



A Place for the Sun on the Network

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The Old Way



Image: SMS PLC

The New Way

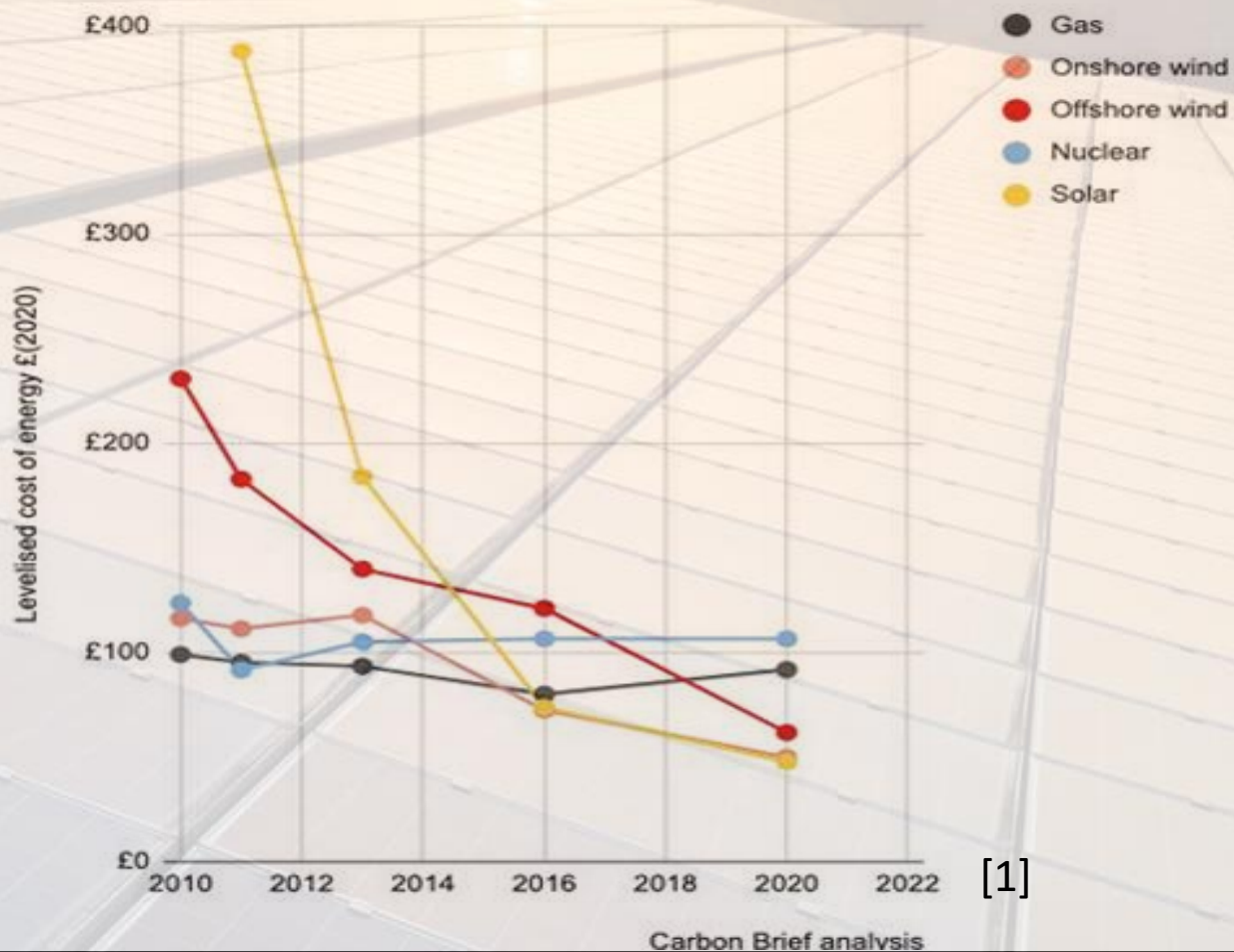


The Value of Solar

- 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

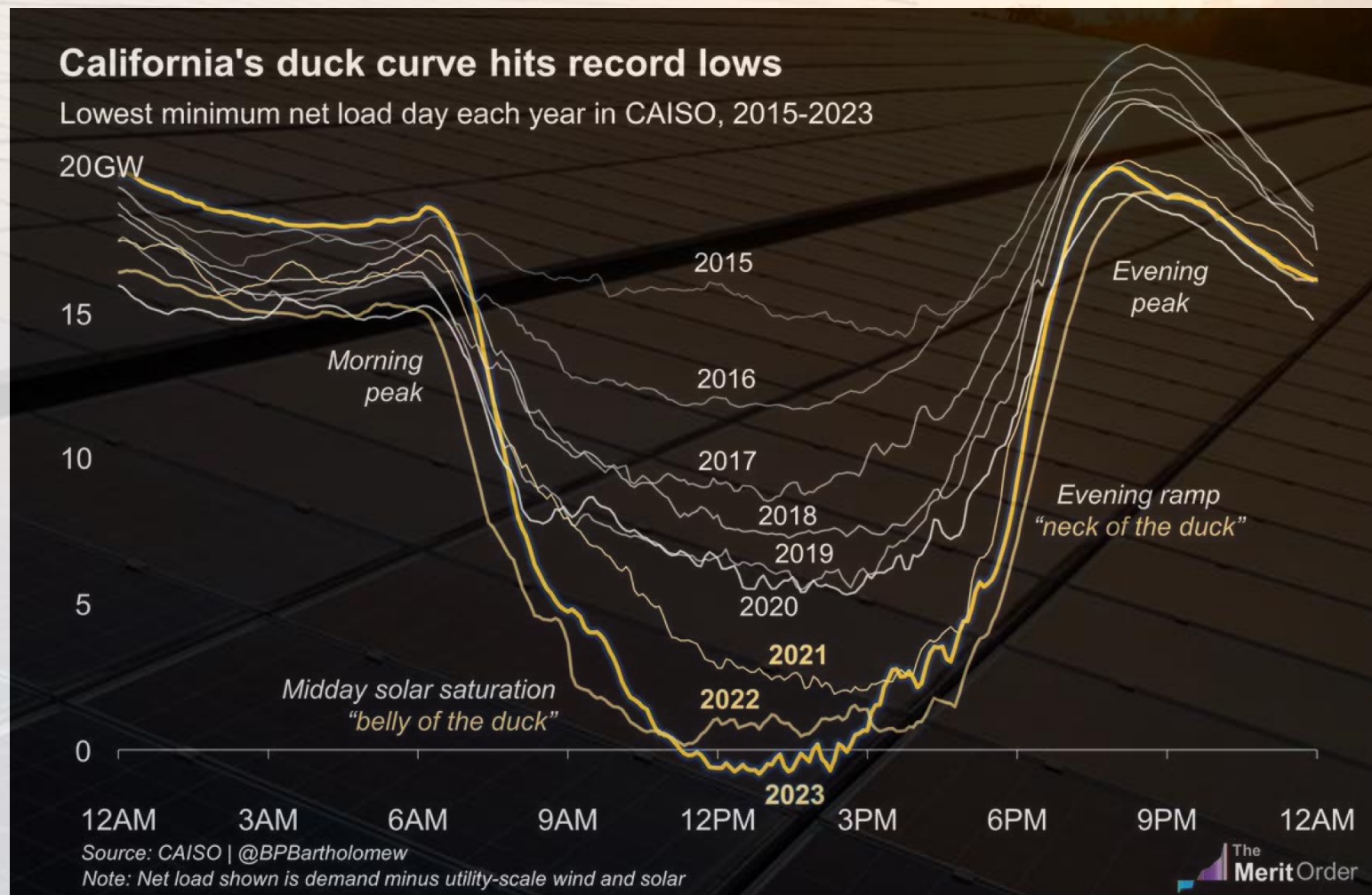
Solar is now 88% cheaper than thought a decade ago, UK govt says – and half its estimate for gas power

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



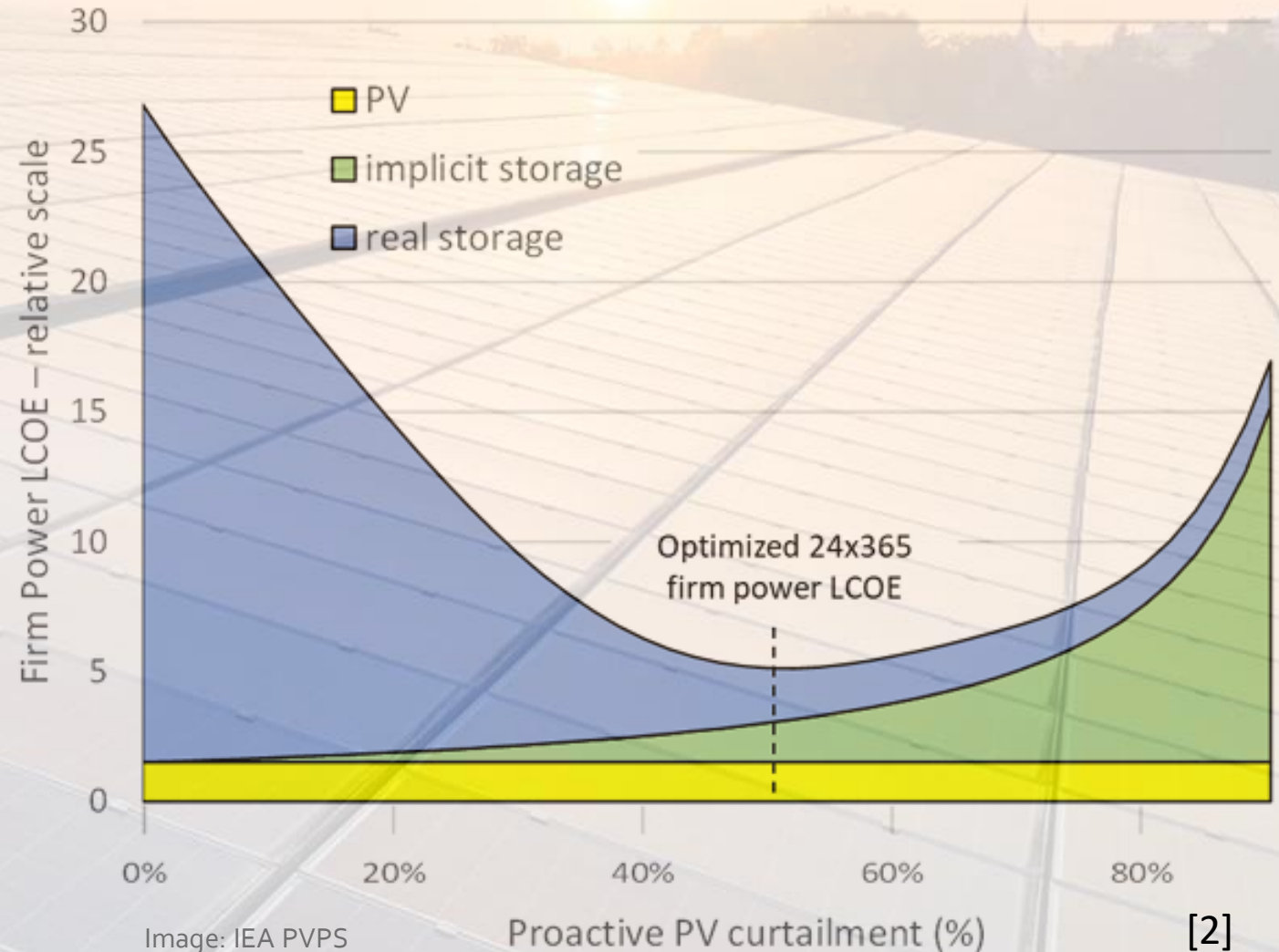
Achieving a Net Zero Network

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)



Solar Energy Scotland

Scotland 2030 Deployment Target by Sector

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



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.GW**
 GSPs constrained (% population) **92%**

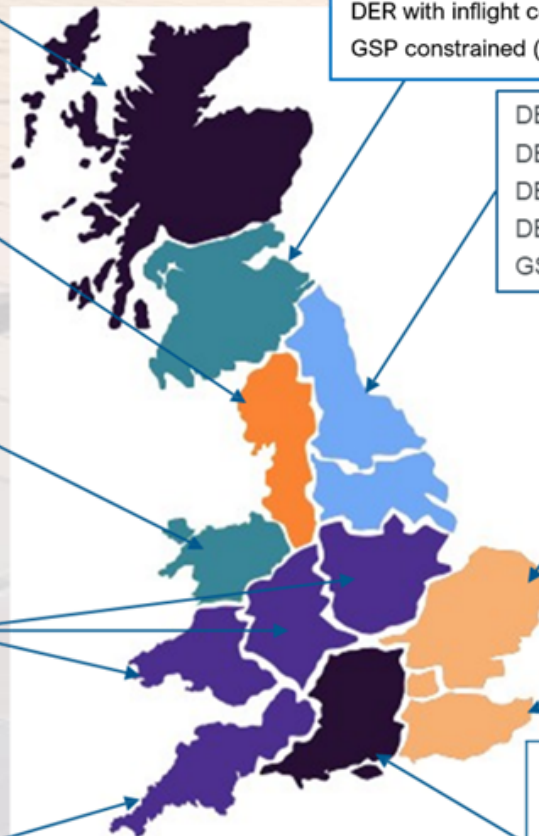
DER Contracted and can connect **5.0GW**
 DER Contracted sitting behind transmission reinforcement **1.2GW**
 DER contracted subject to ESO assessment **(to follow)**
 DER with inflight connection offers **(pending definition)**
 GSPs constrained (% population) **78%**

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%**

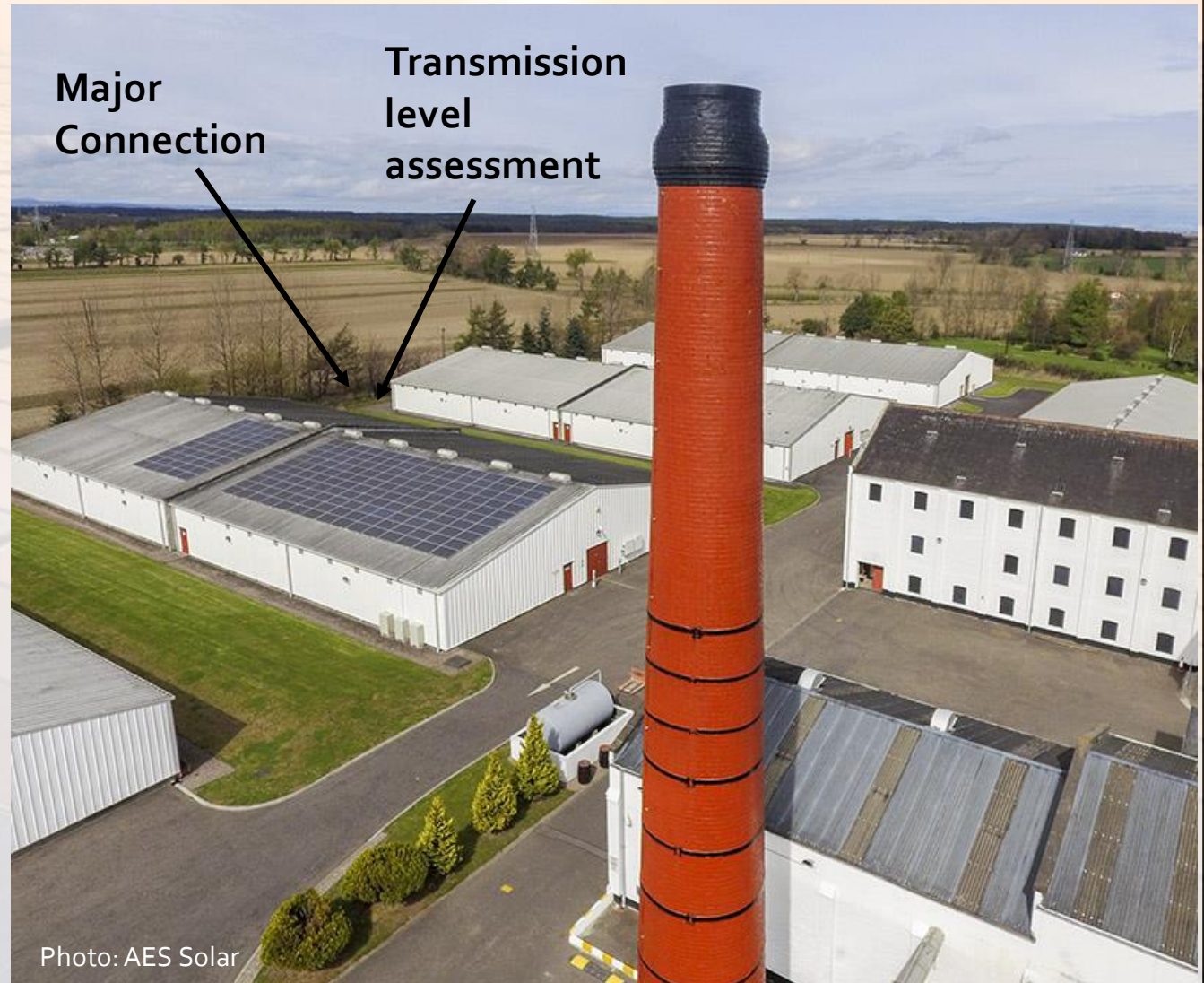
DER Contracted and can connect **1.9GW**
 DER Contracted sitting behind transmission reinforcement **2.7GW**
 DER contracted subject to ESO assessment **1.2GW**
 DER with inflight connection offers **0.7GW**
 GSPs constrained (% population) **69%**

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%**

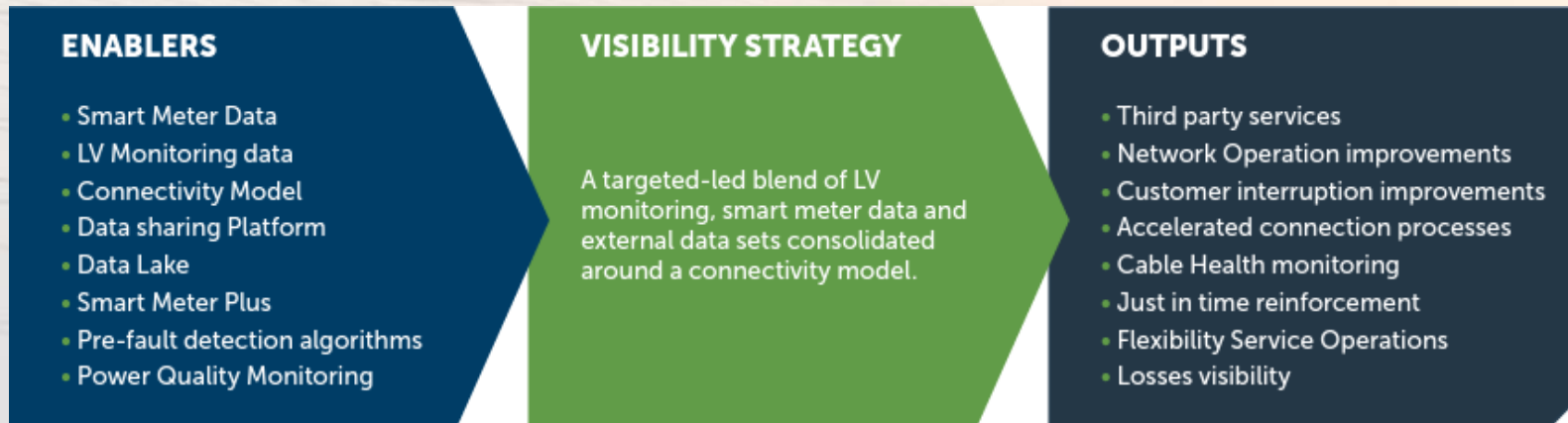


What are the challenges?

- 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



- 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

Fossil Fuels

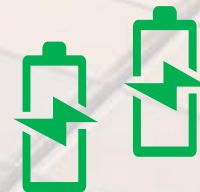


Storage co-located with
wind / solar farms



Grid-side

Front-of-meter storage



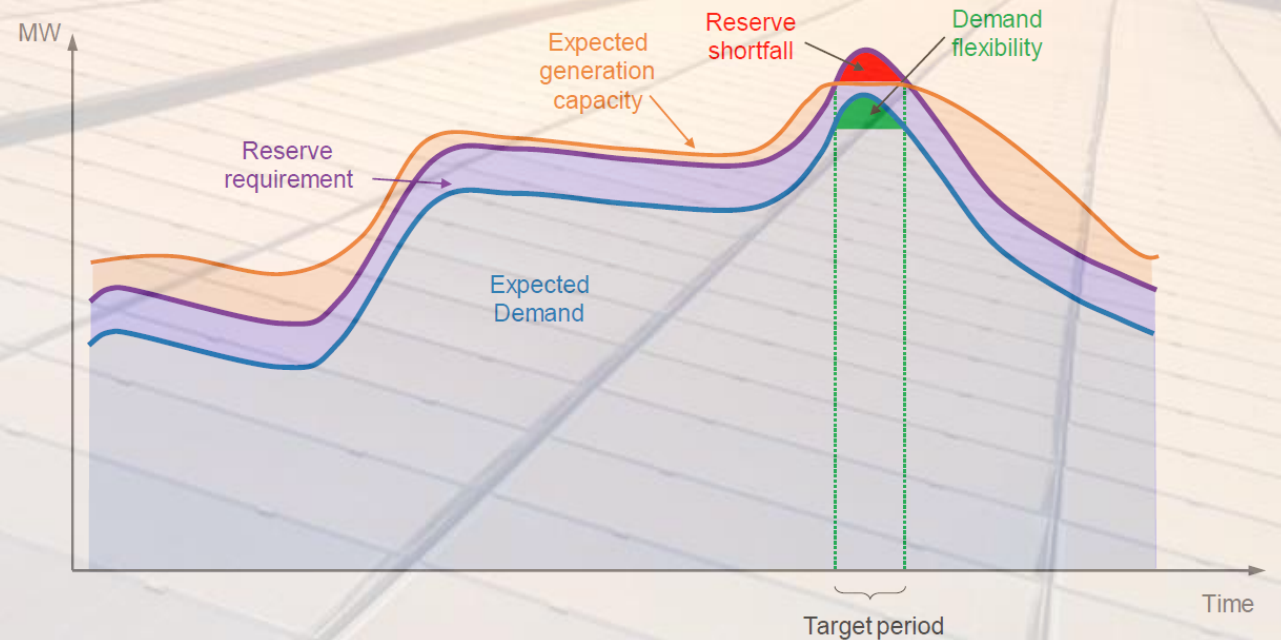
Demand-side

Behind-the-meter /
Demand-side

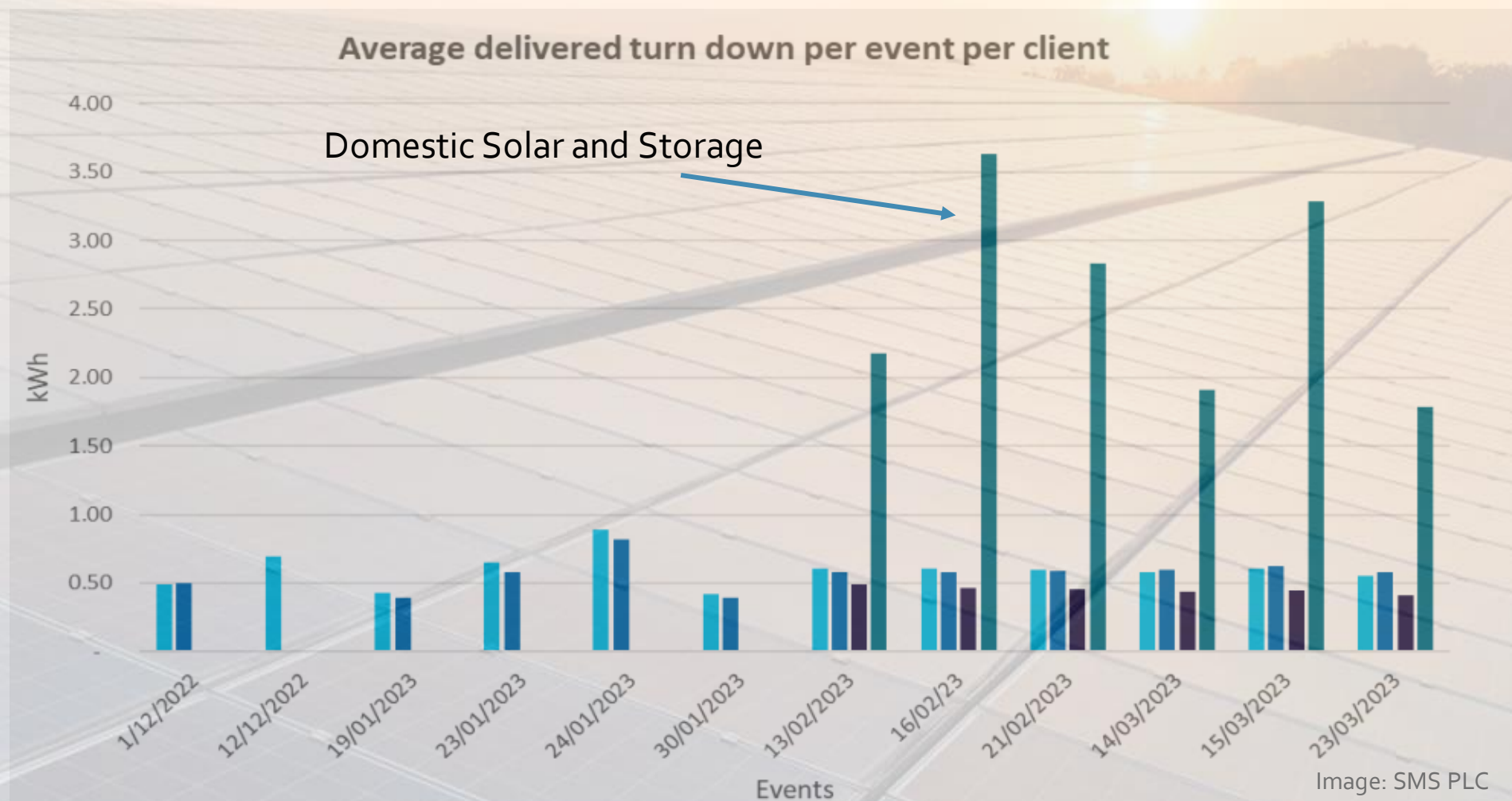


Demand Flexibility Service (DFS)

- 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^[6]
- 3.3GWh were shaved away from our national peak energy demand^[6]



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

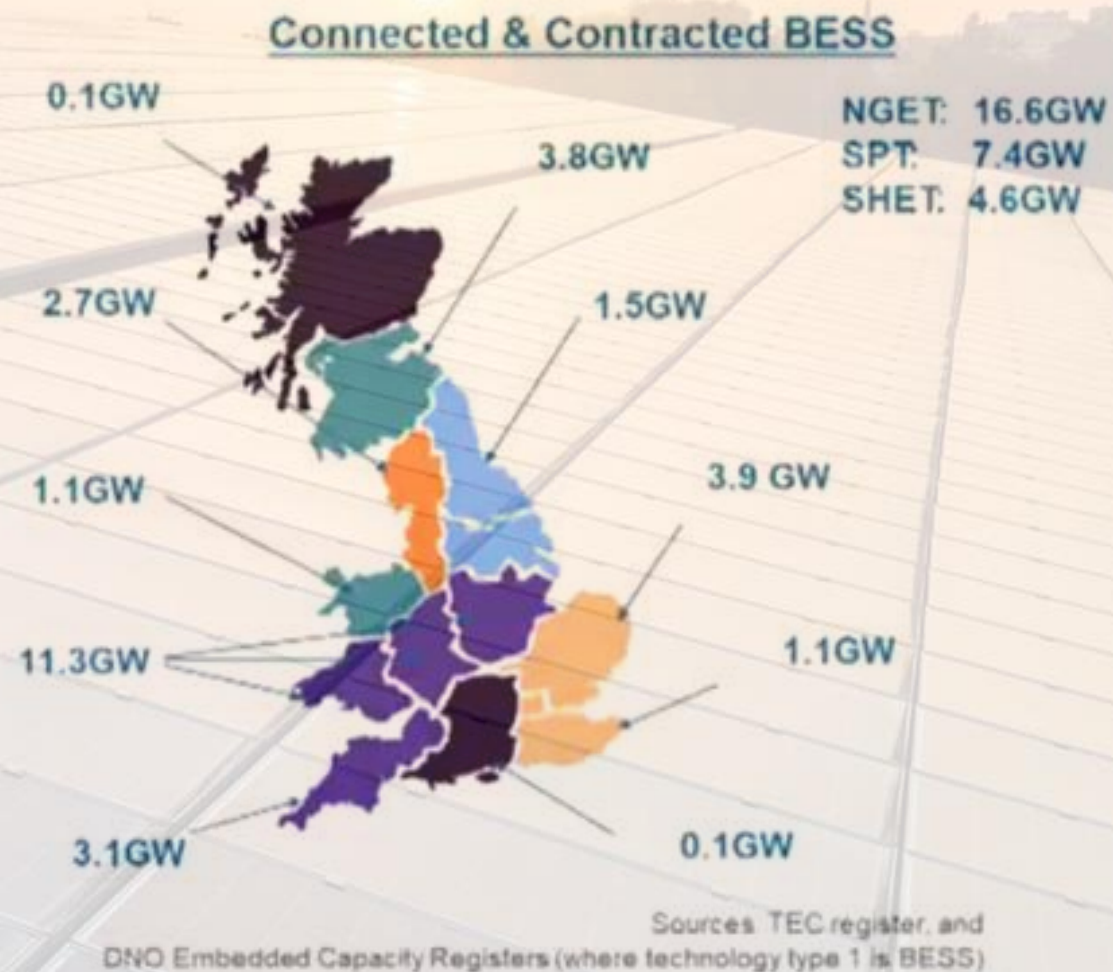


Image: SPEN

Queue Management

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



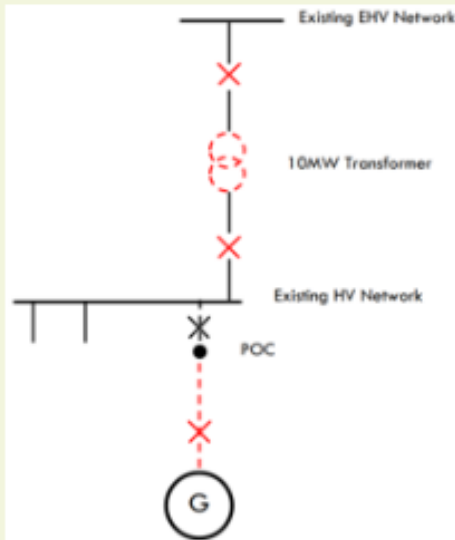
Breaking the Gridlock

- 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



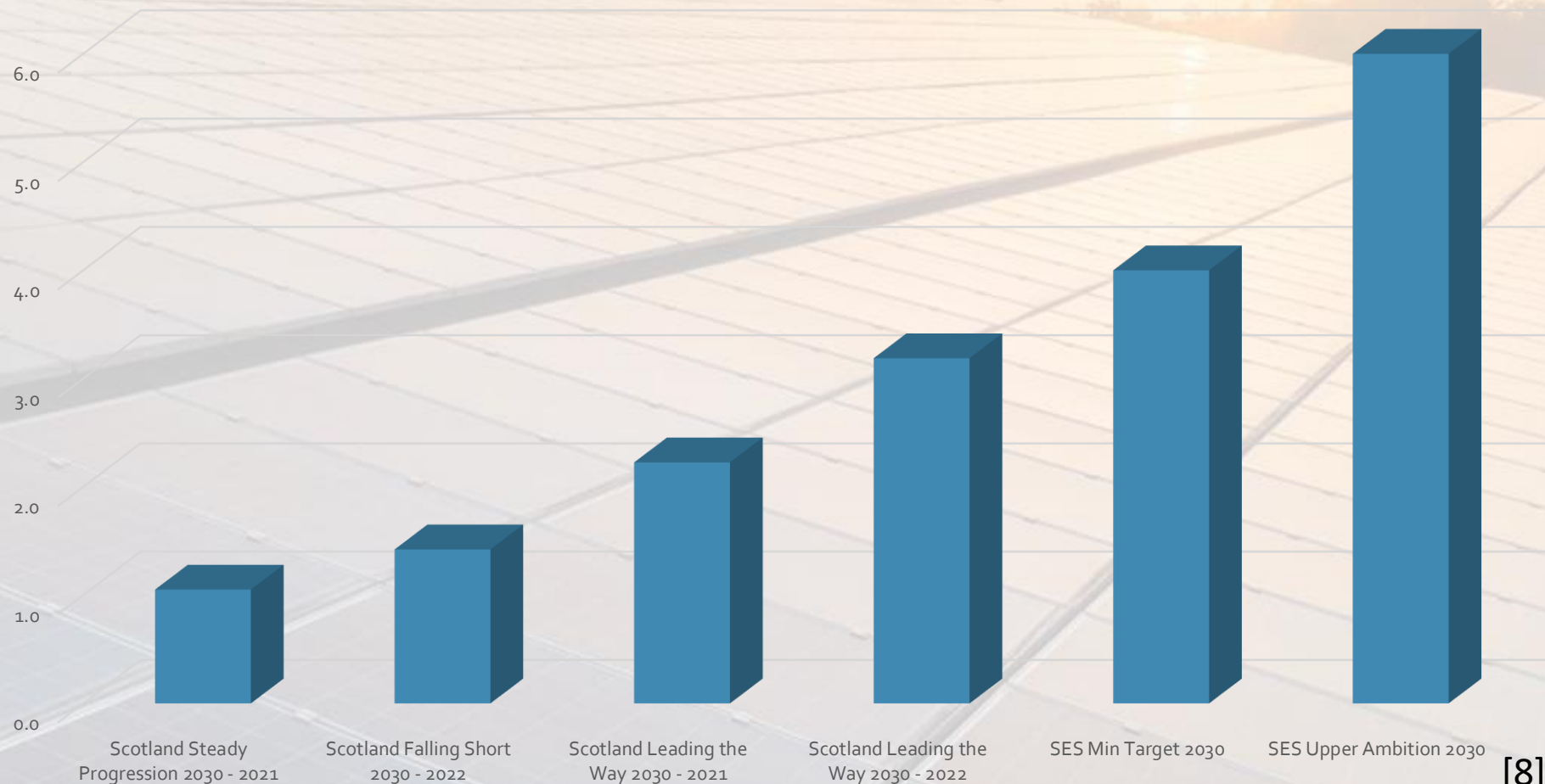
Significant Code Review

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

Impact of Clear Policy Indication

Solar Forecasts (GW) in DFES Scenarios Feeding ED2



Clear Policy Direction

UK

Technology	Policy Indicators
Offshore Wind	50GW by 2030
Onshore Wind	Banned*
Hydrogen	10GW Hydrogen
Solar	70GW by 2035

Scotland

Technology	Policy Indicators
Offshore Wind	8-11 GW by 2030
Onshore Wind	20GW by 2030
Hydrogen	5GW by 2030
Solar	

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