Distributed ReStart

Annual conference

30th January 2020

tnei

SP ENERGY NETWORKS

nationalgridESO

Energy restoration for tomorrow

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Distributed ReStart

Jane Gray
Creative Director,
Faversham House

GAS POWER HEAT SYSTEMS NETWORK

Distributed ReStart

Toilets

Fire

First Aid

Mobile Phones and messages

WIFI

Slido

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GAS POWER HEAT SYSTEMS NETWORK

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Distributed ReStart

Conference Agenda

10:00 – 10:30 *Ambition for 2025*
Duncan Burt
National Grid ESO

10:30 – 11:15 *The Power of Three*
Roisin Quinn
National Grid ESO
Eric Leavy
SPEN
Charlotte Higgins
TNEI

11:15 – 11:45 *Break & Networking*

11:45 – 12:05 *Role of Regulation*
Leonardo Costa –
Ofgem

12:05 – 12:25 *Strategic Telecoms & Innovation*
Randolph Brazier –
Energy Networks Association &
Strategic Telecoms Group

12:25 – 1:10 Lunch

1:10 – 1:40 *Key Speaker*
Dr Robert Gross
Imperial College London

1:40 – 2:00 *The Role of Innovation*
Cian McLeavey-Reville
National Grid ESO

2:00 – 2:20 *Consumers in Black Start*
James Kerr
Citizens Advice

2:20 – 2:50 *Break & Networking*

2:50 – 3:40 *Industry panel discussion: A shift to reliance on Distributed Black Start*
Jane Gray
Faversham House
Peter Chandler
National Grid ESO
Andrew Enzor –
Cornwall Insights
James Kerr –
Citizens Advice
Cian McLeavey-Reville –
National Grid ESO
Professor Nicolas Jenkins –
Cardiff University

3:40 – 4:00 *Reflection and Close*
Roisin Quinn –
National Grid ESO

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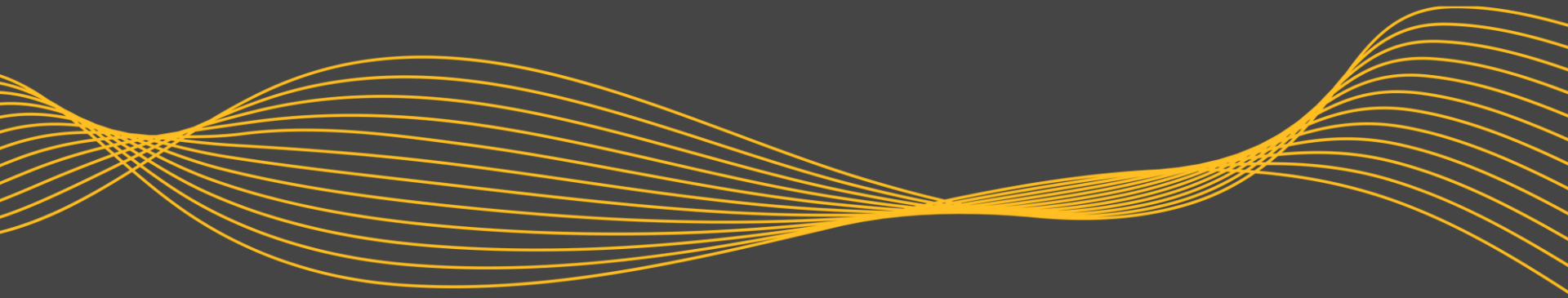
Duncan Burt
Director of Operations,
National Grid ESO

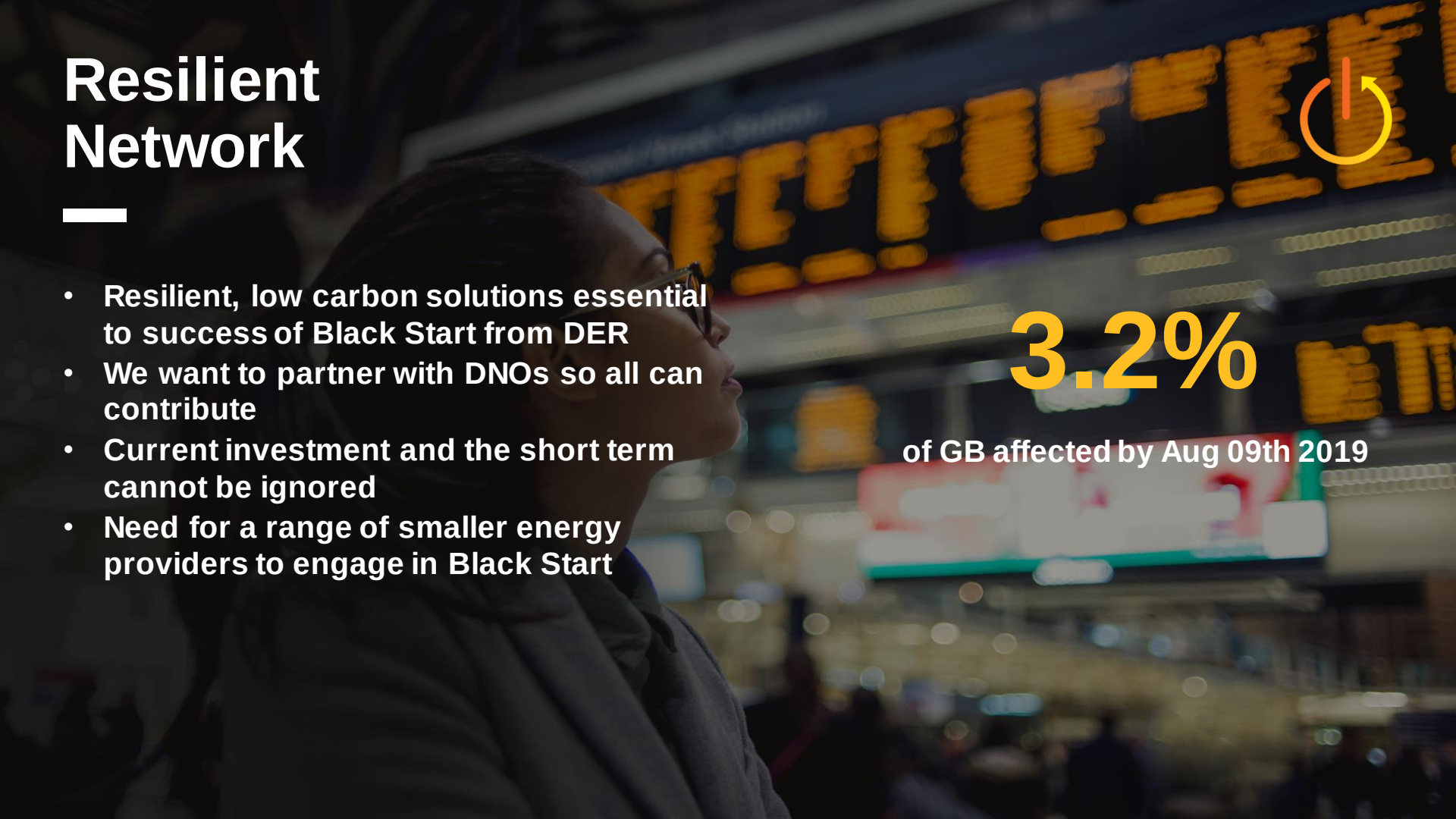


The ambition and opportunity

- Energy industry is changing
- National Grid ESO has set our ambition:
  Ability to Operate a zero Carbon system by 2025
- Electricity usage is growing year on year
- We're all using electricity in more ways than ever before
- Our aim is to use DER to respond to Black Start
- Distributed ReStart project partnership
- 3 year project, including live trials

Resilient Network

- Resilient, low carbon solutions essential to success of Black Start from DER
- We want to partner with DNOs so all can contribute
- Current investment and the short term cannot be ignored
- Need for a range of smaller energy providers to engage in Black Start



3.2%

of GB affected by Aug 09th 2019

The Power of three

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Roisin Quinn
Head of National Control & Distributed Restart Sponsor, National Grid ESO

Eric Leavy
Head of Transmission & Steering Committee Member, SPEN

Charlotte Higgins
Innovation Lead & Steering Committee Member, TNEI

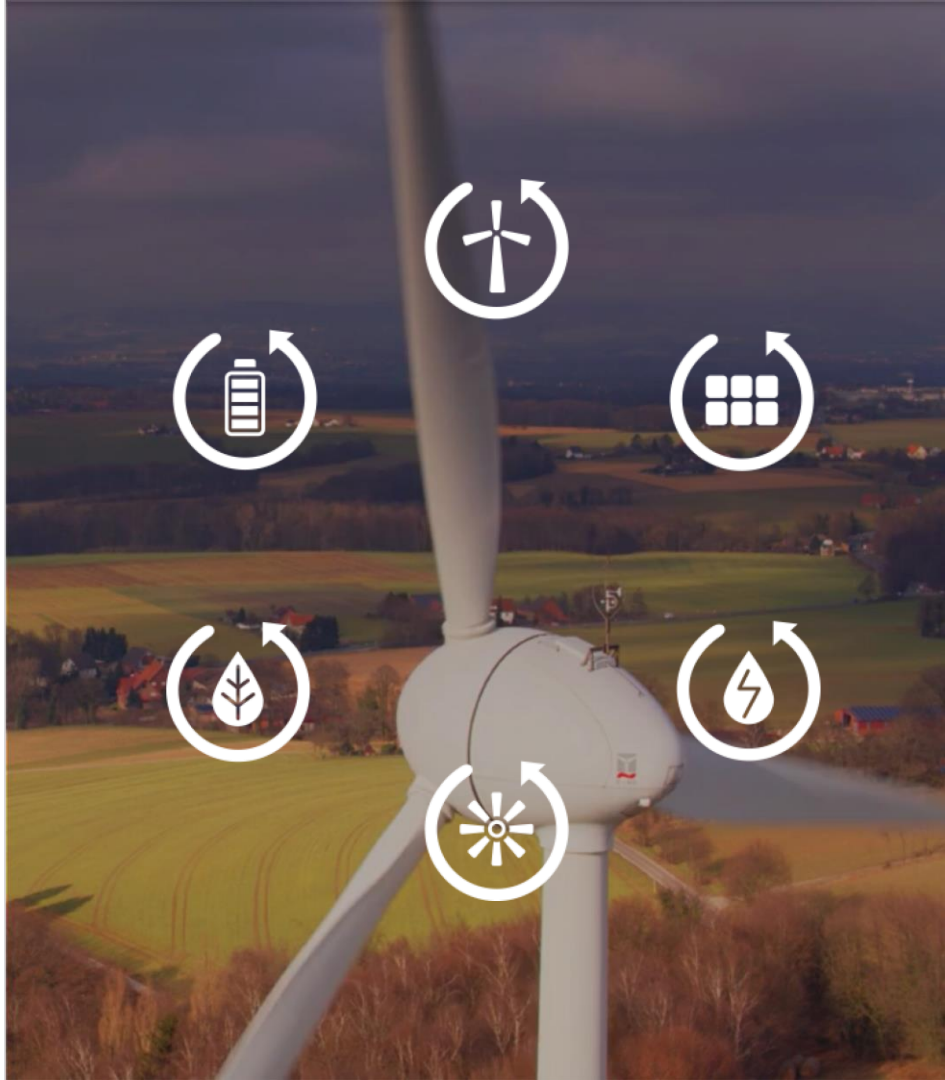
Distributed ReStart

Roisin Quinn
Head of National Control & Distributed Restart Sponsor, National Grid ESO

The Power of three

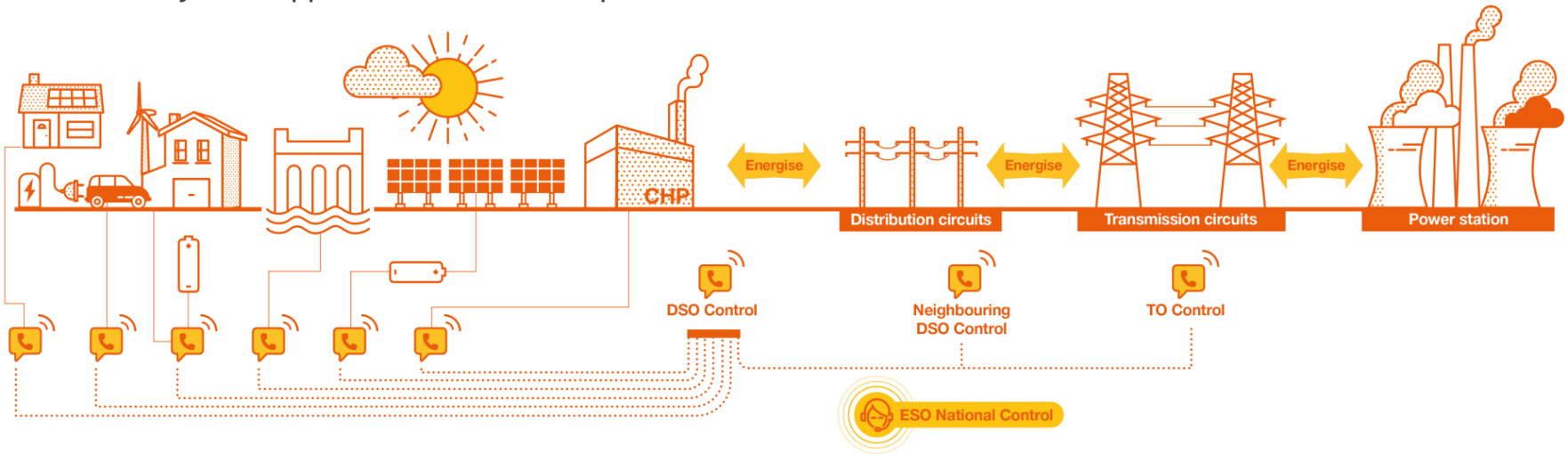
- **Drawing on our strengths**
  - Operational excellence
  - Network expertise
  - Modelling specialism

- **Project Goals**
  - Demonstrate the end to end technical process
  - Integration into business processes
  - Futureproof our solutions



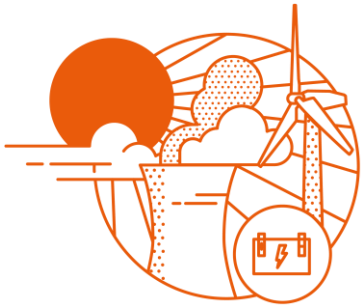
Enabling a Low Carbon Future

- Incorporation of low carbon technologies will reduce environmental impact
- Engaging new providers will introduce additional competition
- A whole system approach will be developed



Project Structure

Project Lead: Peter Chandler



Power Engineering & Trials

Lead:
Neil Miller

Organisational Systems & Telecommunications

Lead:
Joanna Carter

Procurement & Compliance

Lead:
Sophie Corbett

Knowledge Dissemination

Lead:
Emma Penhaligon

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Eric Leavy
Head of Transmission &
Steering Committee Member,
SPEN

The fundamental issue which the project must embrace

Many DER's have been established with Islanded operation out of scope
Installations are typically optimised for cost efficiency therefore:

- are designed without the features and facilities necessary for an "off the grid" start-up
- operating expertise of personnel on site is restricted through lack of exposure to whole system issues

What we are proposing to do
The expected pathway towards trials

- **Provide some means of starting initial generation**
- **Provide some means of absorbing energy (as an alternative to impact on consumers)**
- **Adapt the distribution network to permit safe island operation**
  - Provide earthing of system
  - Provide protection systems
- **Develop an operational control and system operation hierarchy and protocols**

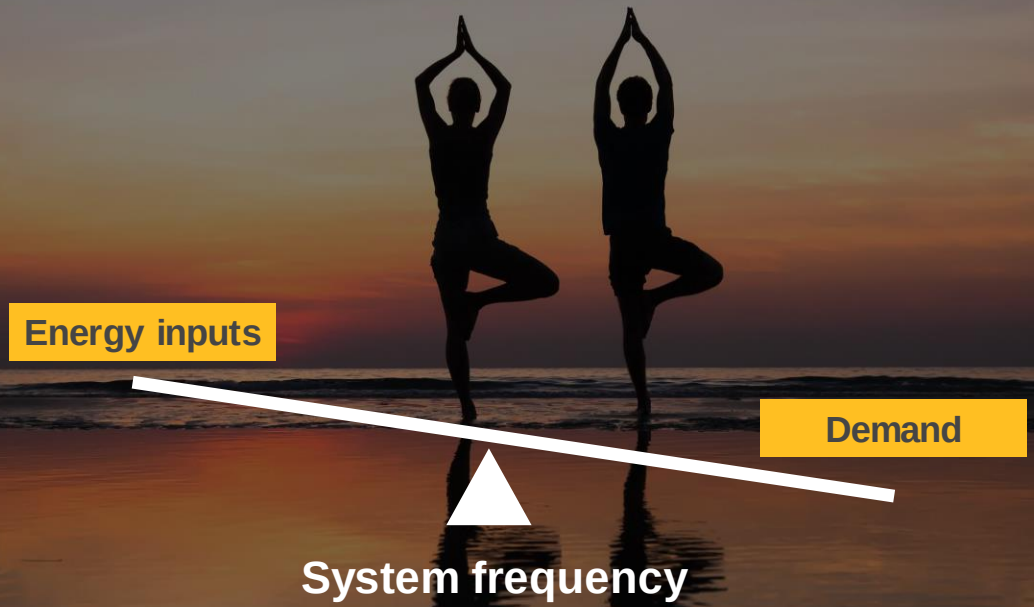
Demonstrate the simple island operation

Demonstrate a black start of the simple island

Extend the island to connect further generation

- **Operate multiple sources of generation in parallel**
- **Check stability against a range of disturbances**

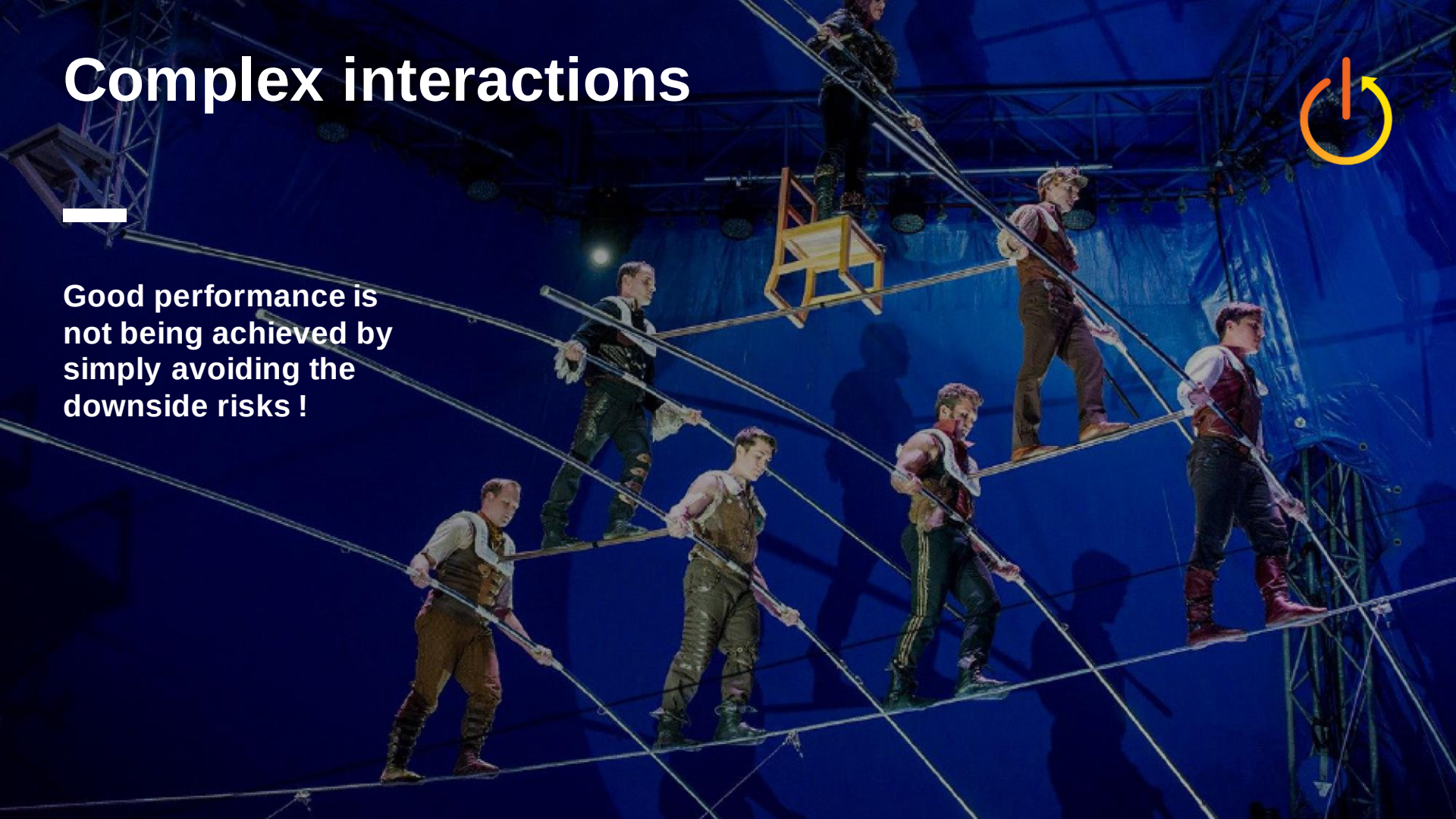
Energy sources and demands must be finely balanced at all times!



Primary goal therefore is to grow the generation and demand CAREFULLY as quickly as can be achieved
Stability under these early conditions will require demand control to be sophisticated and automatic

Energy sources and demands must be finely balanced at all times!

Complex interactions



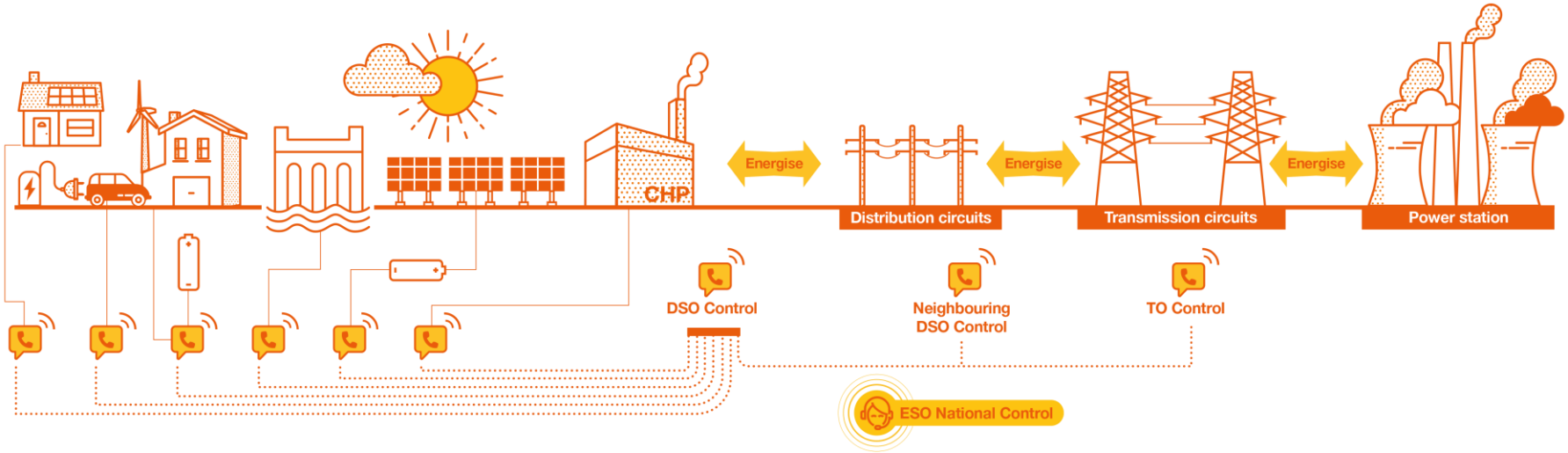
Good performance is not being achieved by simply avoiding the downside risks !

The power island must start with a single source of energy and a controllable or dispatchable load

- Effective island control
- Some human oversight
- Local controllers

- Automation
- Some network load despatch via scada

- Adequate headroom within the energy source



Robust real time communications to support a distributed power island operation

Closing observations

Simply demonstrating that something is possible does not mean it is readily achievable

- If it is difficult then skill and practice will be required
- Incentive to attract enough participants
- Will the show always perform on demand?
- Further incentive to turn out and deliver

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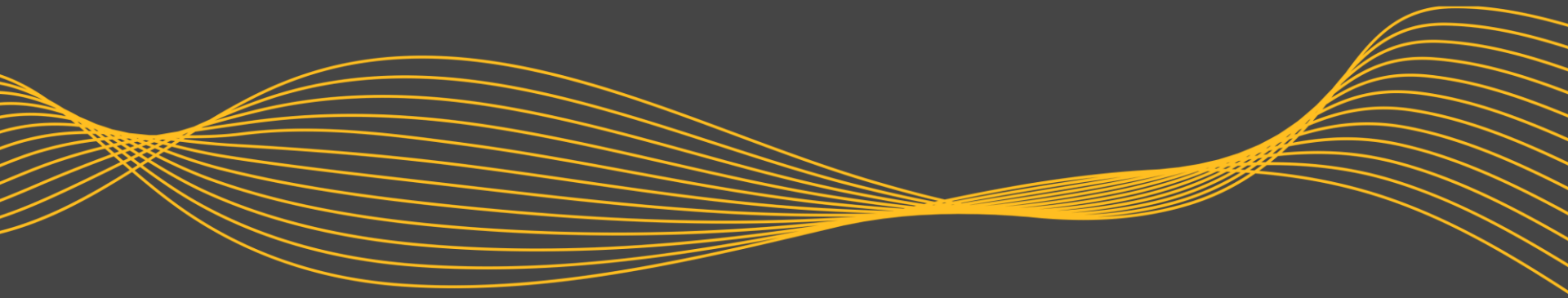
Charlotte Higgins
Innovation Lead &
Steering Committee Member,
TNEI



Introducing TNEI

Independent specialist energy consultancy

- Expertise in generator technology
- Specialist modelling/analysis of transmission and distribution networks across UK and internationally
- Passionate about network innovation and decarbonisation
- Part of the Distributed Restart Team

Non-Traditional Technology Capability and Functionality

Performance Matrix for Black Start and Restoration Capabilities

- Technologies currently deployed and operating around GB and novel technologies

Based on extensive research and stakeholder engagement

- Over 50 stakeholders contacted
- Input from over 27 stakeholders covering a wide range of technologies
- Ongoing inputs from stakeholders is appreciated

All non-traditional technologies investigated have characteristics and capabilities that could be utilised to support a Black Start and restoration effort.

DER Performance Matrix

Restoration Event Timeline	Site capability	Non-Traditional / DER Technology						
		Large Onshore Wind (>30MW)	Small Onshore Wind (<30MW)	Commercial Solar (PV)	Battery Energy Storage	Demand Side Response (I&C)	Electric Vehicles / V2G)	Synchronous DER
1. Shutdown Resilience	Plant resilience (shut-down, standby)	2	2	2	2	4	4	1
	Comms & Control resilience	2	3	3	3	5	5	2
2. Black Start Performance`	Self-starting of plant	3	3	3	2	5	5	1
	Grid-forming capability	3	3	3	2	5	5	1
	Demand Block Loading	2	3	4	3	3	5	1
	Reactive Power Support	1	1	4	1	5	5	2
	Frequency Control	1	1	1	1	5	5	2
	Dispatchability	2	3	4	2	1	5	1
3. Restoration Capability	Power Island joining & support	2	2	2	1	2	5	1
	Sustainability (reliability)	2	3	4	3	1	5	1

DER
Performance Matrix

Case studies - Technical assessment

- A thorough analysis of existing technical capability of DER and networks – challenges (and solutions) but technically viable.
- Case studies chosen with a variety of DER, network topologies, network characteristics and restoration options to provide learning on a GB-wide basis.

Power Systems Analysis

- Focuses on a set of case studies to derisk live trials. Demonstration results – validate analysis.
- Significant value-add through further power systems analysis for a wide range of DER and restoration options.

Please keep letting us know how we are doing!

Questions?