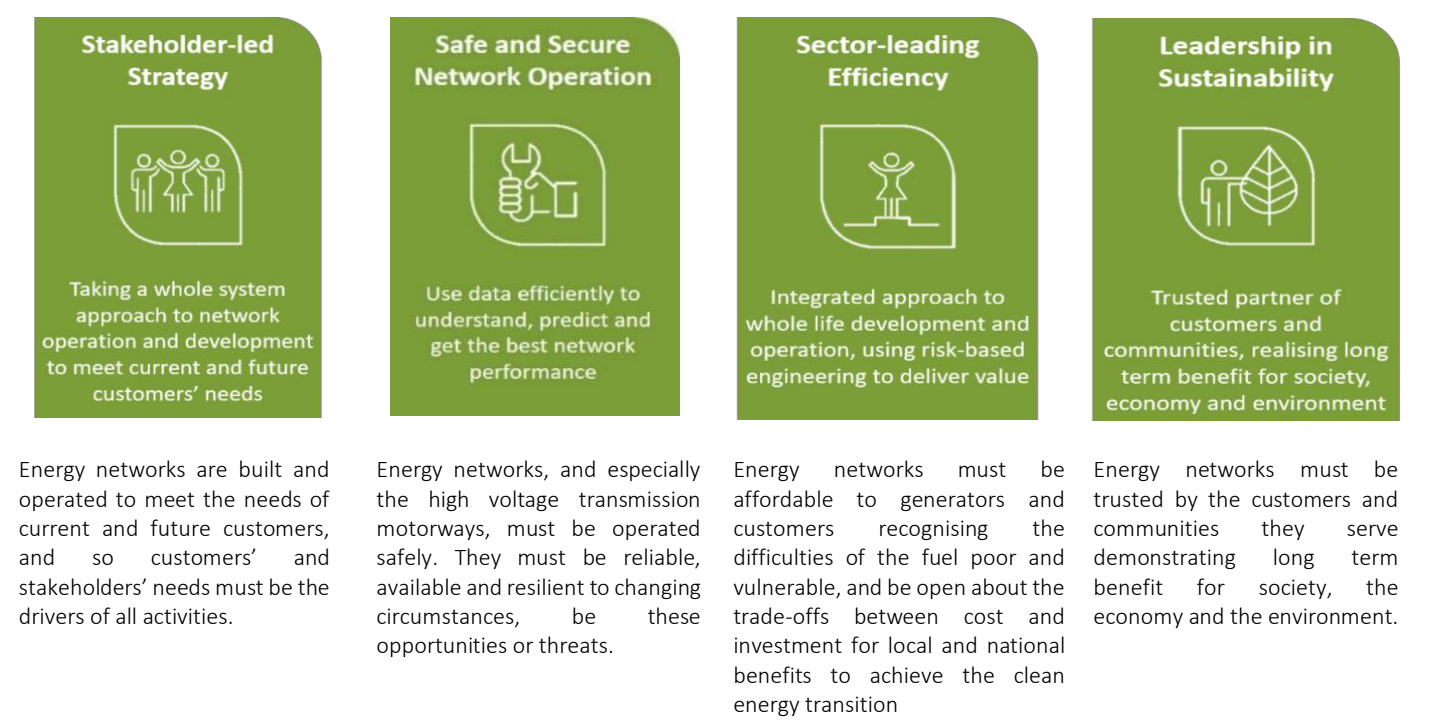


Figure 3 - Our Strategic Themes

We have also developed five goals, based on these four themes that we will target for RIIO-T2. There is a clear line of sight between our Strategic Objective and these five goals, as shown in Figure 4. Given the large Greenhouse Warming Potential (GWP) of SF<sub>6</sub>, its management clearly falls under the “Leadership in Sustainability” workstream, and the reduction in leakage will be a significant contributor towards achieving our Science-Based Target of a one-third reduction in Greenhouse Gases by the end

of RIIO-T2. Our holistic stakeholder-led Sustainability Strategy provides a clear vision of a sustainable business. We have set ourselves ambitious targets to deliver this vision and be at the forefront of best practice. In our Business Plan we set out our proposed actions to deliver a net-zero transmission network into the next price control and beyond. Actions detailed in this document will be included in our [Sustainability Action Plan](#).

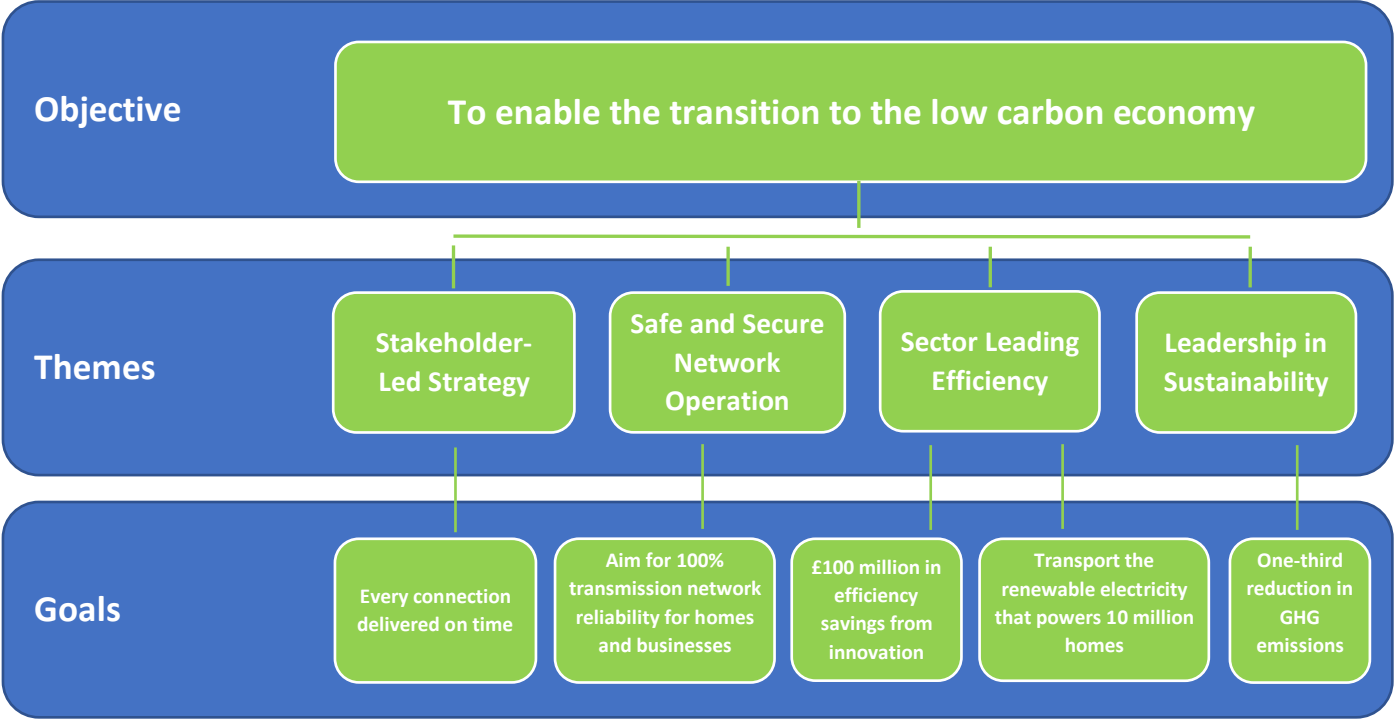
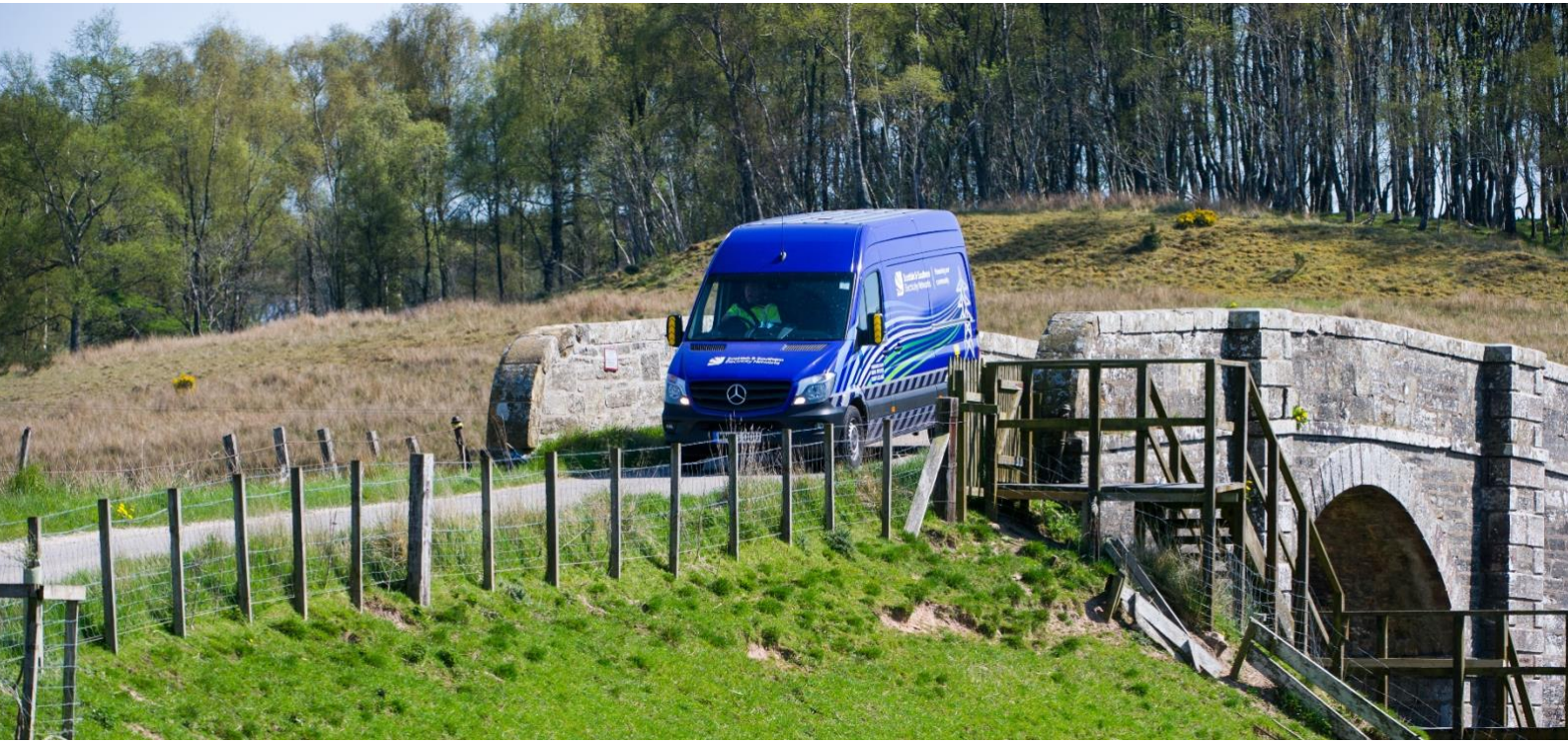


Figure 4 - Our Objectives, Themes and Goals for RIIO-T2



## Dunbeath Switchgear Replacement

We were first in the UK to install SF<sub>6</sub> gas-free circuit breakers at a transmission voltage. The technology has been developed by Siemens, using a combination of vacuum and clean air technology to provide the same level of performance and reliability, without the need for SF<sub>6</sub> gas and with no Global Warming Potential (GWP). Not only are we reducing the environmental impact on our own network but by undertaking this trial using our network as a testbed, and evaluating their viability, we are demonstrating to the wider transmission industry that there is a viable alternative to SF<sub>6</sub>.



## SF<sub>6</sub> in the Electricity Industry

In the wider industry, the general direction of travel is away from the use of SF<sub>6</sub>. The regulation surrounding the use of SF<sub>6</sub> is increasing due to its environmental impact. The EU F-gas regulations in 2006 and 2015<sup>4</sup> have strengthened the restriction of SF<sub>6</sub> usage. Further revision of the regulations in 2020 and 2022 will assess new technologies on the market and whether it is possible to further restrict SF<sub>6</sub> usage.

Our SF<sub>6</sub> asset base will continue to grow during RIIO-T2 due to the growth of our network under the Certain View and the readiness of technologies available to us. However, we are committed to managing the levels of leakage from these assets and undertake to reduce our leakage to 0.15% by the end of RIIO-T2. This is approximately of 3,468 tonnes of carbon dioxide, which is **equivalent to the carbon footprint of the UK for just four minutes**<sup>5</sup>.

Given this commitment it is vital that we seek new alternatives through collaboration with manufacturers. As discussed in our [Innovation Policy](#), we are making progress in the identification and implementation of alternatives for SF<sub>6</sub> gas.

We have led the way in Great Britain, collaborating with several manufacturers and are currently in trial stages for two new IIGs. These projects have progressed **without** innovation mechanism funding, demonstrating our willingness to engage with contractors and suppliers to use our network as a testbed for innovative solutions where there are clear environmental benefits.

**We have led on this during the course of RIIO-T1 and will continue to stimulate and drive innovation and cross-sector working in this area throughout RIIO-T2 and beyond, seeking to ensure that there are viable alternatives to SF<sub>6</sub> available.**

<sup>4</sup> The Fluorinated Greenhouse Gases Regulations 2015 (& Amendments)

[http://www.legislation.gov.uk/uksi/2015/310/pdfs/uksi\\_20150310\\_en.pdf](http://www.legislation.gov.uk/uksi/2015/310/pdfs/uksi_20150310_en.pdf)

<sup>5</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/790086/2018-provisional-emissions-statistics-one-page-summary.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790086/2018-provisional-emissions-statistics-one-page-summary.pdf)



## Stakeholder Feedback



As laid out in our Stakeholder Engagement Strategy, we engage with our stakeholders to effectively understand and include the needs of our stakeholders in our current network planning, development and operations, and in planning for a decarbonised future. We want to be at the forefront of stakeholder engagement by increasing our insights, working collaboratively through partnerships and taking action to achieve real benefits for our stakeholders and society.

Our stakeholders, including our shareholders, want us to take ambitious action on climate change and reduce our emissions following best practice in climate science through the Science Based Target (SBT) initiative. At the

outset of developing our Sustainability Strategy, stakeholders highlighted the importance of reducing our own carbon emissions in-line with climate science and adopting an absolute reduction approach to setting our target.

During our RIIO-T2 stakeholder engagement events, stakeholders have continued to encourage us to reduce our carbon emissions. During our [November 2018 stakeholder workshop](#), it was recommended that we should also place emphasis on reducing our Scope 3 (supply chain) greenhouse gas emissions alongside our scope 1 and 2 emissions. In addition, we have received feedback that we should consider the use of electric vehicles in our fleet to reduce emissions. Most recently our supply chain responded positively to our sustainability questionnaire in support of reducing our scope 3 emissions and the majority were supportive of setting their own science-based target to complement our goal.

During the consultation on our [Sustainability Strategy](#) and [RIIO-T2 Emerging Thinking Paper](#), stakeholders also told us that we need to adapt to the consequences of climate change as the Met Office recently published detailed analysis that indicates there will be further and significant climatic changes this century. We have since included climate resilience planning within our RIIO-T2 plans.

On 5 March 2019, we hosted a stakeholder workshop, aimed at gathering feedback from our stakeholders on our approach to network resilience and reliability for the RIIO-T2 plan.

We have been commended by our stakeholders on our Draft Business Plan and the inclusion of our ambitious carbon target that is in line with an independent science-based target and does not include offsetting of emissions. Our ambition is therefore to reduce our greenhouse gas emissions to facilitate the necessary level of decarbonisation critical to limit rising global temperatures by 1.5 degrees Celsius and become a climate resilient business.





Stakeholders were keen that we used alternative solutions to SF<sub>6</sub>, even at considerable cost. Whilst it was acknowledged that the gas was very good at what it does, it was felt that its impact on the environment, as a gas 23,500 times more potent than CO<sub>2</sub> which stays in the atmosphere for over 3,200 years, meant that it should be avoided and replaced wherever possible. It was, however, commented by some that Government policy should dictate the company's approach and that we should therefore seek to use the most cost-effective option.

Given the cost implications, stakeholders were keen to discuss the pros and cons of the alternatives to SF<sub>6</sub>, along with their viability and impact on the environment. It was widely felt that if these alternatives were better for the environment, equally as reliable and not prohibitively expensive, they should be used wherever possible. For more information on Stakeholder feedback, please see our [Operations Stakeholder Workshop Report](#).

#### Feedback from our Draft Business Plan

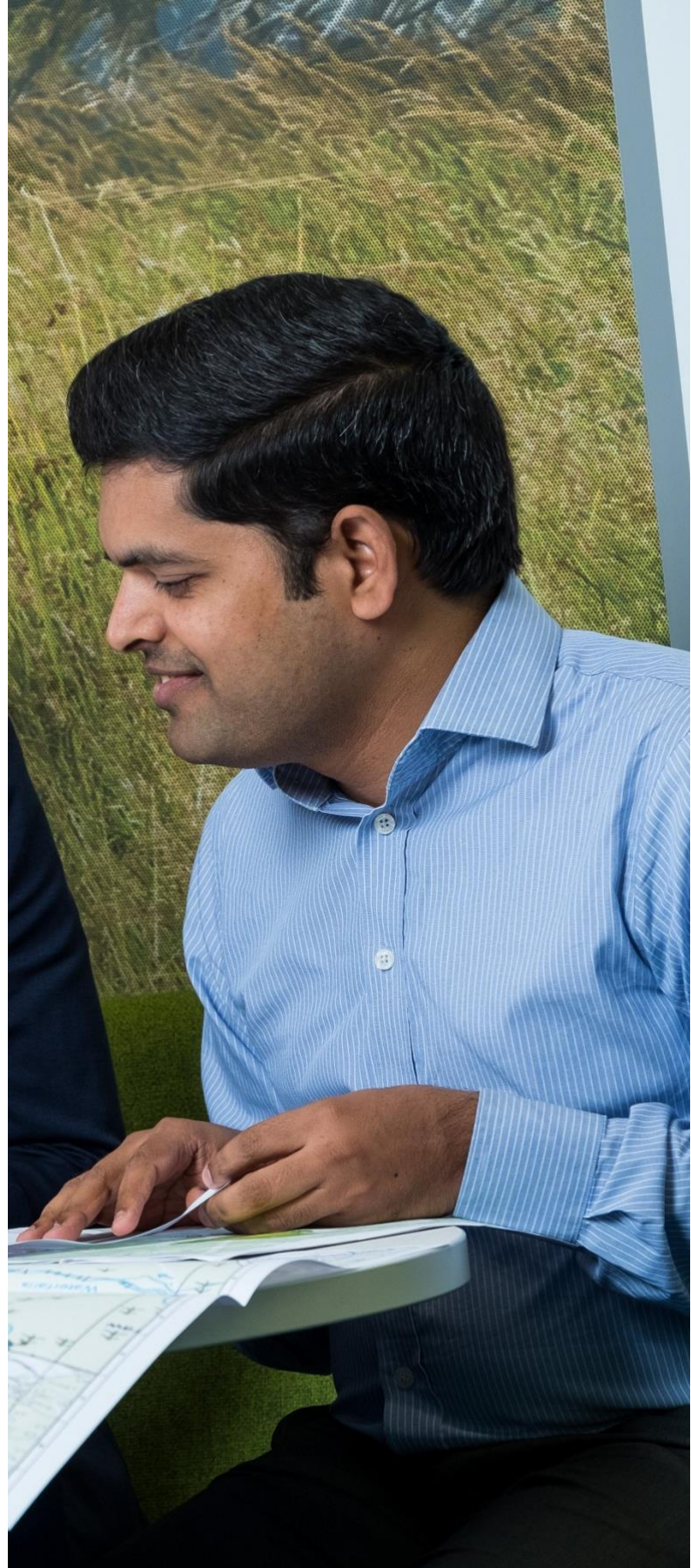


"We strongly support SSEN Transmission's commitment to show ambition and leadership in sustainability. We hope that this commitment will also encourage other businesses to adopt a similar approach"

"We welcome the strong commitments made in the plan to tackling climate change"



"We are supportive of SSEN's ambition to deliver 33% reductions of GHG emissions in the T2 period. We agree with the approach that this is in line with an independent science-based target. We also like that the ambition does not include offsetting of emissions."



"There's a parallel with plastics. In the 70s and 80s everything was plastic, and they said it was better because we weren't burning wood, but now we know plastics are harmful"

## Engagement with Industry Stakeholders

### ENA

We are represented at the ENA Switchgear Assessment Panel which assesses new equipment against ENA and other standards on behalf of UK Network Operators.

We are currently sponsoring the assessment of the Siemens 3AV1 Blue SF<sub>6</sub> free live tank 132kV CB in partnership with Scottish Power. This means our teams carry out the assessment and feed back findings to the ENA assessment panel. We are also actively supporting the assessment of the GE F35-4g SF<sub>6</sub> free 132kV GIS through this forum.

### Health and Safety Executive

One of the issues highlighted during the ENA assessments is the need for non-SF<sub>6</sub> switchgear to comply with the Pressure System Safety Regulations. These regulations cover safety requirements for any vessel which contains gas under pressure. Switchgear containing SF<sub>6</sub> currently has a generic exemption from the Pressure System Safety Regulations. The HSE are responsible for these regulations and they have confirmed they are open to consideration of exemptions from the regulations for alternative IIGs. We are now working with other Transmission Owners to make a case for exemptions.

### Supply chain

We have had several engagements with our supply chain including: GE, Siemens and ABB.

This has included bilateral discussions which have focussed on the technical capability of SF<sub>6</sub> alternatives, in particular where performance differs from SF<sub>6</sub>. This allows us to understand any limitations which might limit use on our network.

These discussions have also been useful in understanding the development timelines for new products from each supplier and the challenges they face.

A key opportunity has been the ability to provide our perspective on our requirements, giving the supply chain confidence that we are serious about using non SF<sub>6</sub> products. It has also helped steer each supplier's developments and prioritise the products we need. In particular this has led to suppliers considering incremental development of non SF<sub>6</sub> gas insulated busbar (GIB) and non-switching components ahead of fully SF<sub>6</sub> free GIS.

## Fort Augustus/New Deer

Our forthcoming projects at Fort Augustus, Inverness-shire, and New Deer in Aberdeenshire will see the installation of GE's gas-insulated switchgear and busbars utilising g<sup>3</sup> gas in place of SF<sub>6</sub>. We have undertaken the risk of installing this new technology on our network. With g<sup>3</sup> gas insulated busbars (GIB) measuring over 1km, the New Deer site will see the world's largest volume of the gas installed at one location. The Fort Augustus substation expansion will be the first transmission site in the country to have a fully g<sup>3</sup> insulated substation and also a significant length of g<sup>3</sup>-insulated GIB. Across these two substations, we will avoid the installation of the equivalent of 200,000 tonnes of CO<sub>2</sub>.





## Our Strategy

Given the environmental impact of SF<sub>6</sub> leakage and, supported by our Stakeholders, we have made the determination that, where it is technically and commercially viable, we will no longer install assets containing SF<sub>6</sub>.

### Lifecycle Management

As with all aspects of what we do, our Strategy is formed around Whole Lifecycle Management. The whole lifecycle for these assets is shown in Figure 5.

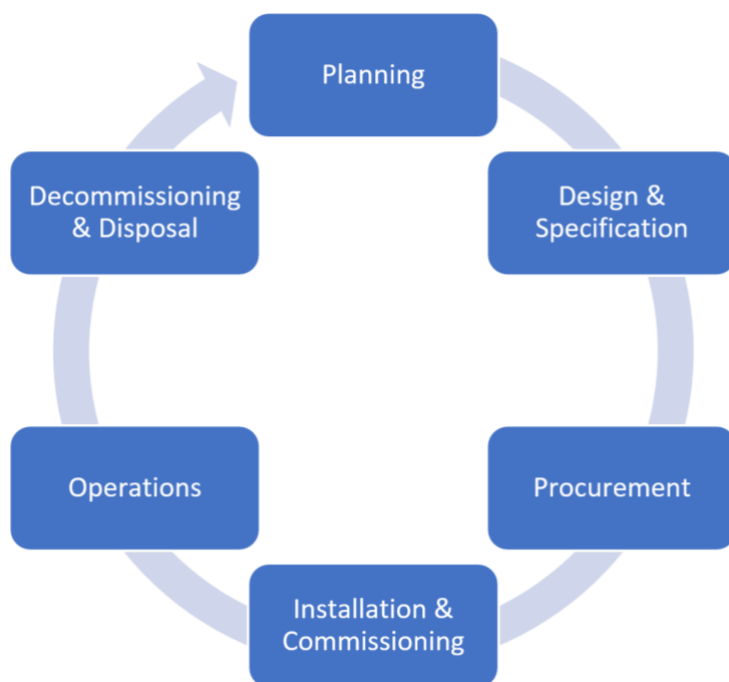


Figure 5 - Whole Lifecycle Management

We have examined this lifecycle to determine how we can improve our existing business practices to contribute to leakage reductions and/or reductions in our holdings of SF<sub>6</sub>. As stated, we will not install SF<sub>6</sub> where there is a viable alternative. In order to achieve this, we need to make some changes to the way we do things.





We have determined that the key areas for improvement are:

### Planning

The planning stage is the beginning of our asset lifecycle, where we identify which assets need intervention and when.

When we proactively plan to replace our assets, sometimes many years ahead, we take account of their leakage rate and past performance when we prioritise intervention. **We will enhance our ability to gather, analyse and interpret data from assets containing IIGs to enhance our asset knowledge and intervene ahead of significant leakage materialising.** We will install monitoring on existing assets to gather data on these assets. This data will then be analysed to enable us to determine when assets begin to leak so we can react quicker and plan large scale interventions early.

### Design & Specification

Historically, SF<sub>6</sub> equipment has often been the only option when installing new or replacement equipment due to the benefits in relation to safety and efficiency. However, given the environmental impacts this can no longer be our primary insulation solution during RIIO-T2, and alternatives should be assessed depending on the voltage level requirement. Our network primarily operates at three different voltages and technological readiness is different at all three levels:

- **132kV and below** – This makes up the bulk of our circuit breaker fleet, approximately 75%. There are several alternative options available at this voltage, including the two new IIGs we are currently trialling, Siemens' clean air and GE's g<sup>3</sup>.
- **275kV** – This makes up approximately 22% of our circuit breaker asset fleet. There are currently no alternative technologies at this voltage.
- **400kV** – This makes up just 3% of our circuit breaker fleet. There is an alternative for GIB at this voltage which we have undertaken to trial at New Deer and Fort Augustus (see page 9).

Following our successful trials during RIIO-T1 **we will ensure that SF<sub>6</sub> becomes the option of last resort during the design and specification stage.** To achieve this, revisions to our specifications are underway stating no IIG (including SF<sub>6</sub>) with a GWP greater than 500 can be installed on our network. Any new installation of SF<sub>6</sub> will be on an exceptional basis and will require Design Authority approval for a deviation from our standard Specification.

**We continue to work closely with manufacturers to develop and test alternative IIGs.** However, this is not a quick process and our current alternatives are limited. From discussions with industry, we anticipate that technological alternatives will not be widely available until after RIIO-T2, though **we will engage with manufacturers to bring this date forward if possible.** When new technologies do become available, we will assess their suitability and deploy where viable.

We will also continue to proactively engage with manufacturers and the wider industry to encourage development of new technologies to speed up the technology readiness of options. This engagement will include:

- Issuing requests for information;
- Bi-lateral discussions with manufacturers;
- Sharing information; and
- Providing feedback on manufacturers' R&D timescales.

We will continue to update our internal standards and specifications to ensure that all new SF<sub>6</sub> or other IIG-filled equipment is fitted with monitoring systems that allow proactive trending of IIG pressures.

### Procurement

We are in the process of developing new procurement strategies with various supply chains (including OEMs & construction integrators) for supply of plant required during the RIIO-T2 period. **These discussions will include contractual provision to help incentivise the supply chain to provide more accurate leakage specifications and prioritise leakage rates in the manufacturing process.** For example, monies may be withheld from awarded contractors should equipment leak more gas within the warranty period than stated in their specifications (usually 0.5% per year). Withheld monies will be equivalent to the carbon cost of gas leaked, and these monies will be spent reducing our carbon footprint.

### Installation & Commissioning

When we install new assets on our network, they can be subject to “early-life failures”, meaning that we can see high leakage in the months after they are installed. We will undertake targeted inspections on new assets to attempt to identify these leaks at an early stage. New assets will also be fitted with real-time monitoring to allow us to analyse performance trends.

### Operations

The improvements made to date mean that there is little further change to be employed that would contribute a significant reduction in our leakage. Therefore, whilst continuing with our new practices, we will also deploy a more targeted approach. **This targeted approach will involve a risk-based approach to inspections, identifying plant with increasing leakage trends and applying enhanced visual and SF<sub>6</sub> camera inspections.**

### Decommissioning & Disposal

At the end of service life, the SF<sub>6</sub> gas in the equipment is recycled for reuse if at all possible. The gas will be analysed to establish if it is suitable for recycling. If the gas quality has deteriorated to a point where recycling is not possible, then, it is destroyed at a licensed, high-temperature incineration plant.

Whilst we record the decommissioning and disposal of assets containing SF<sub>6</sub>, they are not currently included in our leakage rates. We would welcome industry-wide research in this area, focussed on the environmental impact of the incineration of SF<sub>6</sub>.

### Continual Improvement

As responsible asset managers, we are continually seeking to improve how we do things and will continue to identify new areas for improvement. In order to promote best practice, we will share any improvements in our annual reporting.

Reporting Emissions

Information on all our IIGs will be reported on an annual basis, both to Ofgem and wider stakeholders, as part of the SSE group’s corporate carbon emission reporting and our Transmission annual Environmental report. We will manage the reporting of all IIGs in the same manner, as outlined in

Figure 6.

Any leakage from assets containing IIGs will be captured in our Asset Database, Maximo. On a regular basis, we will examine this data to determine any increasing leakage

trends or other information which might influence our future asset intervention plans.

A key piece of information for reporting this information is the Global Warming Potential, or GWP. This is a figure which describes how damaging to the environment an IIG is compared to CO<sub>2</sub>. For example, SF<sub>6</sub> has a GWP of 23,500. New IIGs we are trialling have much smaller IIGs, with one having a GWP of zero.

To ensure that we are reporting on a consistent basis, we therefore need to convert our IIG leakage to a comparative value, that is, its equivalent in CO<sub>2</sub>. Once that conversion has been completed, we can compare this to our target, which will also be expressed in this fashion.

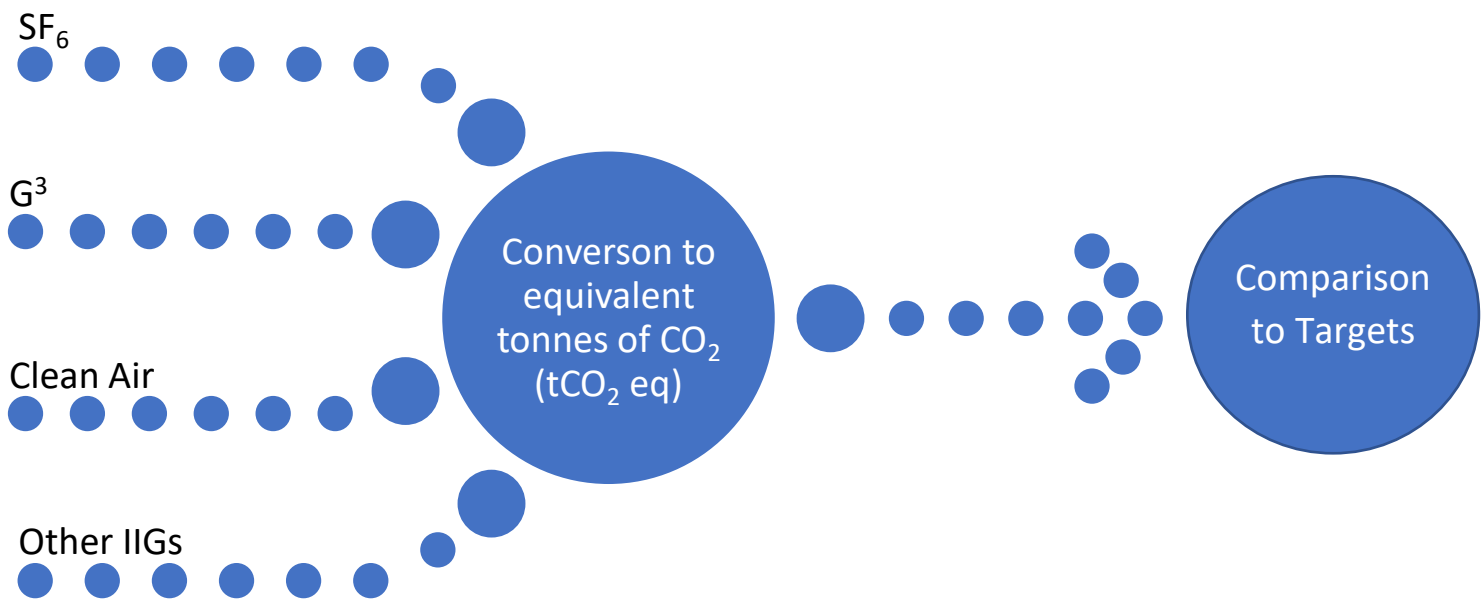


Figure 6 - IIG Reporting



## Setting Our Targets

During the development of our Business Plan, Ofgem will set us a target for IIG leakage in the RIIO-T2 period as part of our regulatory settlement; however, as a business we have a clear goal to achieve one third reduction in greenhouse gas emissions by the end of the RIIO-T2 period and targets associated with IIGs will significantly contribute towards this.

## RIIO-T2 Projects

Our network is forecast to grow in RIIO-T2 under our Certain View (and in any other feasible scenario we set out in our Net Zero Paper), which will entail the addition of new SF<sub>6</sub>-filled assets on our network. However, we have reviewed our plans for the RIIO-T2 period and determined that we can significantly reduce the amount of SF<sub>6</sub> we need to add to our holdings in the period and beyond, [based on the assumption that technology develops as we expect](#).

## Leakage Rates

The benefits of the improvements we have already made can be seen in the reduction in our leakage rates. Between 2016/17 and 2018/19, we saw an average leakage rate of 0.19%. We are aiming to reduce further, ending RIIO-T2 with a leakage rate of 0.15%. This ambitious leakage rate target exceeds our performance in RIIO-T1 despite the actual mass of IIGs on our network increasing. We know that this is a very challenging target, but we believe that this challenge will drive us to continue to be industry leading in this area.

As stated, our levels of IIG leakage are very low<sup>6</sup>. Over the course of RIIO-T1 to date, we have reduced our leakage by an average of 18% per annum. We do not believe we can continue to reduce our leakage at this rate given the significant improvements we have made during RIIO-T1. Despite our network's growth during RIIO-T2 we will continue to drive improvements in this area, through continuously improving our whole asset life cycle.

We have identified several projects within the RIIO-T2 Certain View where we intend to install alternative IIGs, which we trialled during RIIO-T1. Cost Benefit Analysis has shown that, despite an increase in the cost of the asset, alternative IIGs are the preferred option. These projects will remove the need to install 19.9 tonnes of SF<sub>6</sub> on the network, meaning that it will also remove the need to manufacture that much SF<sub>6</sub>, and remove the risk of it leaking to the atmosphere.

As mentioned in the previous section, we can sometimes see high leakages on new assets when they're first installed and commissioned on the network. Whilst we will look to address this through inspections and remote monitoring, this still presents a risk and will impact on our overall leakage rates. We have taken this into account when setting our internal targets and projected that leakage rates will likely increase during the 2023/24 and 2024/25 period due to the increase in new assets and, in turn, IIGs in these years before decreasing in 2025/26, as shown in Figure 7.

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<sup>6</sup> Note this is limited to SF<sub>6</sub> leakage; there have been no leaks of any other IIGs at the time of writing.

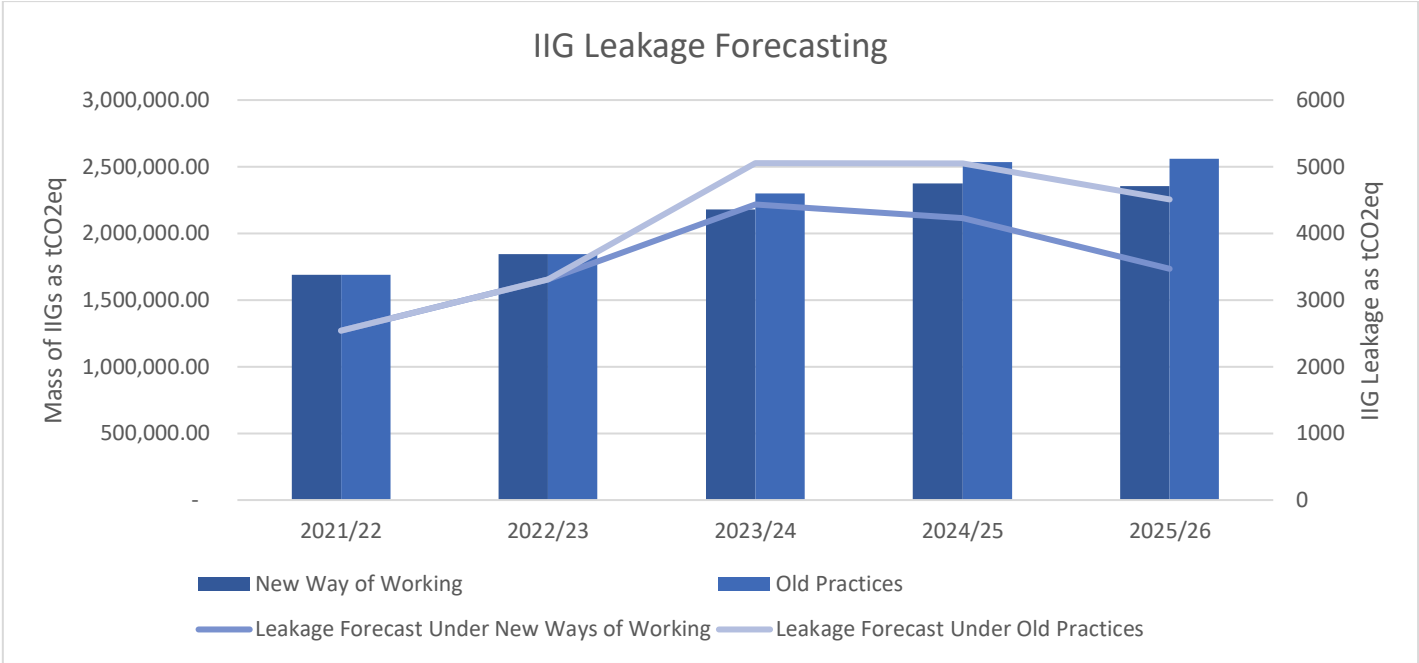


Figure 7 – IIG Leakage Forecast

Over the course of RIIO-T2, this new approach delivers a reduction in leakage of 105.9kg of SF<sub>6</sub>, the equivalent of 2,489 tonnes of carbon dioxide. The real value of this substitution is shown in Figure 8



Figure 8 - The value of our leakage reduction target

### The Incentive Mechanism

Ofgem has decided to continue the existing incentive mechanism into RIIO-T2, but to extend it to cover all IIGs and not just SF<sub>6</sub>. This means that Ofgem will measure how we've performed by comparing our actual leakage to our target and, using a number of variables, calculate a value of either penalty or reward, depending on how well we've done in the year.

Whilst our targets have not yet been set, Ofgem has stated that it is considering the following options for setting the initial amount of base emissions:

- Multiplying each TO's IIG inventory at the end of RIIO-T1 by the lowest leakage rate (e.g. 1%) observed on each TO's network over RIIO-T1,
- The average of leaked IIG emissions from the final three years of RIIO-T1, or
- Leaked IIG emissions in the final year of RIIO-T1.

We do not believe that any of these options is optimal for setting this target. In RIIO-T1 we are incentivised for the whole eight-year period to reduce our emissions. In order to provide a valid mechanism for RIIO-T2, we propose that the baseline be set using the average of leaked IIG emissions from the whole eight-year period.

This would avoid punishing network operators with leading performance and avoid any reward for operators who have had poorer performance. An eight-year average would provide Ofgem with a more realistic baseline than one taken over an arbitrary timeframe.

While we are still to complete delivery of the final three years of RIIO-T1, we have examined our potential to meet our target in this area using our performance average over RIIO-T1 to date and comparing it to our internal targets as shown in Table 1.

	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026
Target Emissions (tCO <sub>2</sub> eq)	6585.8	7194.0	8494.0	9243.9	9176.0
Forecast Emissions (tCO <sub>2</sub> eq)	2540.5	3312.7	4433.7	4228.3	3468.3

Table 1 - RIIO-T2 Targets

Given this, we believe our expected reward, as well as the maximum reward or penalty we might receive to be as shown in Table 2<sup>7</sup>. We have used the highly unlikely scenario of "no leakage" to calculate our maximum reward, and the equally unlikely scenario of 1.01% leakage to calculate our maximum penalty. 1.01% was our highest leakage over the RIIO-T1 period.

	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	TOTAL
Maximum Reward	£138,763	£155,907	£186,639	£205,899	£207,148	£894,358
Expected Reward (based on Forecast Emissions)	£85,234	£84,115	£89,218	£111,717	£128,852	£499,137
Maximum Penalty	-£220,598	-£247,853	-£296,709	-£327,327	-£329,313	-£1,421,800

Table 2 - Potential Incentive Values

The overall expected return is very small relative to the investment being made in non-SF<sub>6</sub> assets. The financial reward available does not encourage TOs to consider environmental impacts when procuring new IIG containing assets. Neither does this incentive provide a strong signal to companies or their suppliers about the need for low GWP alternatives to SF<sub>6</sub>. The financial value is not sufficient to encourage TOs or suppliers to prioritise R&D strategies. **We will continue to drive for alternatives in this area because we believe this is the right thing to do, but this small financial incentive does not incentivise companies to outperform their baseline leakage targets.**

<sup>7</sup> Based on a Post-Tax Incentive Strength (PTIS) on 0.301 and not including for RPI or PV Factor



Beyond RIIO-T2

The above targets are limited to the five-year price control window and we need to look further ahead than this.

Fundamentally, **the best way to reduce the impact of IIG leakage is to reduce the mass of SF<sub>6</sub> held** on the network and install new assets with significantly lower GWPs. Whilst alternatives are not widely available at the moment, our supply chain believes that SF<sub>6</sub> alternatives will be ready for deployment across all asset types and voltages by 2025.

**Our long-term goal is to remove all SF<sub>6</sub> from our network by 2050.** In order to achieve this, there will be some element of investing ahead of need, i.e., replacing assets that are in good condition. However, this approach is supported by our stakeholders and we believe this could offer the best value to future consumers in the longer term. **We will develop a Cost-Benefit Analysis during RIIO-T2 for this anticipatory investment to ensure that it is of value for future consumers and society.**

Measuring Success

We need to have mechanisms for measuring the success of this strategy, so we can demonstrate its effectiveness to our Stakeholders. We will look at three different Performance Indicators for this IIG Strategy as described in Figure 9.

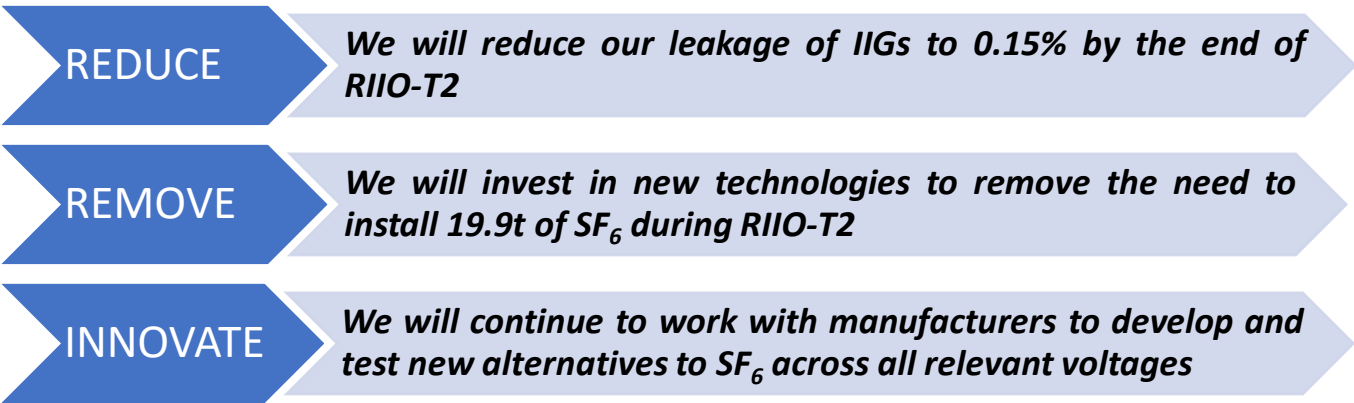


Figure 9 - Our RIIO-T2 Commitments

Actions detailed within this document are detailed in our [Sustainability Action Plan](#) for RIIO-T2. We will report our progress against these three points every year in our annual report and continue to actively engage with our stakeholders to ensure we are meeting their expectations.



## We want to hear from you

This document is our Strategy for the Management of Insulation & Interruption Gases over the RII0-T2 period, from 1 April 2021 to 31 March 2026. Our approach is one of continuous development and improvement. To support that, this is a living document which you can directly influence by challenging and amending areas to increase its effectiveness. Please contact us if you would like to provide input on our proposed actions.

Information provided in response to this document may be used in future SHE Transmission documents. Responses will be generalised and not attributed to specific people. If you would prefer the information you provide to be confidential, please let us know.

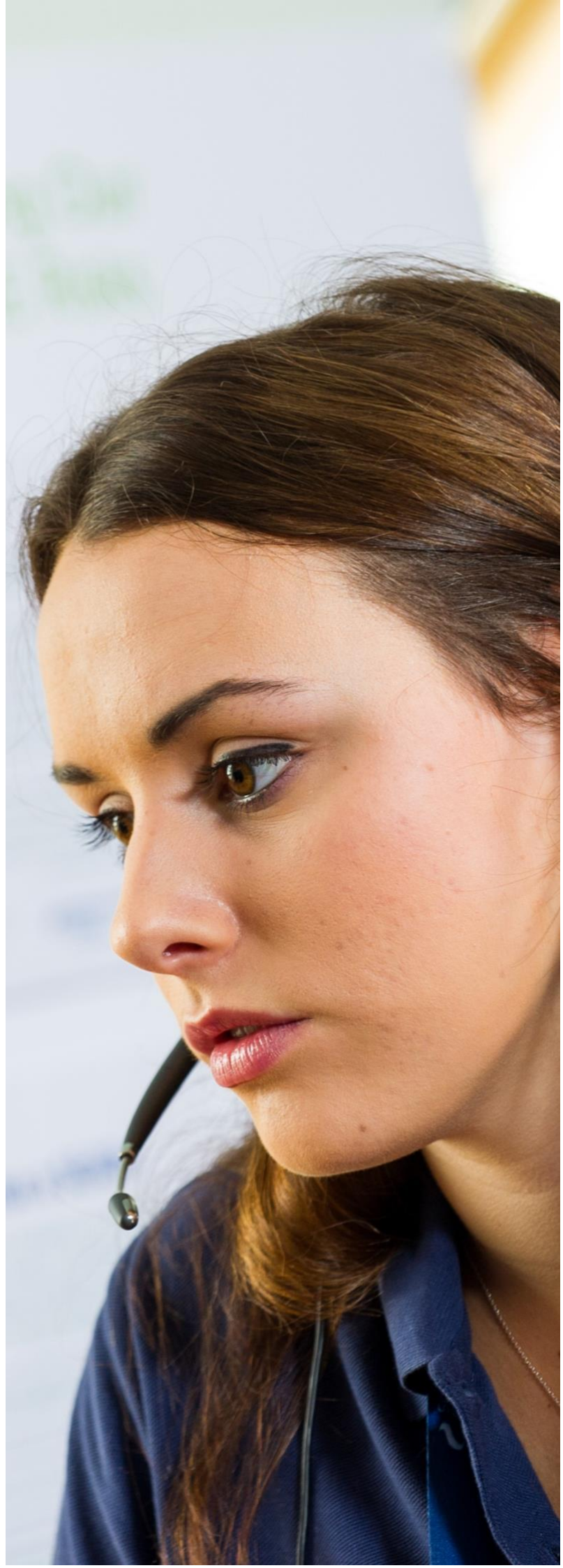
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