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**A Place for the Sun on the Network**

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# The Old Way

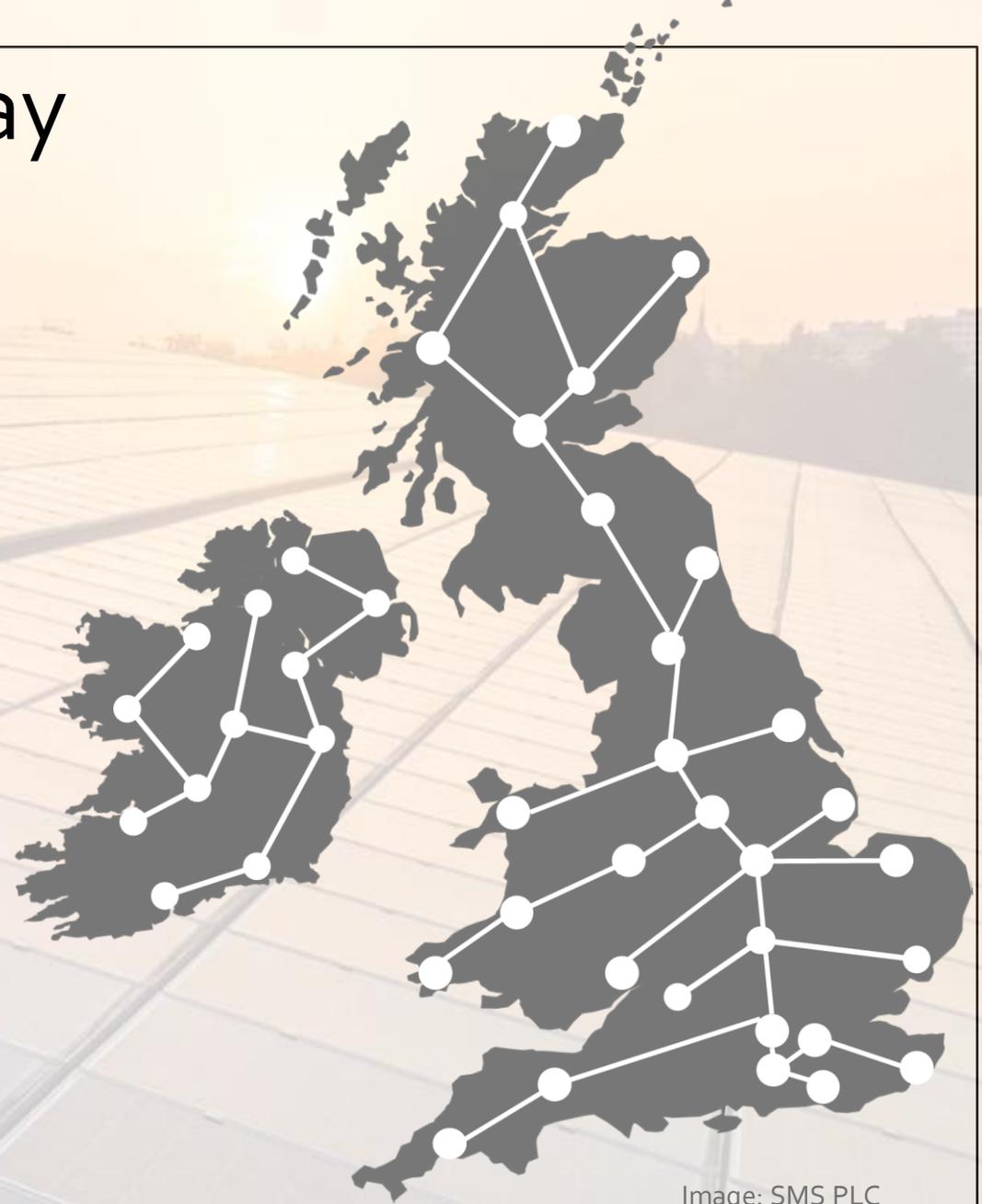
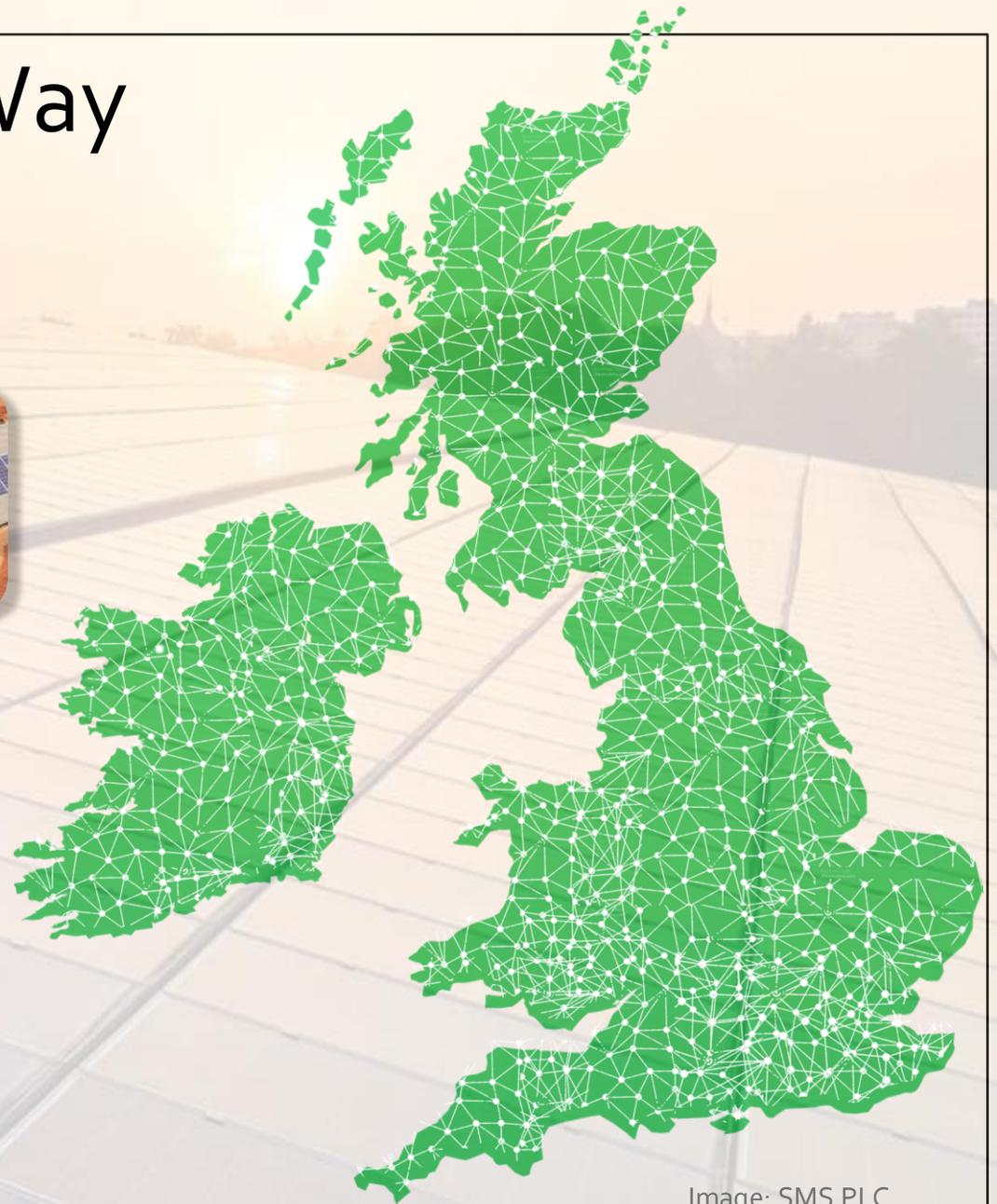


Image: SMS PLC

# The New Way

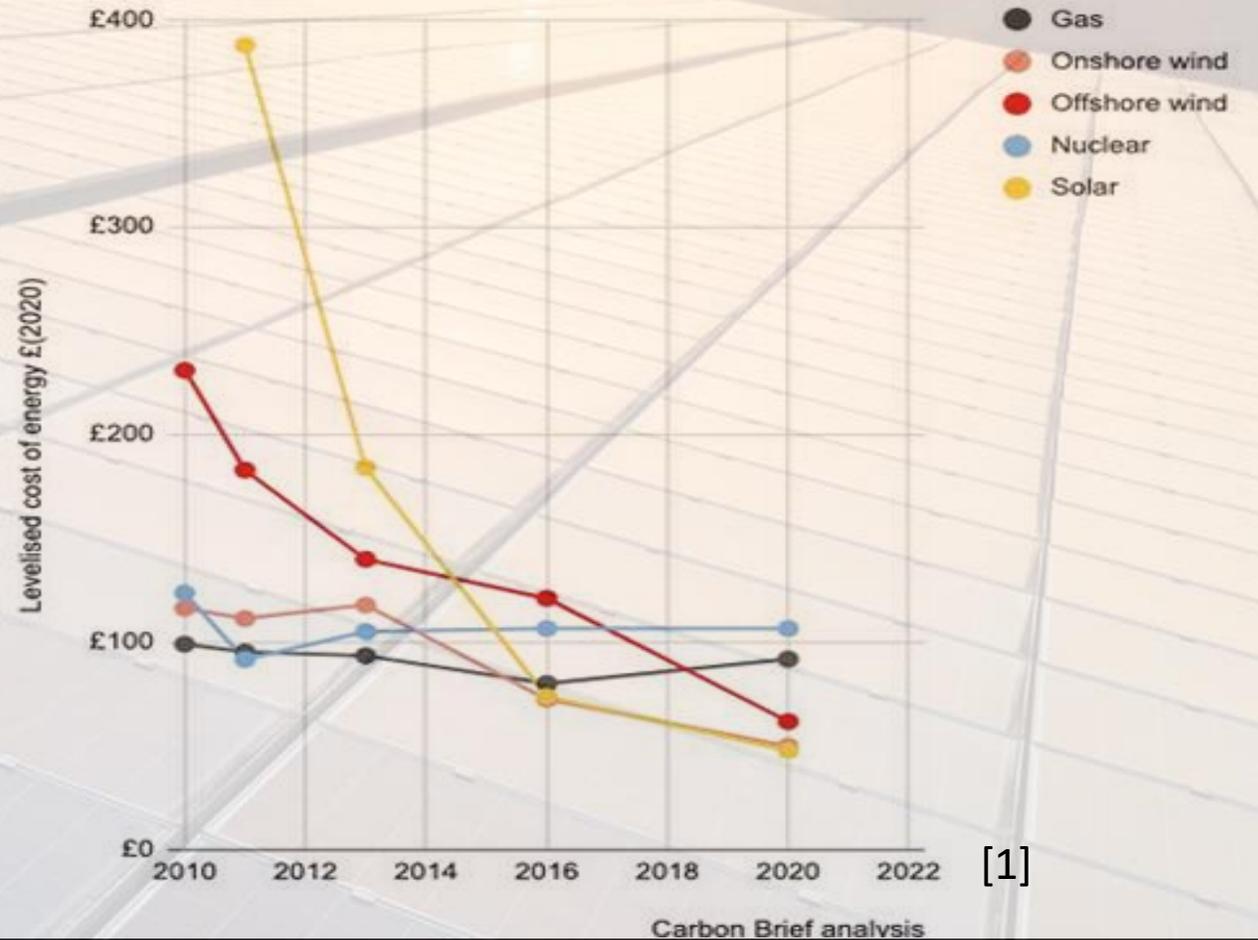


# The Value of Solar

- Now the cheapest form of energy
- Deployable at scale and pace
- Reliable, predictable and secure
- Supports jobs, economy and Just Transition
- Supports industry, communities and people
- Hugely popular

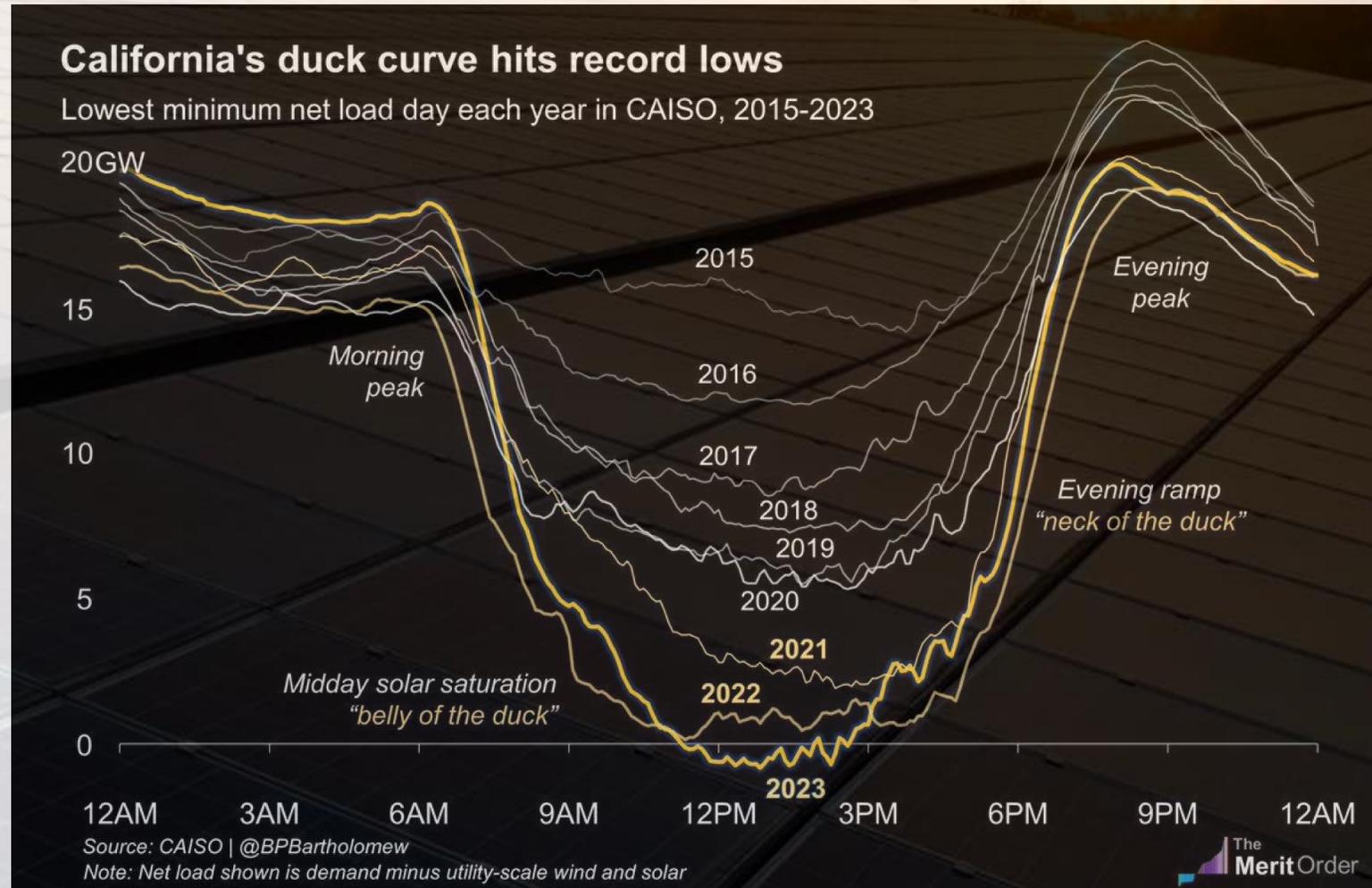
Solar is now 88% cheaper than thought a decade ago, UK govt says – and half its estimate for gas power

Levelised cost estimates are down 57% for onshore and 73% for offshore wind



# Achieving a Net Zero Network

This is the opportunity



# Achieving a Firm Net Zero Network

- Diverse and optimised mix of renewable energy
- Energy Storage
- Demand Flexibility
- Geographical Dispersion
- Interconnection
- Implicit Storage (optimised curtailment)

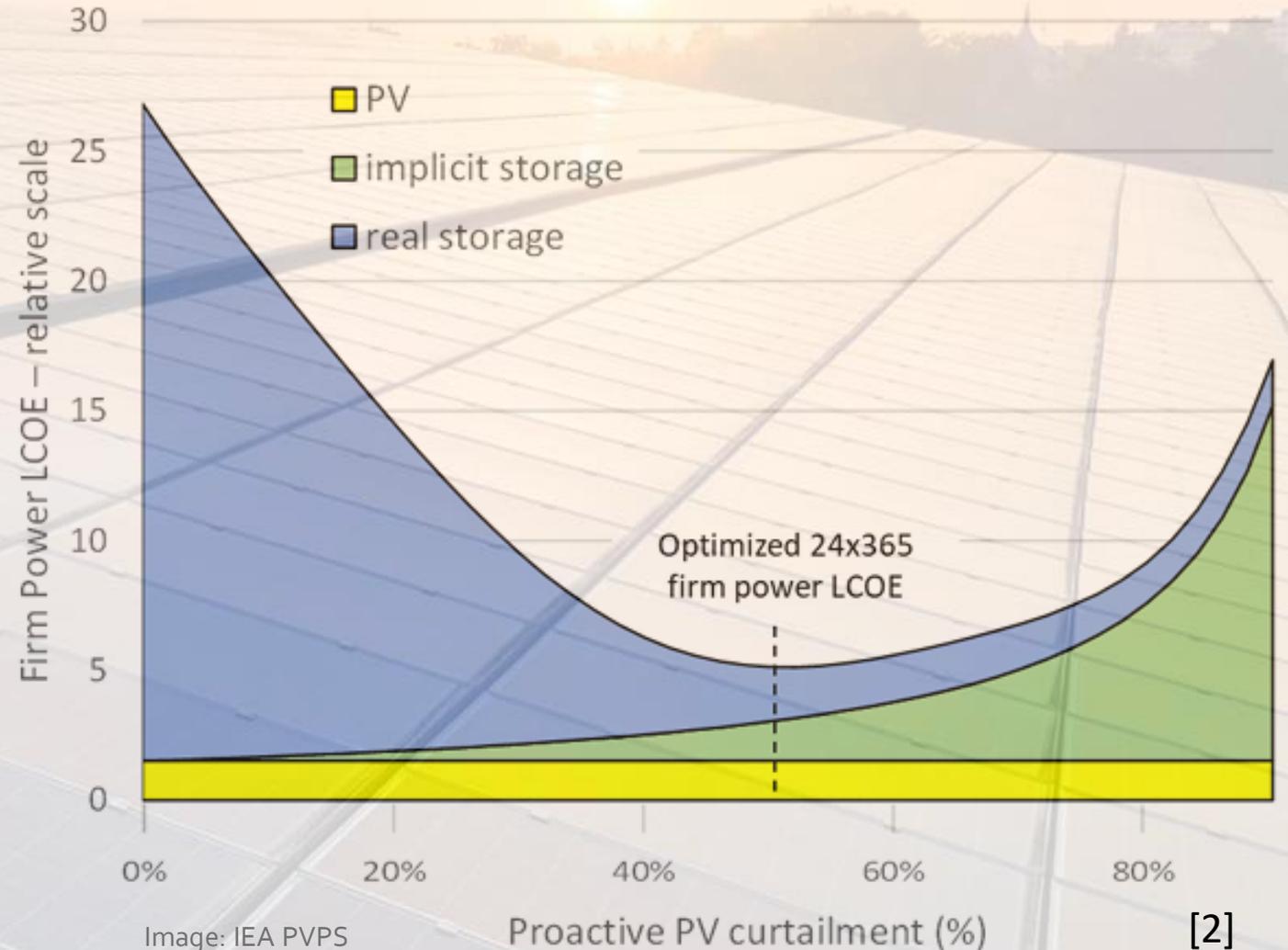


Image: IEA PVPS

# Solar Energy Scotland

Scotland 2030 Deployment Target by Sector

- A solar ambition of 4-6 GW
  - Approx. 1kW per person
  - 15% of Electricity Consumption <sup>[3]</sup>
  - Equivalent to Torness 1 <sup>[4]</sup>
- Domestic: 1 – 1.5 GW
  - 500k homes with 2-3kW <sup>[5]</sup>
- Commercial: 0.7 – 1 GW
  - 200 SEC Centres <sup>[5]</sup>
- Utility: 2.3 – 3.5 GW
  - An area of land 7.5 x 7.5 km <sup>[5]</sup>



Utility Scale, 58%



Domestic, 25%



Commercial Rooftop, 17%

# What are the challenges?

DER Contracted and can connect **0GW**  
 DER Contracted sitting behind transmission reinforcement **3.8GW**  
 DER contracted subject to ESO assessment **3.8GW**  
 DER with inflight connection offers **1.4GW**  
 GSPs constrained (% population) **100%**

DER Contracted and can connect **1.8GW**  
 DER Contracted sitting behind transmission reinforcement **0.7GW**  
 DER contracted subject to ESO assessment **2GW**  
 DER with inflight connection offers **1.5GW**  
 GSPs constrained (% population) **60%**

DER Contracted and can connect **1.4GW**  
 DER Contracted sitting behind transmission reinforcement **1.4GW**  
 DER contracted subject to ESO assessment **TBC**  
 DER with inflight connection offers **TBC**  
 GSPs constrained (% population) **69%**

DER Contracted and can connect **10.4GW**  
 DER Contracted sitting behind transmission reinforcement **4.8GW**  
 DER contracted subject to ESO assessment **8.9GW**  
 DER with inflight connection offers **3.9GW**  
 GSPs constrained (% population) **56%**

DER Contracted and can connect **0.6GW**  
 DER Contracted sitting behind transmission reinforcement **2.2GW**  
 DER contracted subject to ESO assessment **1.3GW**  
 DER with inflight connection offers **0.0GW**  
 GSPs constrained (% population) **92%**



DER Contracted and can connect **5.0GW**  
 DER Contracted sitting behind transmission reinforcement **1.2GW**  
 DER contracted subject to ESO assessment **(to follow)**  
 DER with inflight connection offers **(pending definition)**  
 GSPs constrained (% population) **78%**

DER Contracted and can connect **3.4GW**  
 DER Contracted sitting behind transmission reinforcement **3.7GW**  
 DER contracted subject to ESO assessment **5.3GW**  
 DER with inflight connection offers **2.8GW**  
 GSPs constrained (% population) **48%**

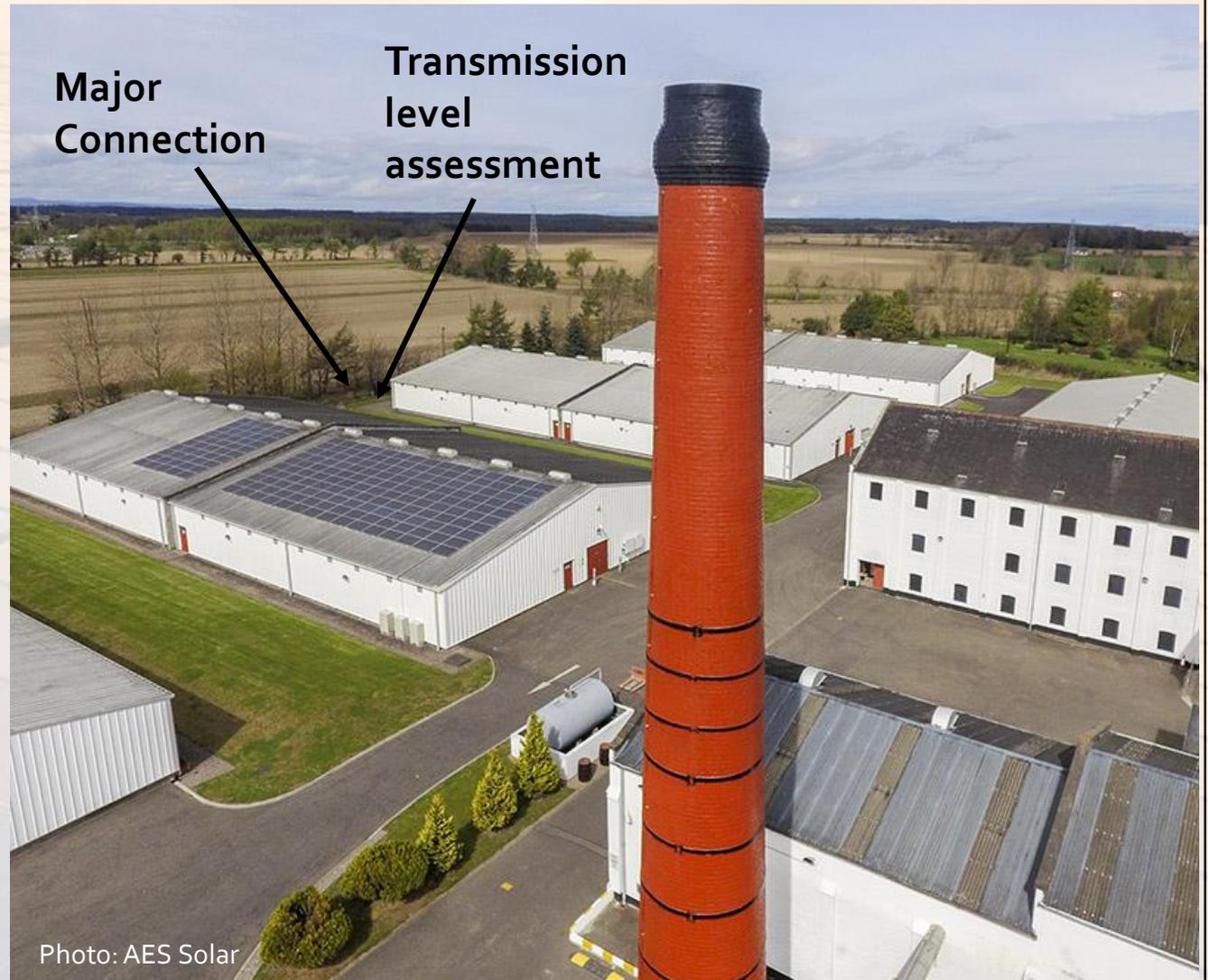
DER Contracted and can connect **3GW**  
 DER Contracted sitting behind transmission reinforcement **4.2GW**  
 DER contracted subject to ESO assessment **3.6GW**  
 DER with inflight connection offers **1.1GW**  
 GSPs constrained (% population) **75%**

DER Contracted and can connect **1.9GW**  
 DER Contracted sitting behind transmission reinforcement **2.7GW**  
 DER contracted subject to ESO assessment **1.2GW**  
 DER with inflight connection offers **0.7GW**  
 GSPs constrained (% population) **69%**

DER Contracted and can connect **2.6GW**  
 DER Contracted sitting behind transmission reinforcement **2.7GW**  
 DER contracted subject to ESO assessment **3.9GW**  
 DER with inflight connection offers **0.9GW**  
 GSPs constrained (% population) **100%**

# What are the challenges?

- Access to network
- Statement of works for small distributed generation
- Wind transmission downwards
- Battery Storage treatment on network
- Data and visibility at distribution level
- Calculation methodology
- DNO capacity - quality and timescales for offers
- No anticipatory investment



# Enhanced Data

## ENABLERS

- Smart Meter Data
- LV Monitoring data
- Connectivity Model
- Data sharing Platform
- Data Lake
- Smart Meter Plus
- Pre-fault detection algorithms
- Power Quality Monitoring

## VISIBILITY STRATEGY

A targeted-led blend of LV monitoring, smart meter data and external data sets consolidated around a connectivity model.

## OUTPUTS

- Third party services
- Network Operation improvements
- Customer interruption improvements
- Accelerated connection processes
- Cable Health monitoring
- Just in time reinforcement
- Flexibility Service Operations
- Losses visibility

- SPEN 14,000 LV Network monitors
- SSEN 19,000 (19% secondary subs)

- Rapid digital self service connection and additional load quotations
- Tools to allow domestic customers to participate in the flexibility services market
- Local community energy exchange markets
- Tools to predict faults and reduce interruptions

# Flexibility

## Supply-side

## Grid-side

## Demand-side

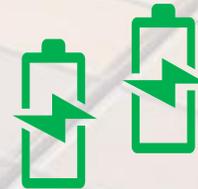
Fossil Fuels



Storage co-located with  
wind / solar farms



Front-of-meter storage

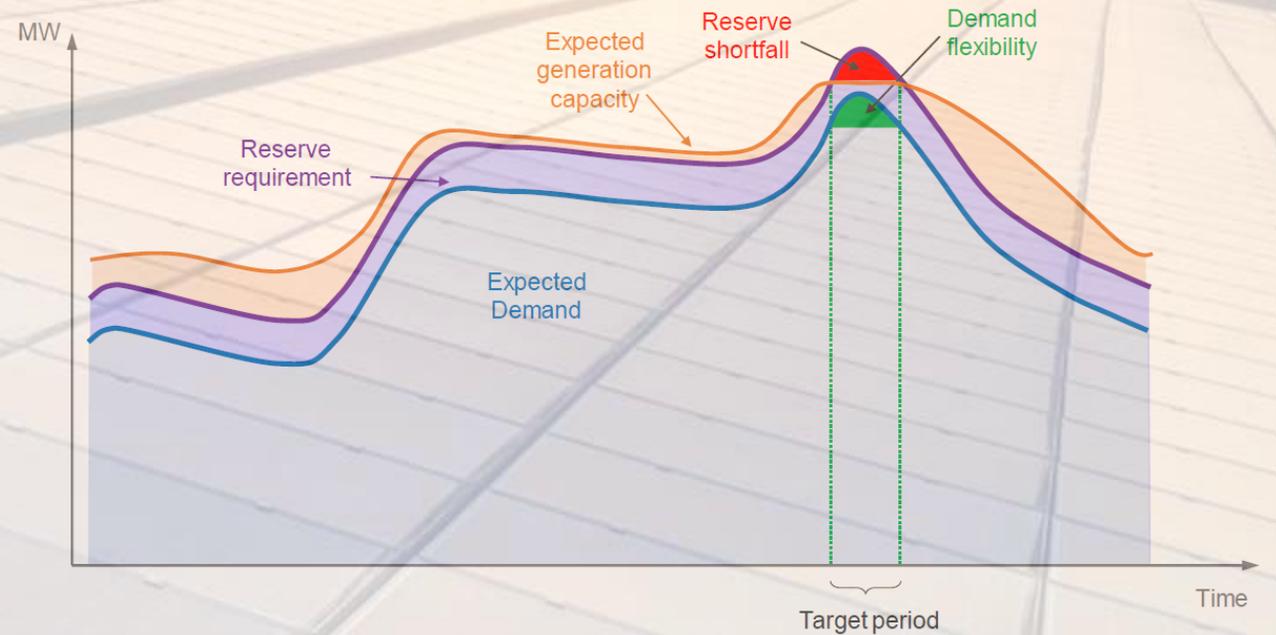


Behind-the-meter /  
Demand-side

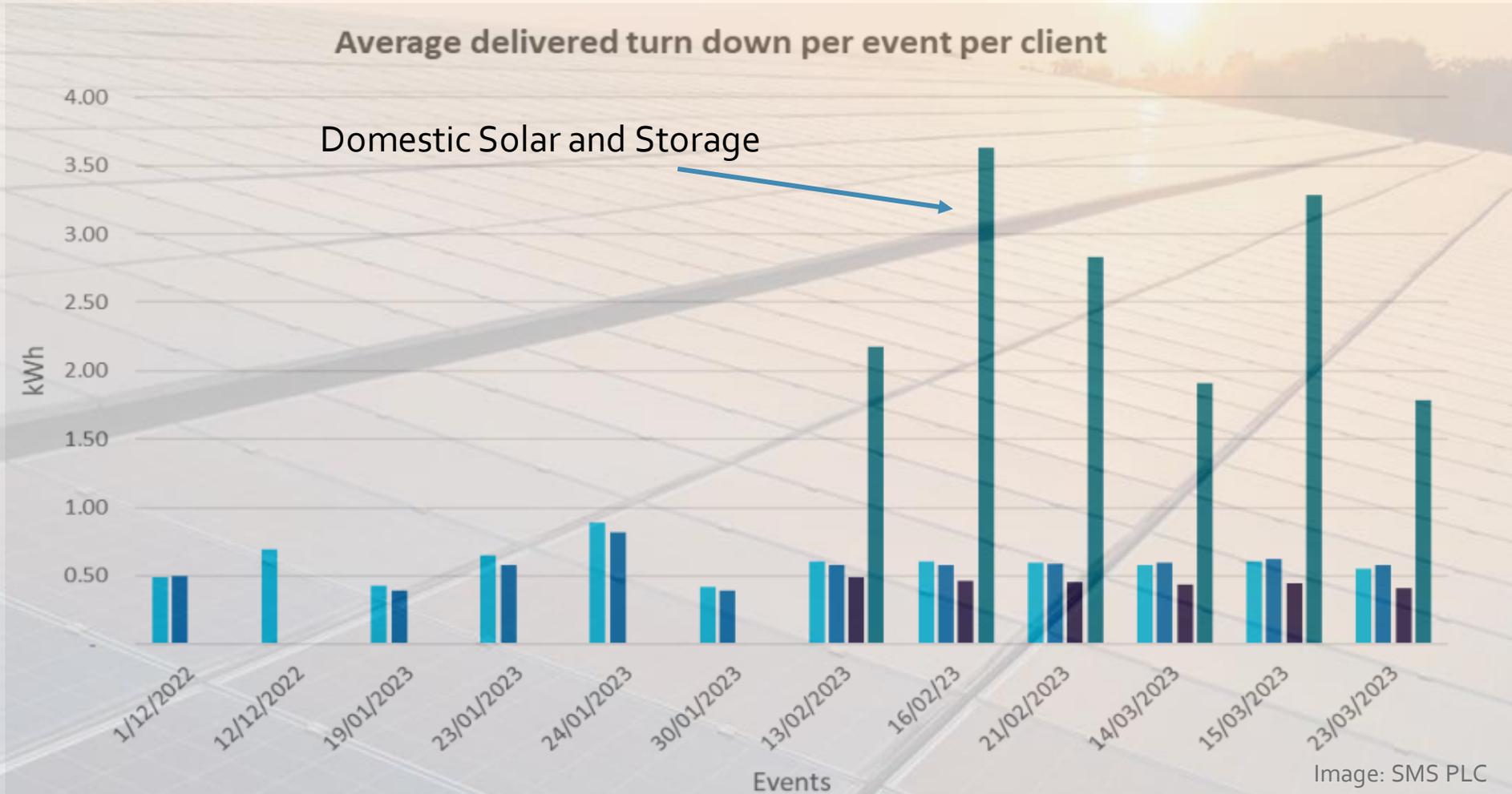


# Demand Flexibility Service (DFS)

- New “emergency measure” introduced by National Grid to pay consumers to reduce electricity demand during peak demand periods this winter
- Without demand reduction, possible that NG would resort to rolling blackouts
- 1.6 million homes participated<sup>[6]</sup>
- 3.3GWh were shaved away from our national peak energy demand<sup>[6]</sup>

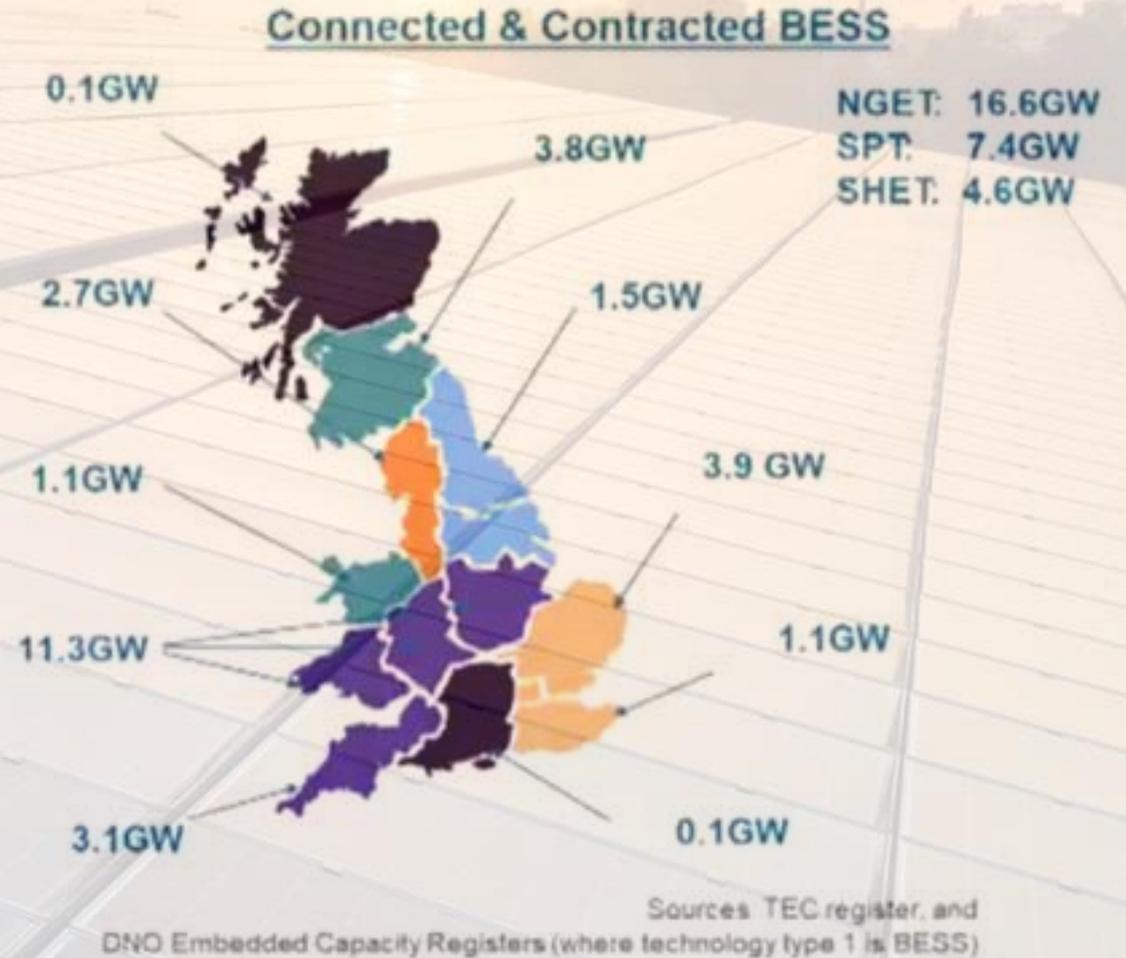


# Demand Flexibility Service (DFS)



# Battery Storage

- 56GW contracted in last 18-24 Months
- 13.6GW in Scotland
- 200%-500% greater than ESO GB FES 2030 scenarios
- Close to GB total Demand
- Transmission should treat batteries as neutral
- Distribution needs policy and market solutions



# Queue Management

- Currently over 360GW of Generation on TEC Register<sup>[7]</sup>
- No mechanism to filter applications
- ESO believes as many as 80% won't proceed
- 2037 Connection Date



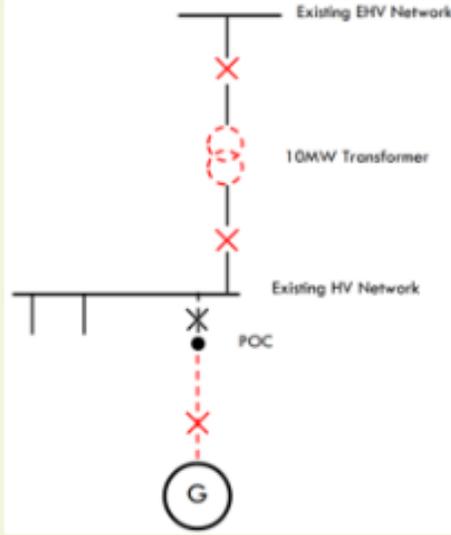
# Breaking the Gridlock

- Tech Amnesty – 5.7GW
- Sunset Clause on generators
- Prioritise based on readiness, national and regional needs
- 2-stage Process in consultation
- Increased interaction between transmission and distribution
- Reduced barriers to flexible connections and flexibility services



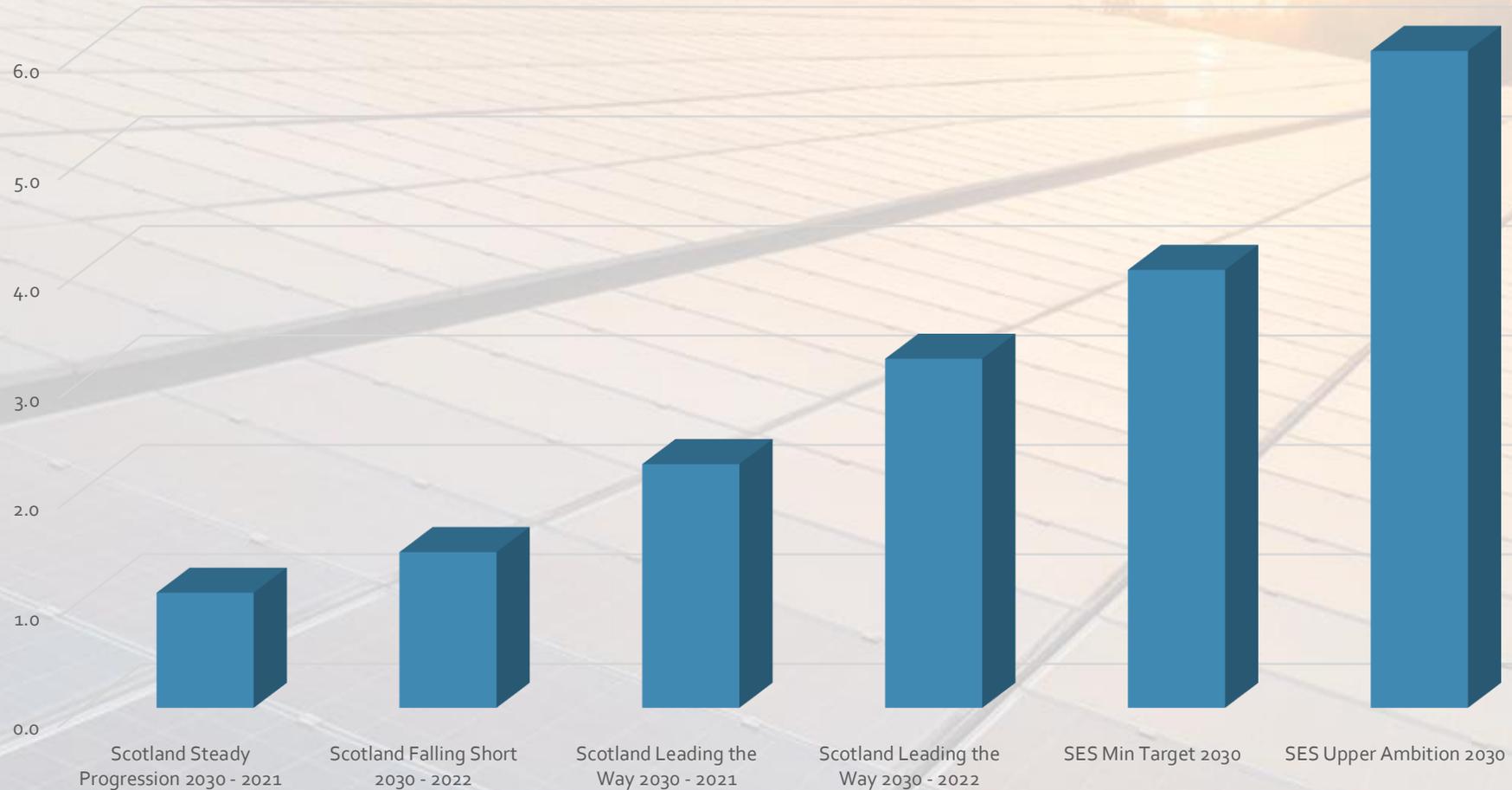
# Significant Code Review

- Aimed at
  - allowing more low carbon generation and demand
  - More strategic investment
- Charging impact
  - Overall connection charge reduced
  - Only pay for reinforcements at the voltage you connect at
- Access Rights
  - Always be offered a connection date
  - Curtailed connection until firm date

	NOW	FROM APRIL 2023
	<p><b>Reinforcement Costs:</b></p> <p>11KV Jointing (apportioned): £900</p> <p>11KV breaker (apportioned): £9,000</p> <p>33KV breaker (apportioned): £24,000</p> <p>Transformer replacement (apportioned): £450,000</p> <p><b>Extension Assets:</b></p> <p>Install 200m of 11KV cable: £60,000</p> <p>11KV breaker at Customer's substation: £25,000</p> <p>11KV Jointing: £3,000</p> <p><b>Total Charge to Customer:</b></p> <p>£571,900</p>	<p><b>Reinforcement Costs:</b></p> <p>11KV Jointing (apportioned): £900</p> <p>11KV breaker (apportioned): £9,000</p> <p><b>Extension Assets:</b></p> <p>Install 200m of 11KV cable: £60,000</p> <p>11KV breaker at Customer's substation: £25,000</p> <p>11KV Jointing: £3,000</p> <p><b>Total Charge to Customer:</b></p> <p>£97,900</p>

# Impact of Clear Policy Indication

Solar Forecasts (GW) in DFES Scenarios Feeding ED2



# Clear Policy Direction

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## UK

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Technology

Policy Indicators

Offshore Wind

50GW by 2030

Onshore Wind

Banned\*

Hydrogen

10GW Hydrogen

Solar

70GW by 2035

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## Scotland

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Technology

Policy Indicators

Offshore Wind

8-11 GW by 2030

Onshore Wind

20GW by 2030

Hydrogen

5GW by 2030

Solar

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# Thank You

1. BEIS electricity generation cost report (2020), <https://www.gov.uk/government/publications/beis-electricity-generation-costs-2020>
2. IEA PVPS, Firm Power Generation, <https://iea-pvps.org/key-topics/firm-power-generation/>
3. Scottish electrical energy consumption, <https://scotland.shinyapps.io/Energy/?Section=RenLowCarbon&Subsection=RenElec&Chart=RenElecTarget>
4. Torness 1 and 2 Annual Generation, <https://www.world-nuclear.org/reactor/default.aspx/TORNESS-1>
5. Calculations available on request
6. SMS PLC – Flexigrid Team
7. TEC register
8. SSEN DFES 2021, SSEN DFES 2022, SPEN DFES 2021, SPEN DFES 2022