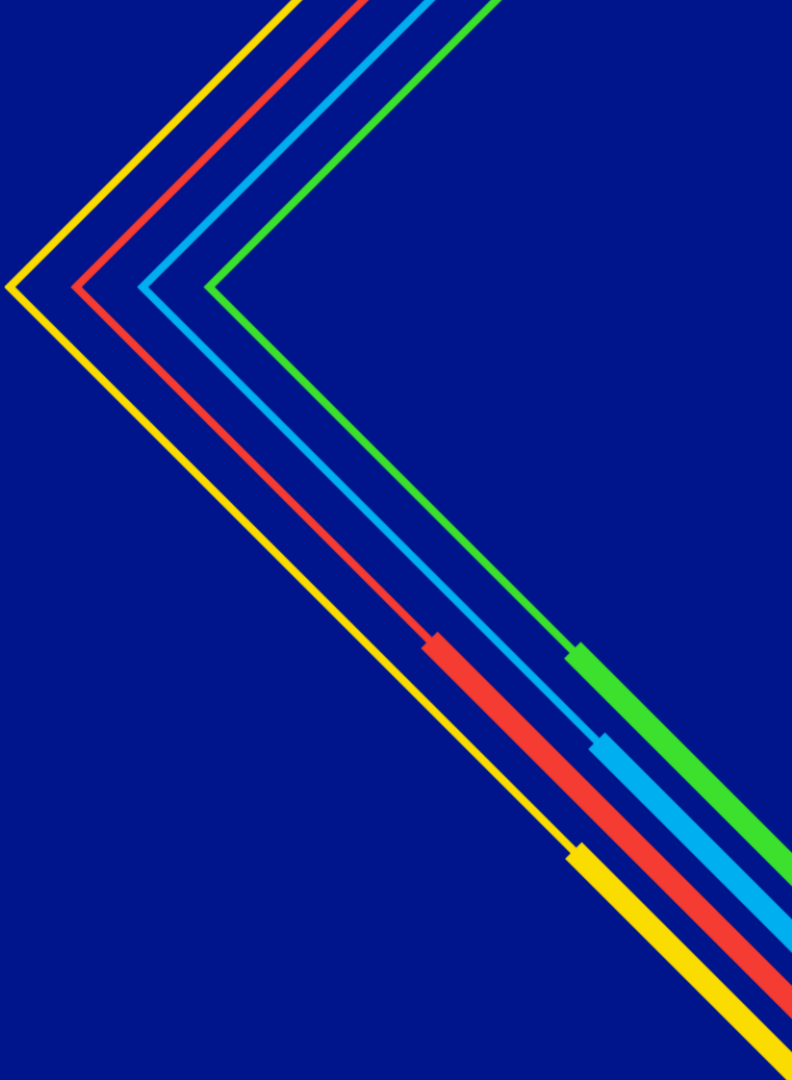




Electricity
Distribution

***A showcase of the ways in which
distribution network operators
(DNOs) can explore voltage
management on their networks***

Laurence Hunter

Innovation and Deployment Engineer

Greg Shirley

Innovation and Deployment Engineer

national**grid**

In 2007, our network was primarily serving demand customers...

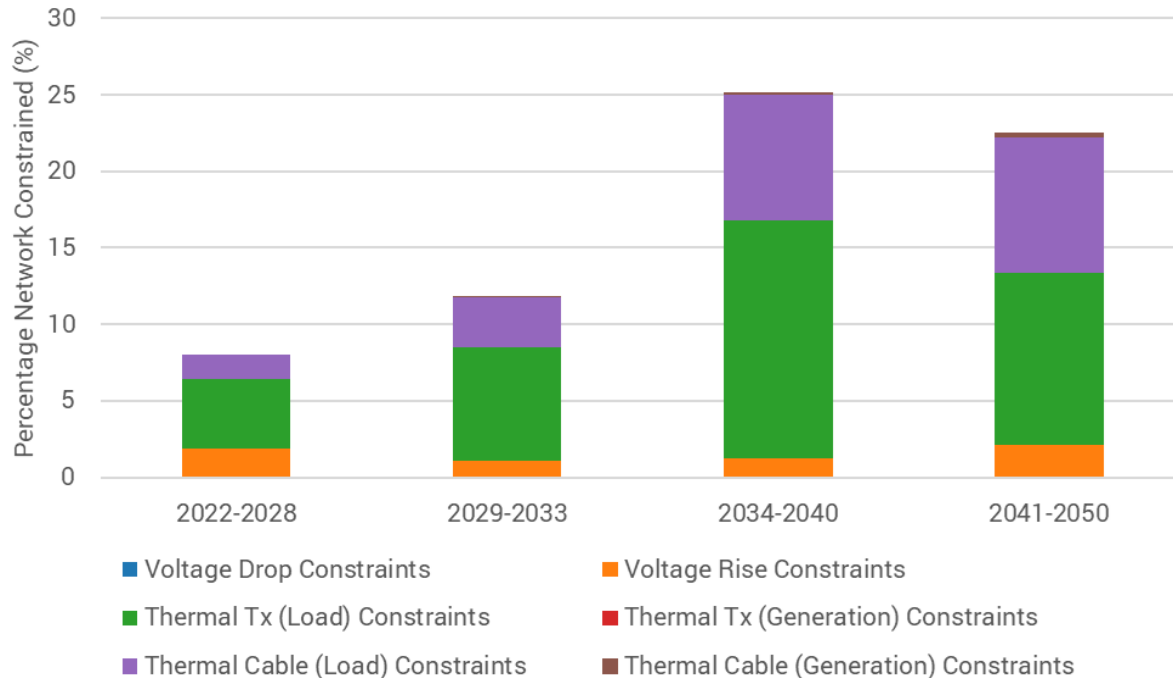


...but by 2025, solar connecting to the LV network can increase volts



Voltage rise is one of the many constraints forecast to impact our LV network

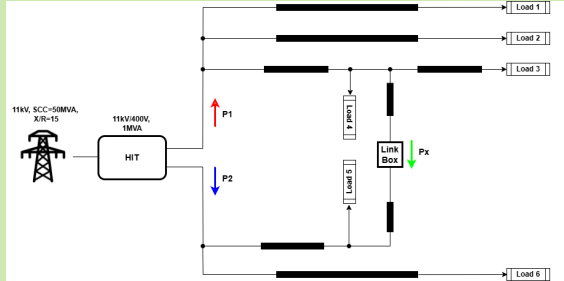
- Voltage rise issues forecast to affect mostly domestic LV networks
- Thermal issues begin to occur in greater numbers



Source: EA Technology, SILVERSMITH

What are our options?

Innovative approaches



LV ACT



Phase Switch System



Hybrid Intelligent Transformer



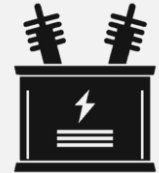
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On Load Tap Changer



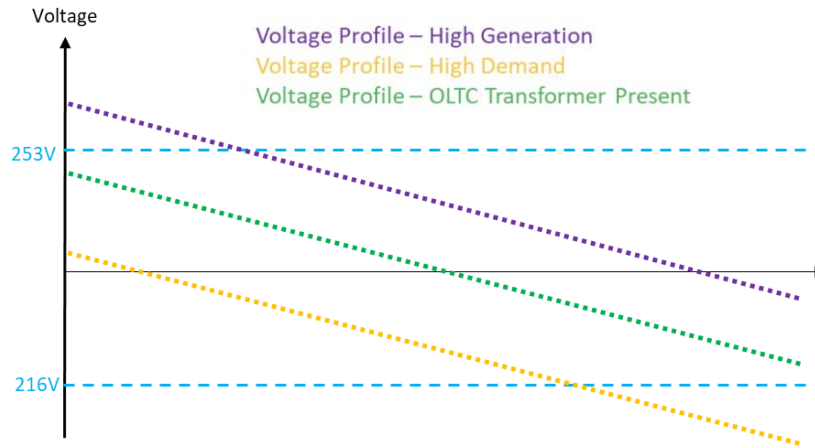
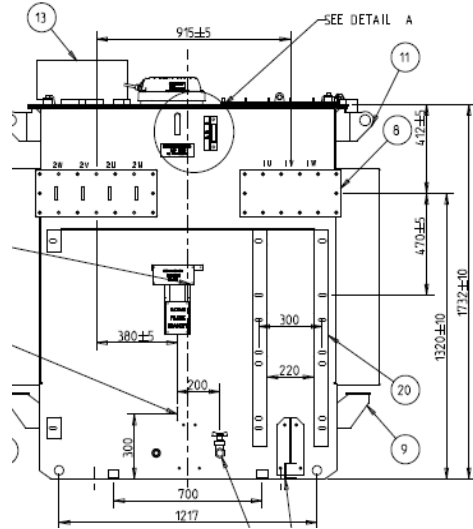
Adjust Tap Position



New equipment

On Load Tap Changer (OLTC) Distribution Transformer

Roll-out of a technology proven during a previous innovation project



- Avoid high/low voltage constraints
- Voltage regulation: +12.5% to -7.5% in 2.5% taps
- Varies all 3 phases simultaneously
- Simple passive operation – option to control voltage setpoint dynamically

Solution	TRL	Deployment Cost	Solves Voltage Constraints	Solves Thermal Cable Constraints	Phase Balancing
On Load Tap Changing Transformer	High	Medium	+12.5%/-7.5%		

LV ACT (1/2): Hybrid Intelligent Transformer

NIA project exploring:

- Use of hybrid intelligent transformer (HIT) for voltage control, phase balancing, harmonic reduction.
- Concept of smart transformer to control active power around a low voltage network loop.

Benefits:

- Remove both voltage and thermal constraints.
- Finer voltage control.
- Voltage control on phases independently.
- Reduce harmonics.

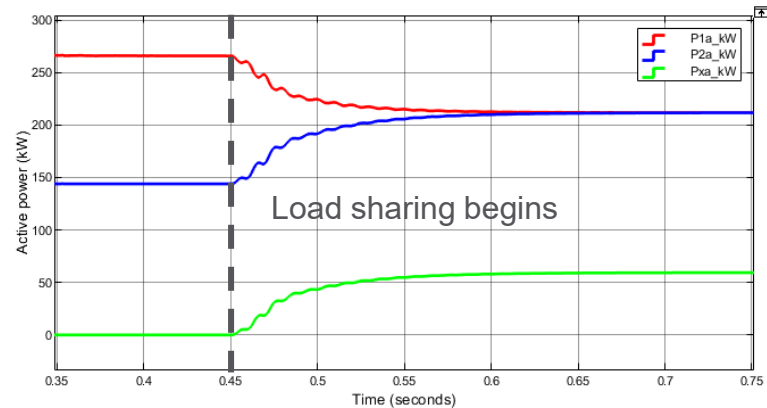
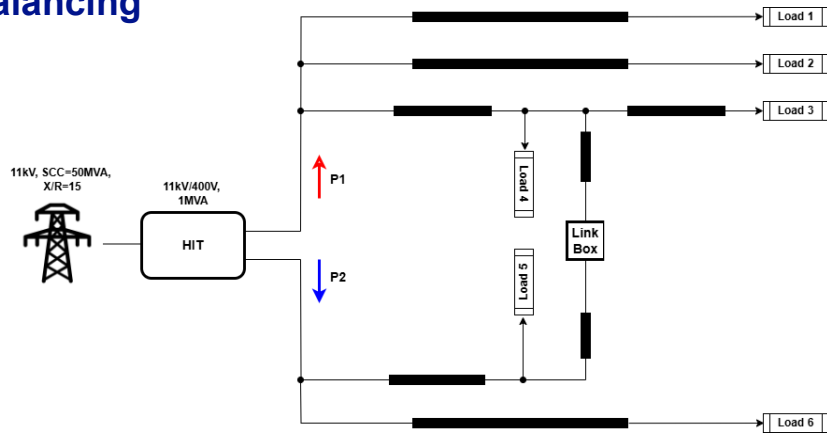


Solution	TRL	Deployment Cost	Solves Voltage Constraints	Solves Thermal Cable Constraints	Phase Balancing
Hybrid Intelligent Transformer	Low	Medium			

LV ACT (2/2): LV power sharing using HIT and Smart Link Box

Exploring power sharing concept to remove thermal cable constraints >>>> Avoid conventional reinforcement

Benefit from other smart transformer capabilities (voltage management, harmonic reduction, phase balancing)

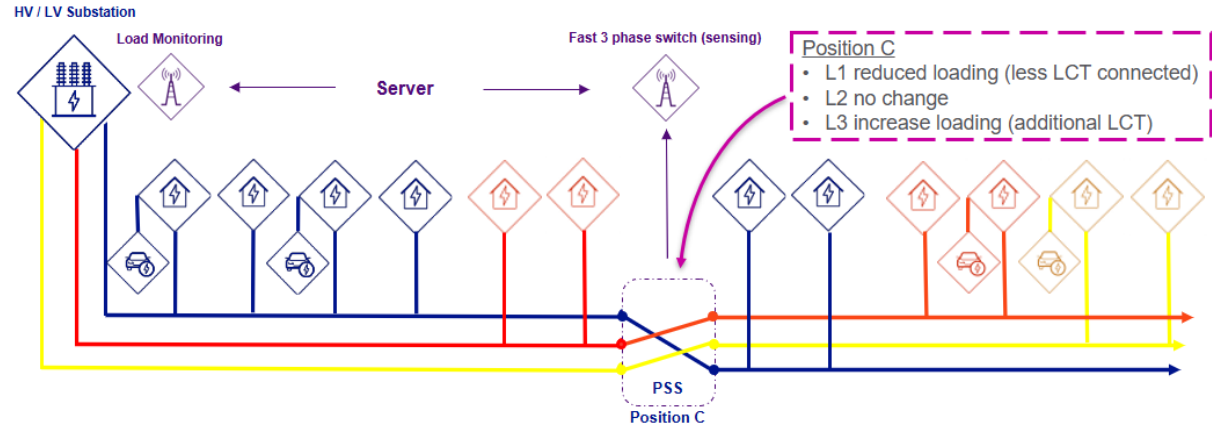


Solution	TRL	Deployment Cost	Solves Voltage Constraints	Solves Thermal Cable Constraints	Phase Balancing
LV ACT	Low	Medium			

Phase Switch System

- PSS enables dynamic reconfiguration of phases along LV feeder to reduce phase imbalance.
- It dynamically shifts load among the three phases, rather than permanently assigning customers to one fixed phase.
- Builds on an existing prototype (from a prior NIA project) and progresses it toward market readiness, with lab and field trials, design improvements, and deployment planning tools.

How does it work?



Solution	TRL	Deployment Cost	Solves Voltage Constraints	Solves Thermal Cable Constraints	Phase Balancing
Phase Switch System	Medium	Medium			

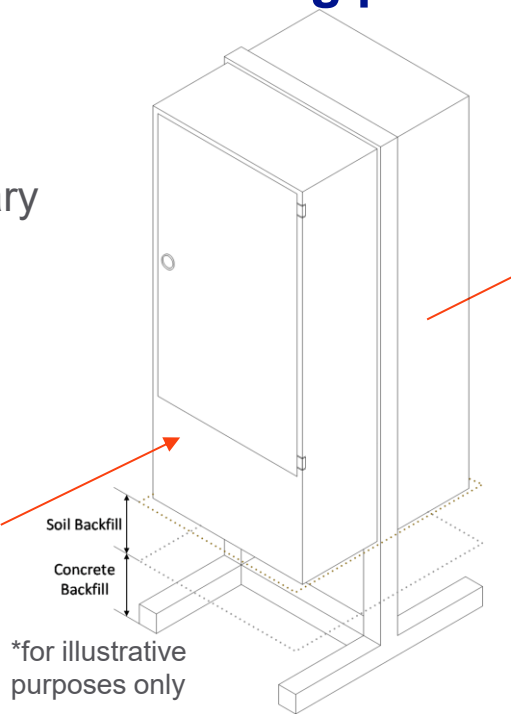
OBELISC – Three phase connections balancing phases

OBELISC is developing a new 3 phase cabinet, which allows for greater phase balancing

Service Cabinet installed on boundary edge, outside

DNO side:

- 3 phase service connection
- 3 phase cutout



Customer side includes:

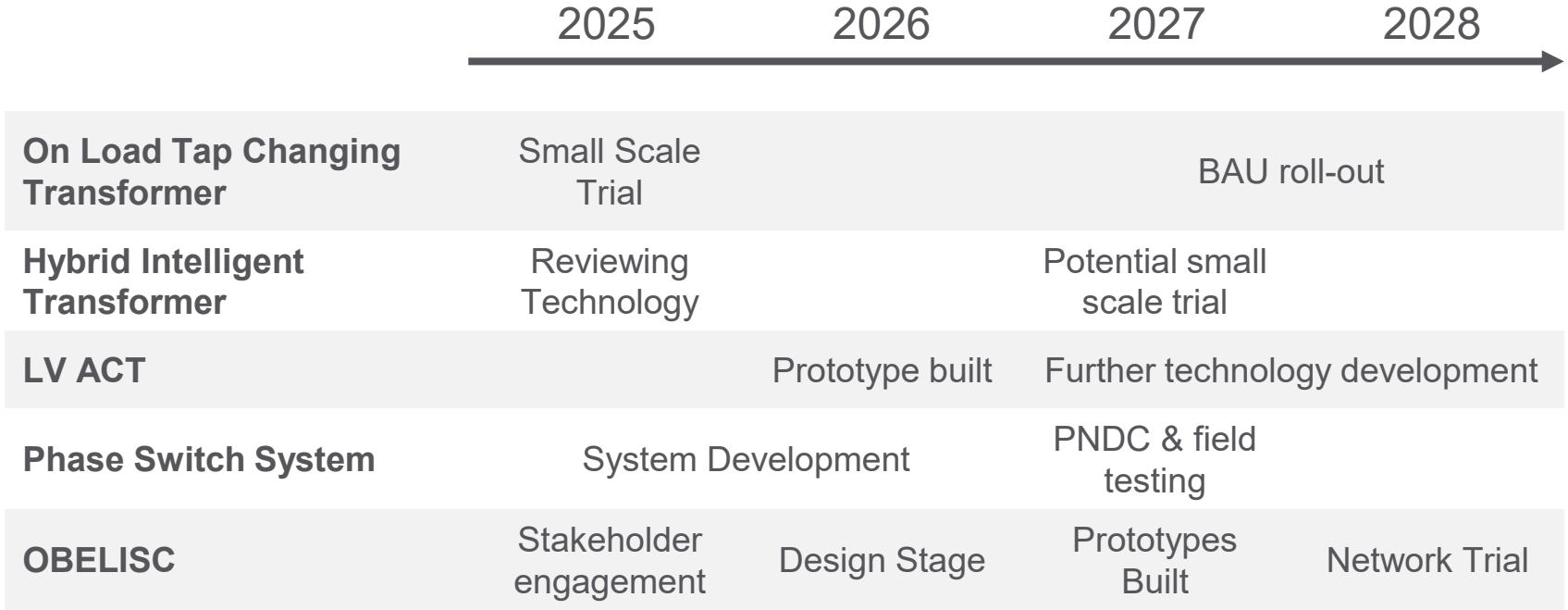
- Existing single phase supply to home
- Any low carbon technologies (EV, heat pump etc.)
- Meter (may also look at meter-less version)

Solution	TRL	Deployment Cost	Solves Voltage Constraints	Solves Thermal Cable Constraints	Phase Balancing
OBELISC	Low	Low			

Comparison of approaches – where should they be used

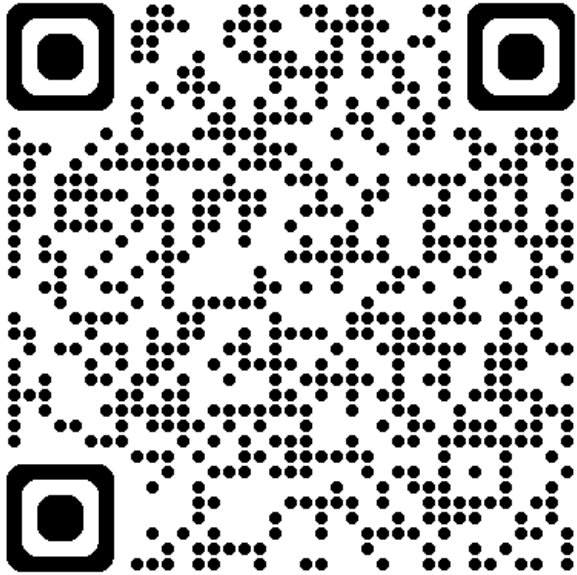
Solution	TRL	Deployment Cost	Solves Voltage Constraint	Solves Thermal Cable Constraint	Phase Balancing
Conventional Reinforcement	High	Medium/High			
On Load Tap Changing Transformer	High	Medium			
Hybrid Intelligent Transformer	Medium	Medium			
LV ACT	Low	Medium			
Phase Switch System	Medium	Medium			
OBELISC	Low	Low			

What is the result?



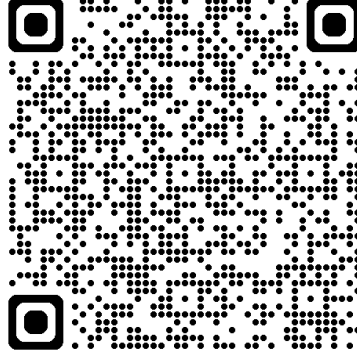
To learn more about these projects head to our website!

NGED Innovation

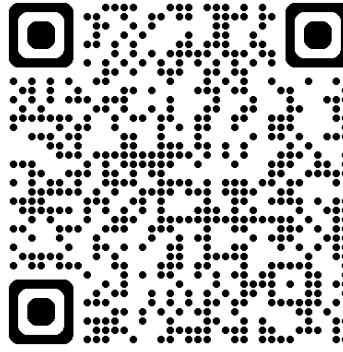


<https://commercial.nationalgrid.co.uk/innovation>

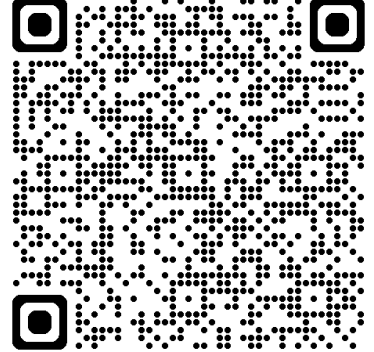
OBELISC



PSS



LV ACT



We welcome feedback and questions at our stand or in the Q&A

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