

# Agenda – LEO Stakeholder Advisory Board 22/01/20

Welcome and Safety Moment	Mel Bryce	10:00 – 10:10
Introductions	All	10:10 – 10:30
LEO Overview – Progress to date	Mel Bryce	10:30 – 11:00
LEO Wider Context	All	11:00 – 11:30
Break		11:30– 11:45
WP4 – Future System Planning	Malcolm McCulloch	11:45 – 12:15
Lunch		12:15 – 13:00
WP2 – Flexibility Exchange Developers	Kelsey Devine	13:00 – 13:30
WP3 – ‘Plug in Projects’	Barbara Hammond	13:30 – 14:00
WP5 - Transition	Kyle Murchie	14:00 – 14:30
Reflections and Next Steps	Maxine Frerk	14:30 – 15:00



# Introductions



# Project LEO

Local Energy Oxfordshire

Maximising Prosperity from Local Energy Systems



Barbara Hammond  
Low Carbon Hub



Benjamin Mousseau  
EDF Energy



Professor Rajat Gupta  
Oxford Brookes University



Paige Mullen  
Nuuve



Llewelyn Morgan  
Oxfordshire County Council



Malcolm McCulloch  
Oxford University



Kelsey Devine  
Piclo

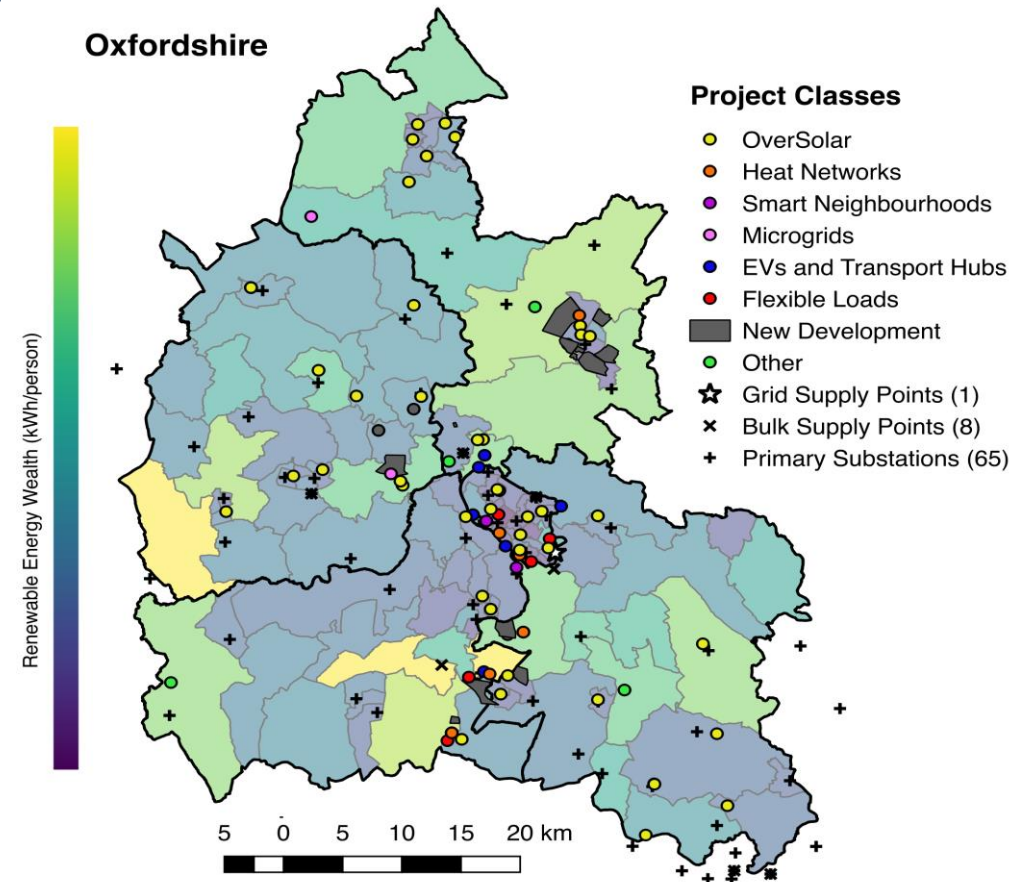


Stevie Adams  
SSEN



# Objectives

1. Demonstrate a commercially viable local energy market that operates at the scale of a county.
2. Demonstrate assets working behind the meter to maximise commercial opportunity.
3. Inform the role of a DSO acting as a neutral market facilitator in a market with competitive range of service providers.
4. Inform the use of smart flexibility, including storage, Vehicle to Grid (V2G), smart heat, to overcome grid constraints.
5. Develop new business approaches to fund renewable generation in a post-FiT world.
6. Inform the interaction between different emerging commercial Marketplace Operators with the DSO Market Integrator and DER/Service Providers.
7. Deliver a model for future local energy system mapping across all energy vectors through the use of multiple data sources and analysis tools





Grid Management Platform



Whole System Coordinator



Neutral Market Facilitation



Flexibility Exchange

Other Flexibility Exchange



Technology Platform(s)

Value Optimisation

Aggregation

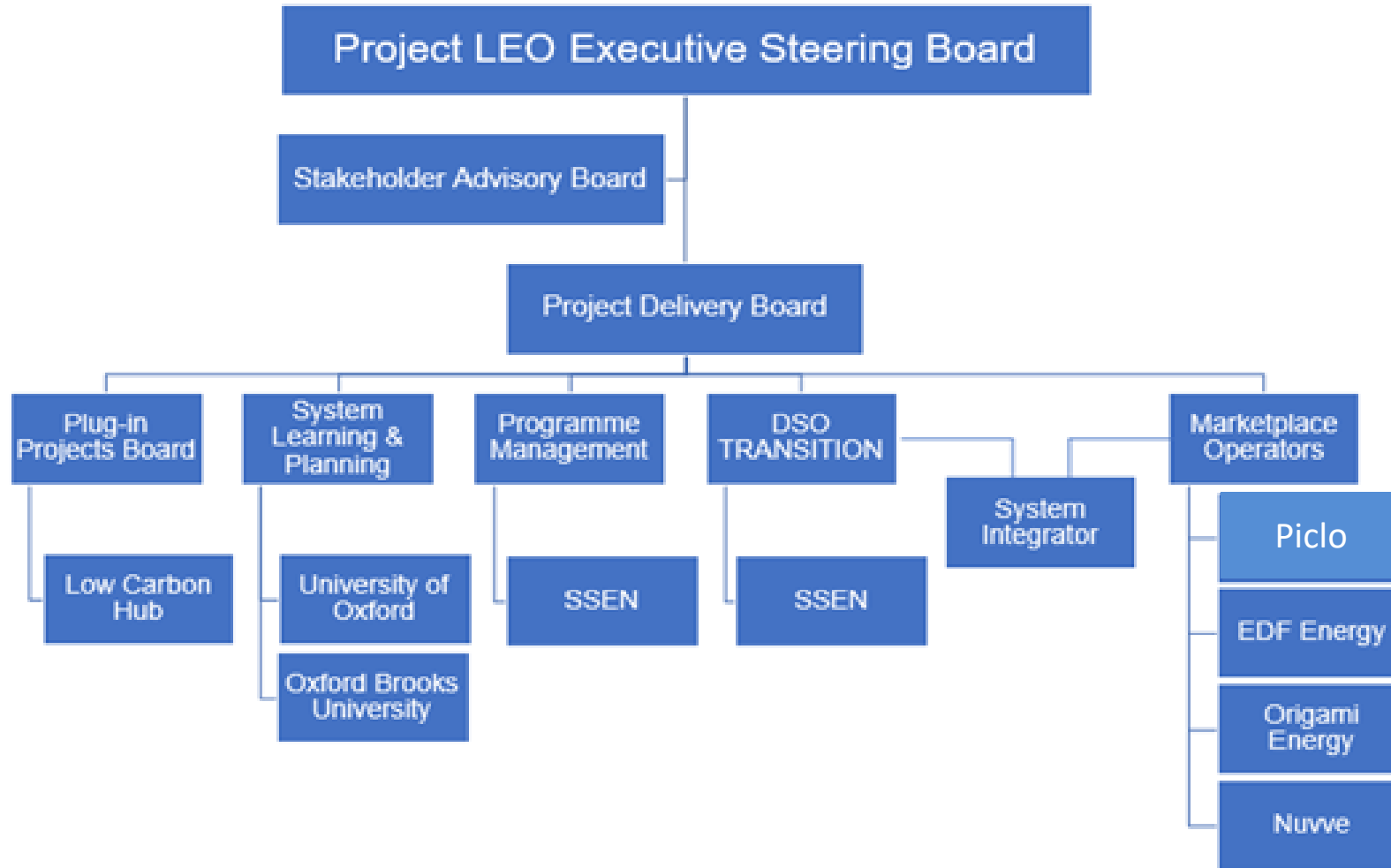
Flexibility Trade



# Progress



# Governance and Funding



## The first 6 months:

### Challenges

- Governance
- Recruitment
- Funding Adjustments

### Learnings

- IUK/Ofgem Funding
- Forecasting
- Governance Duplication



# Minimum Viable System (MVS)

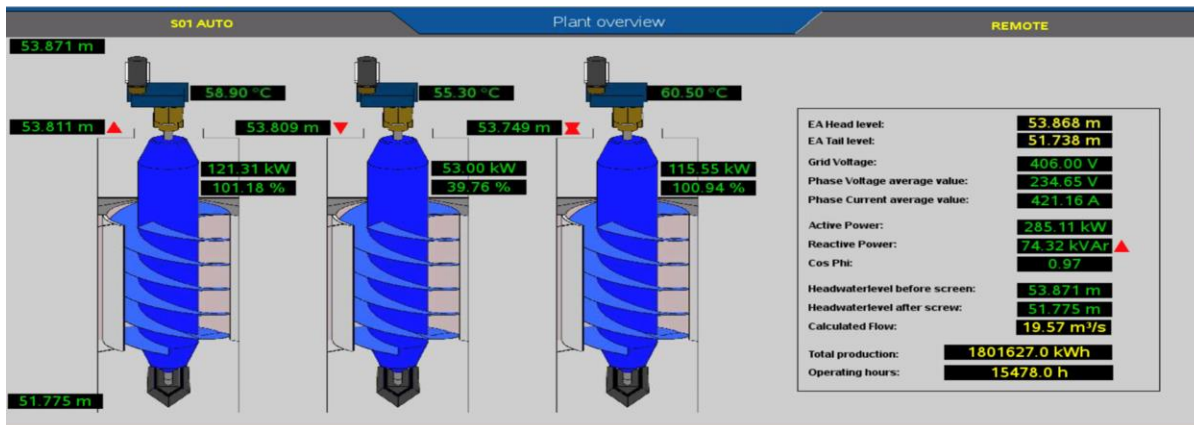
## MVS A1 OBC + Battery – Successful Dispatch



## MVS A3 Sackler Library – Delayed Dispatch



## MVS A2 Sandford Hydro (Generation) – Failed Dispatch

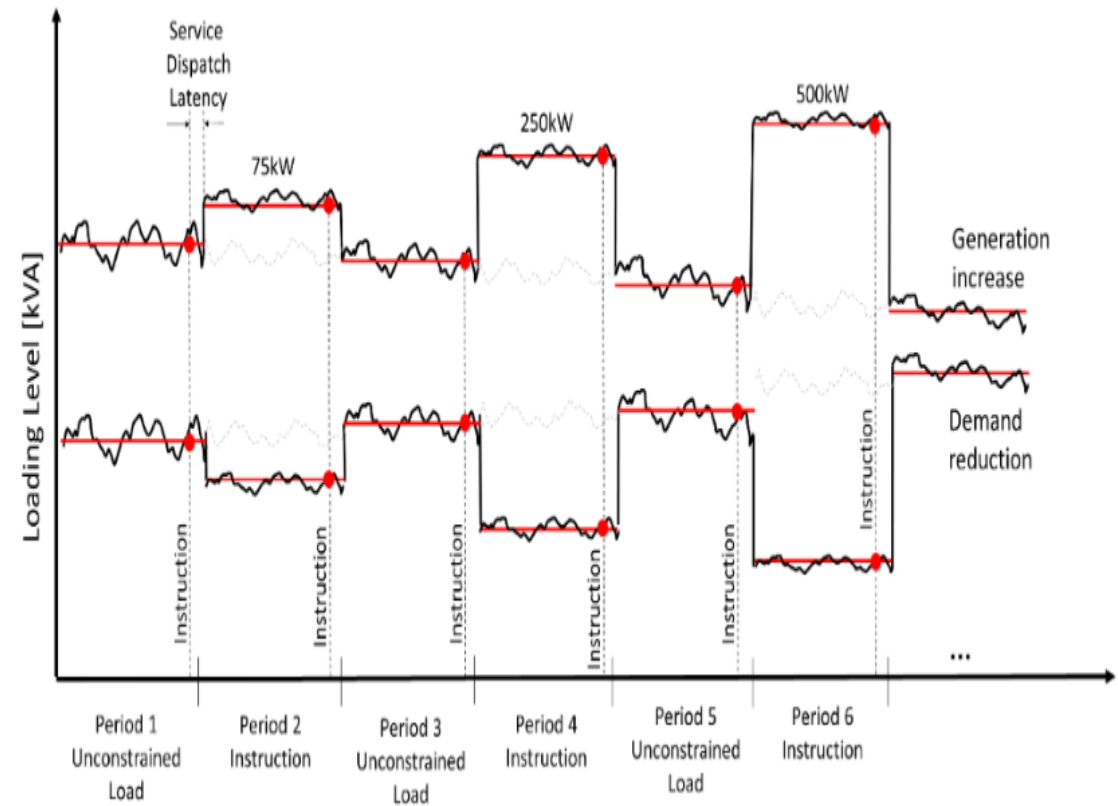
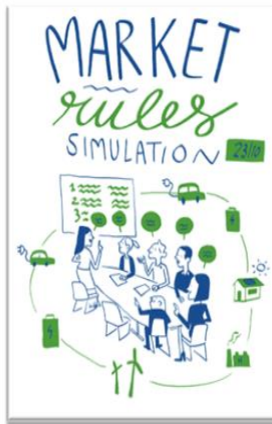


## Learnings

- Battery Configuration
- Metering
- Water Levels
- Building Control Systems
- Contingency

# Flexibility Services and Market Games

- 5 services
  - Peak and Constraint Management, STOR
  - Capacity Trading, Offsetting
- Documented Approach
- Market Simulation Events
- Development of Market Rules





Date: 12-14 November 2019  
Location: Paris, France



# Interest and Events

## Mitsubishi and TEPCO visit Oxfordshire for a fact-finding mission at Project LEO



MPs visit key multimillion-pound Oxfordshire project unlocking the UK's decarbonisation ambitions

Distribution, Innovations / 11 July 2019

# Oxford Mail

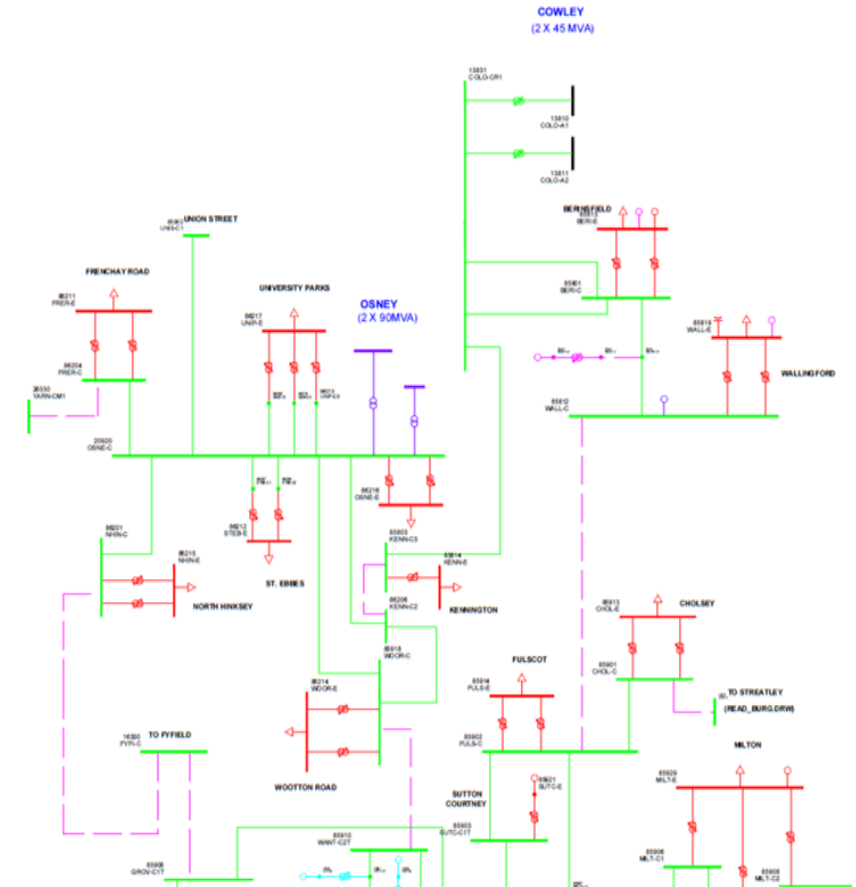


# Challenges



# Site Selection, Monitoring and Energy Planning

- Site Selection and Monitoring
  - 62 Primary (33/11kV) Substations, 6458 (11kV/LV) Secondary Substations
  - 89 sites provided by LCH, 120 OxU, 59 Oxfordshire Councils, 3 Nuvve
- Workshop Jan 30/31
  - 2/3 Primaries
  - 100 LV Monitors
  - Focus for participant recruitment by EdF and Origami
  - Aggregator Function
- Gaps in Technology
  - Trials tech type, wind, biomass
- LAEPs
  - Decarbonisation
  - Heat, Power, Gas, Energy Efficiency
  - Whole System Thinking
  - Clean Growth, Job Creation, Investor Confidence
- Marketing
  - Project LEO accelerating net zero



# Smart and Fair

- Equable Energy Transition
  - Essential Service with social licence to operate
  - Focus on Domestic Households
  - Pace of Change
- Ethical Framework
  - Fast and Fair
  - Communities, employers, government
- No one gets left behind – Example Electrification of Heat
- Role of suppliers and aggregators
- Regulatory TCR, entrenched organisations working together building regs/ofgem/planning

Financial

Tech Readiness

Personal and Social

Energy & Tech Usage

Dwelling and Local Area

Capability Lens



# What do we need from you?.....

- Strategic Direction
- Regulatory Alignment
- Fair Transition
- Wider Participation
- Are there any gaps?
- How best to replicate / disseminate learning
- Legacy of the project

# Thankyou





# LEO Wider Context



# Break



# Developing a **zero carbon** smart energy **system**

**Malcolm McCulloch**



**Maximising prosperity of local energy systems**



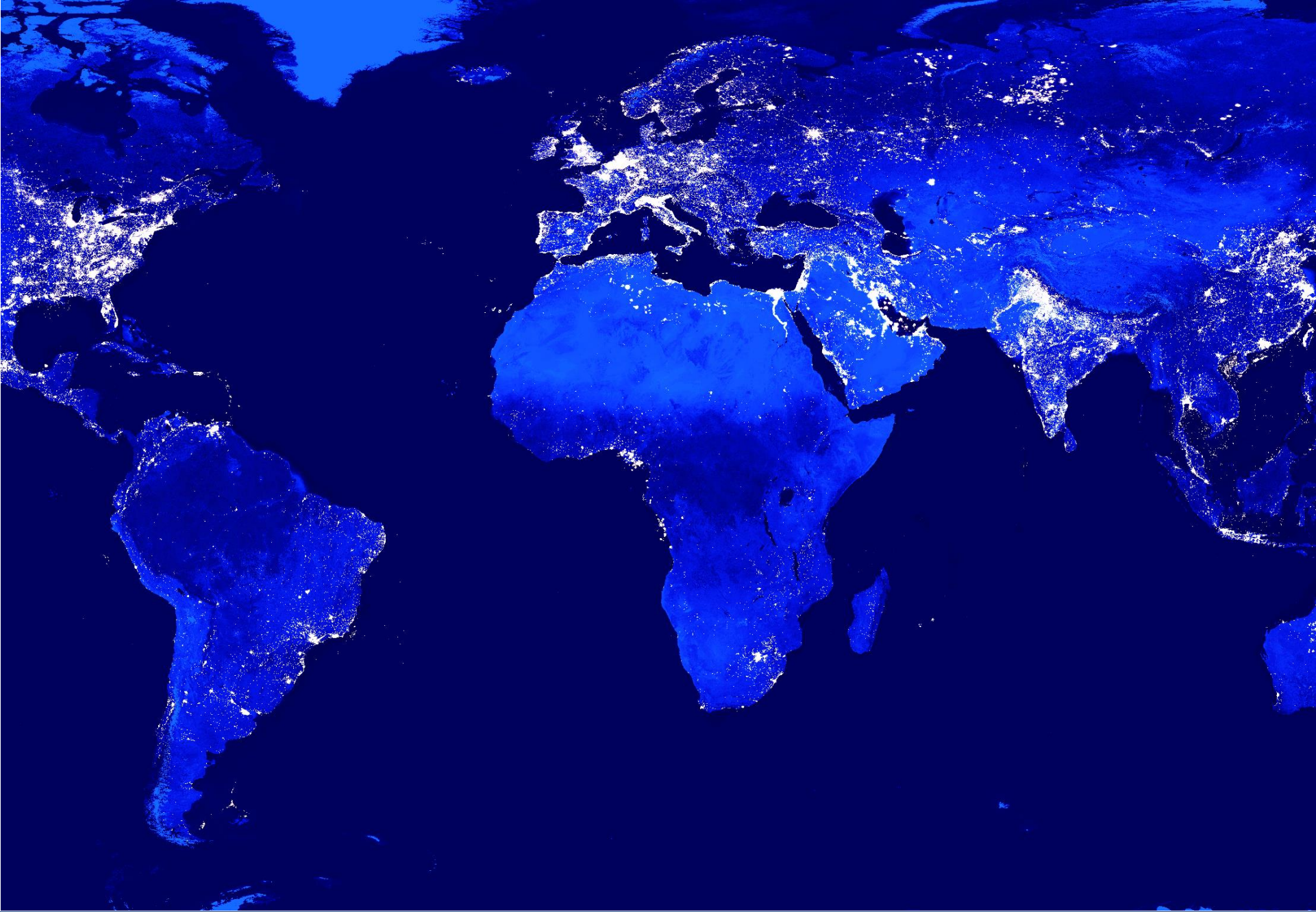
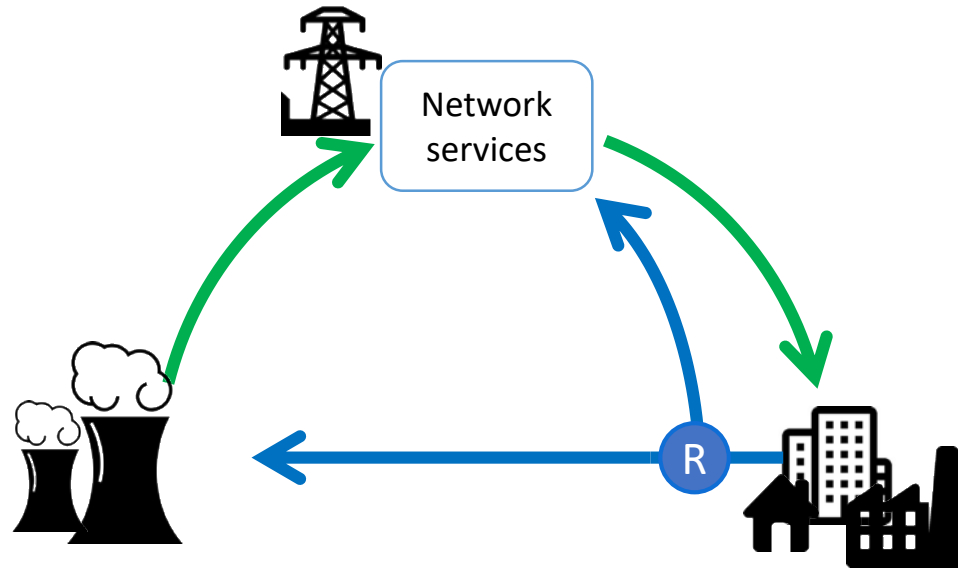




Photo Dave Price, CC BY-SA 2.0



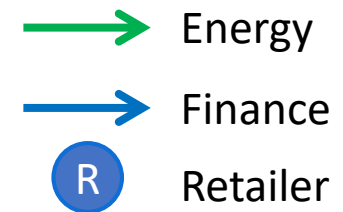
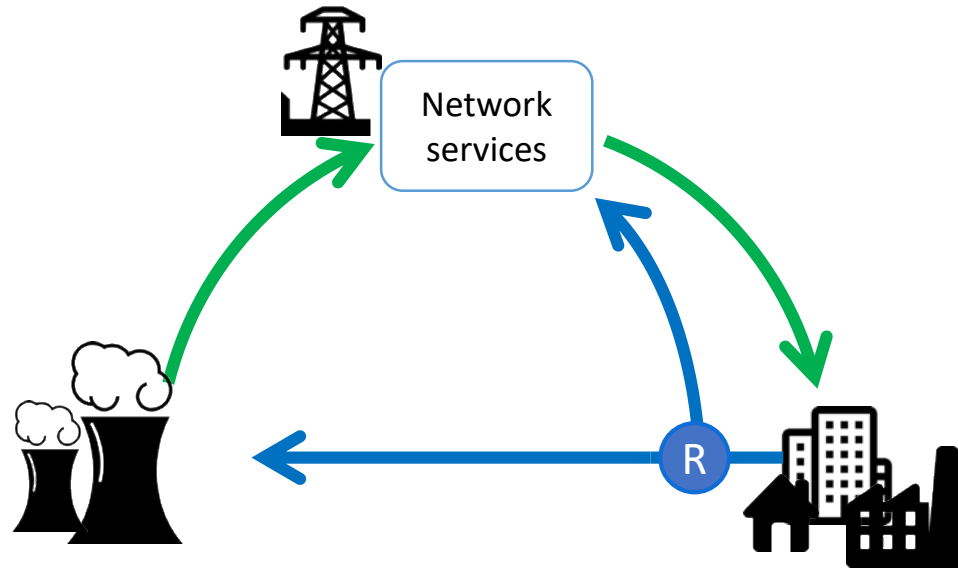
- Energy
- Finance
- Ⓡ Retailer

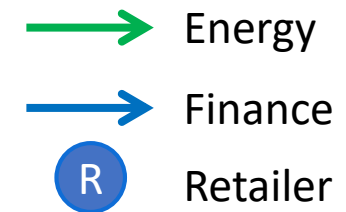
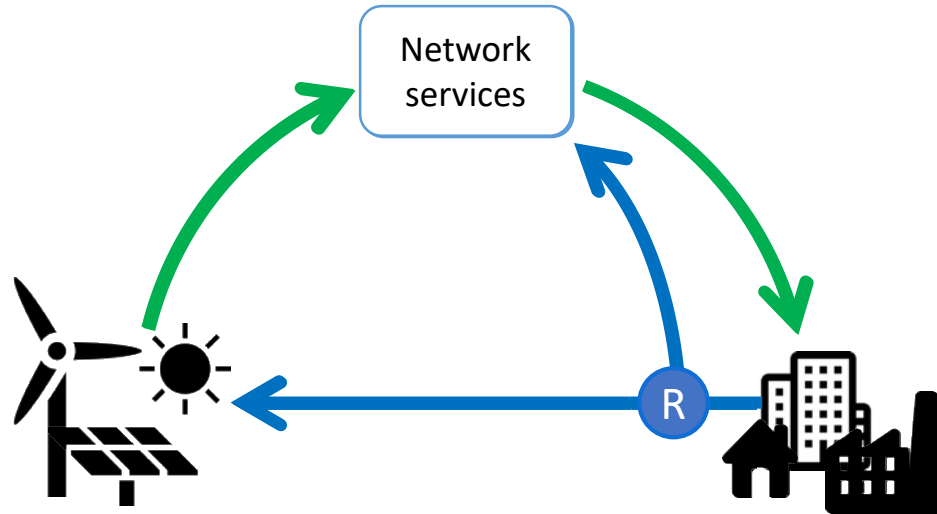




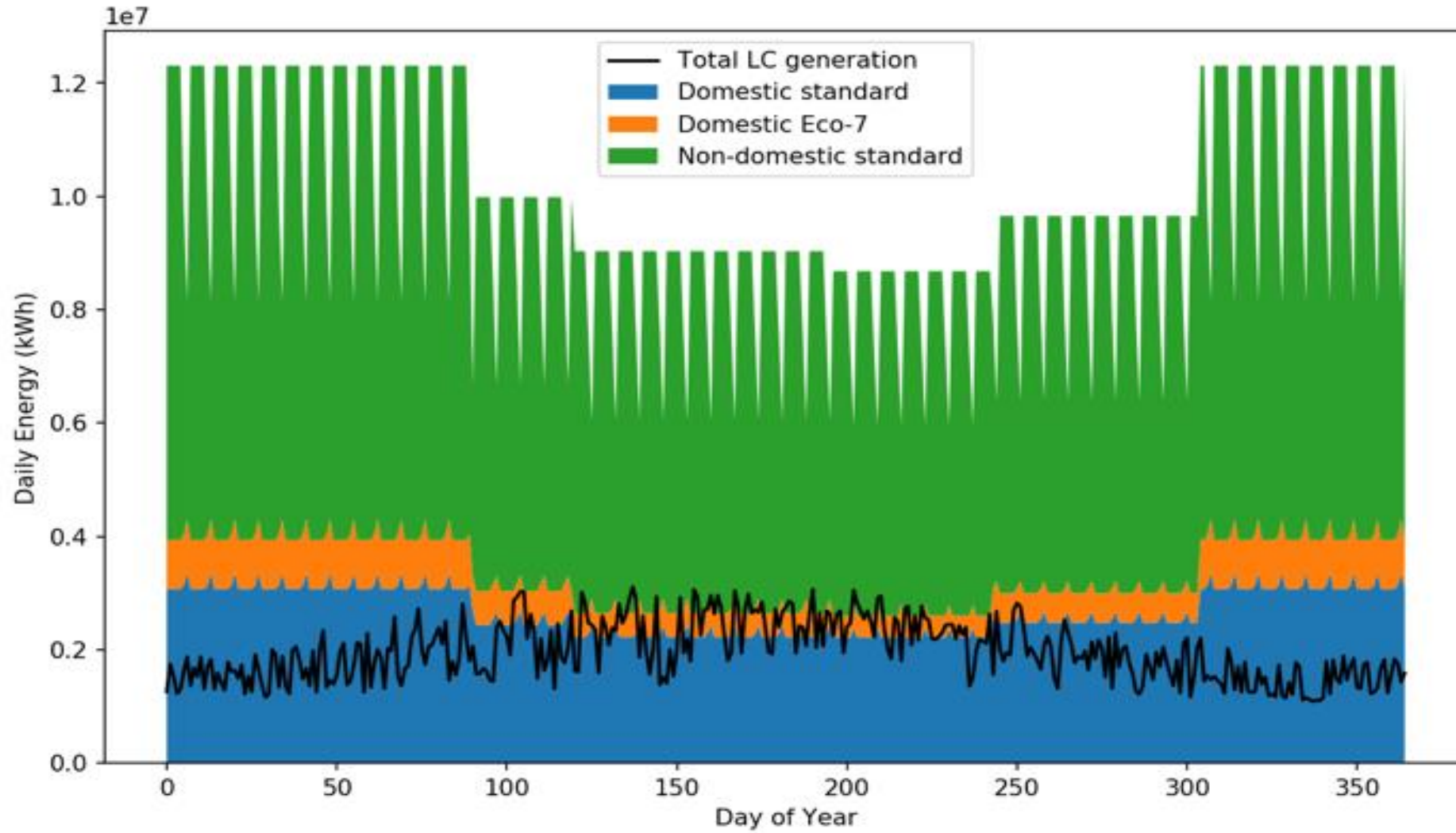




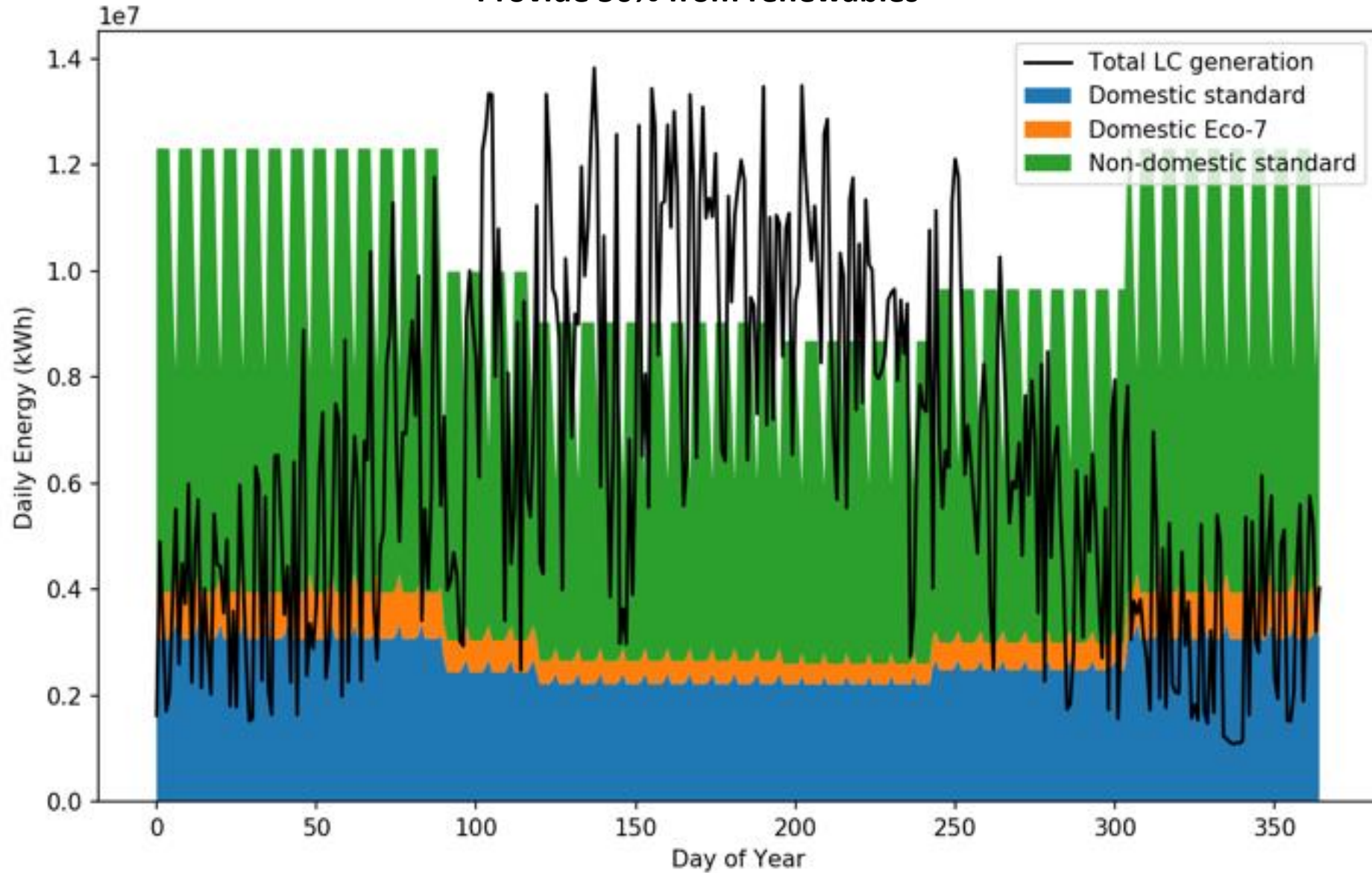




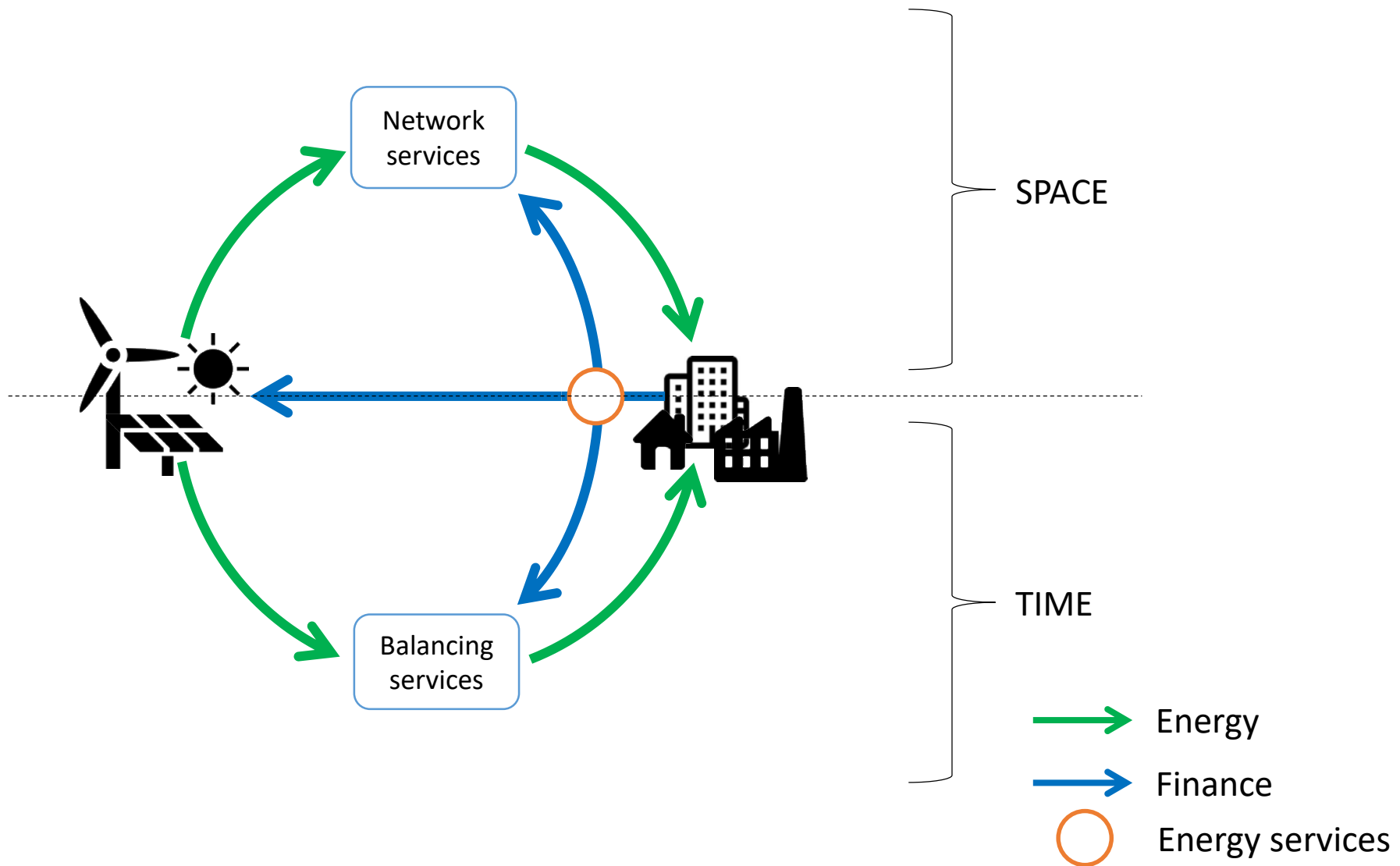
# Oxfordshire Electricity 2018, 300 MW

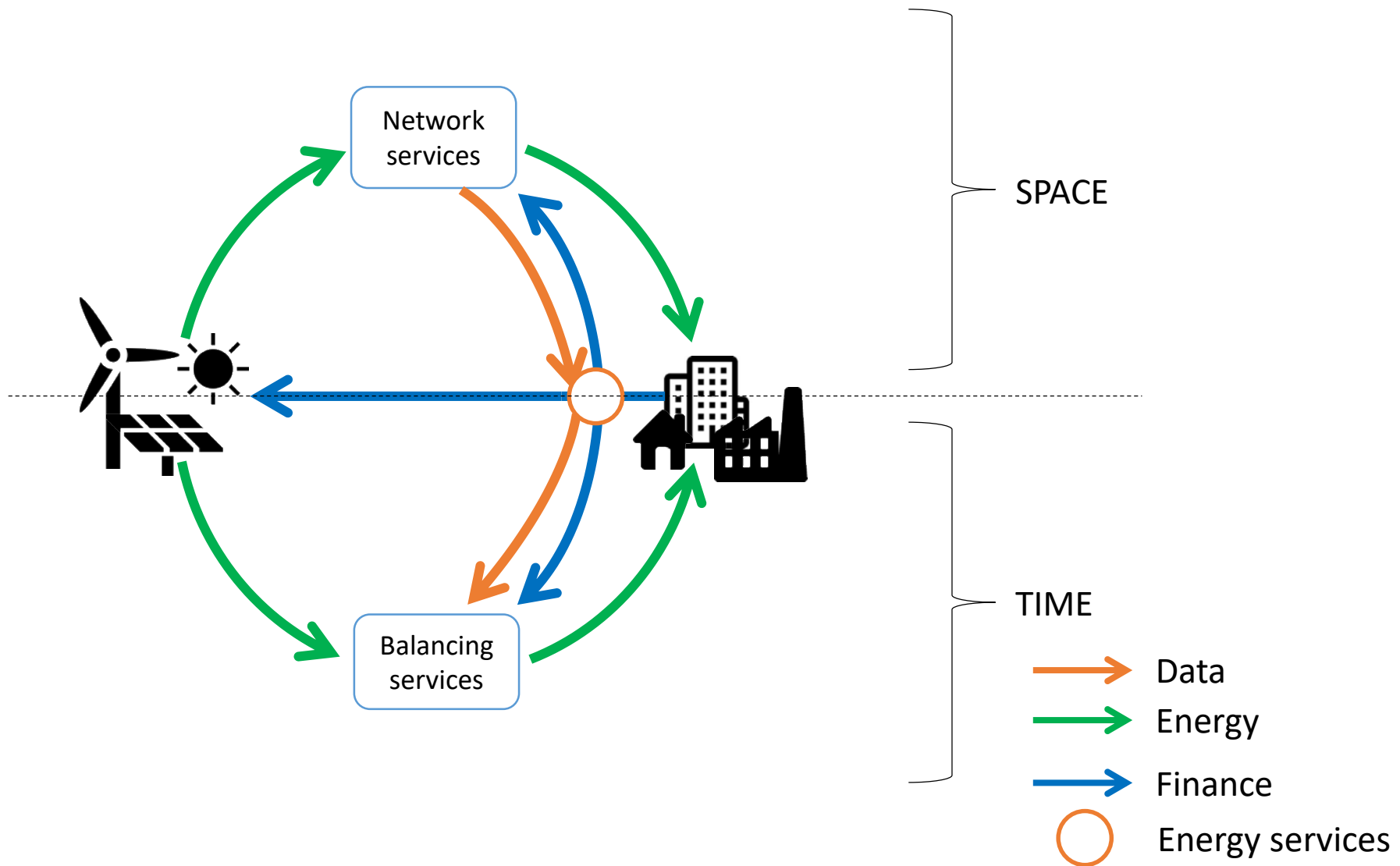


# Oxfordshire Electricity 2030, 1800 MW Provide 50% from renewables

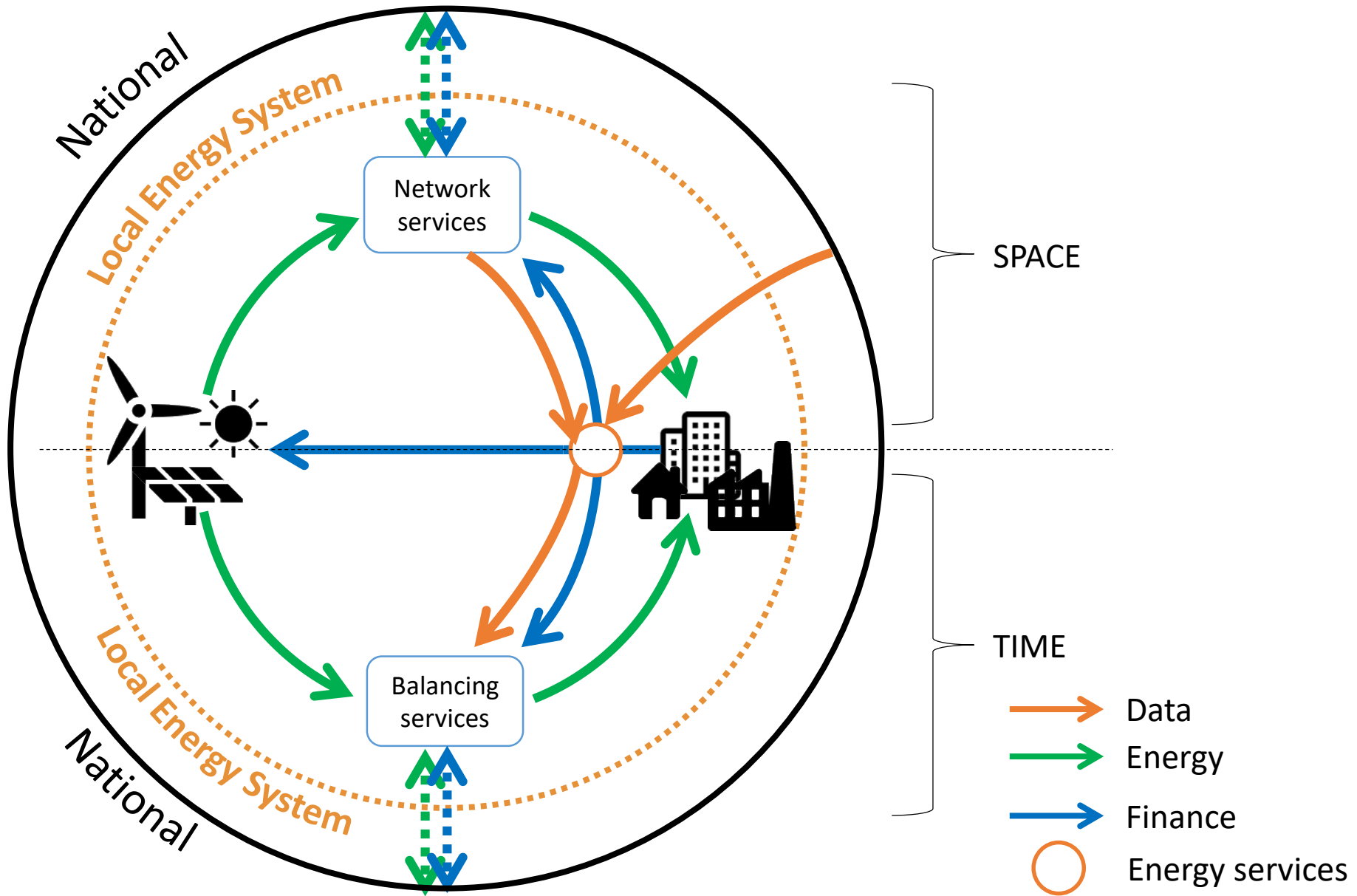


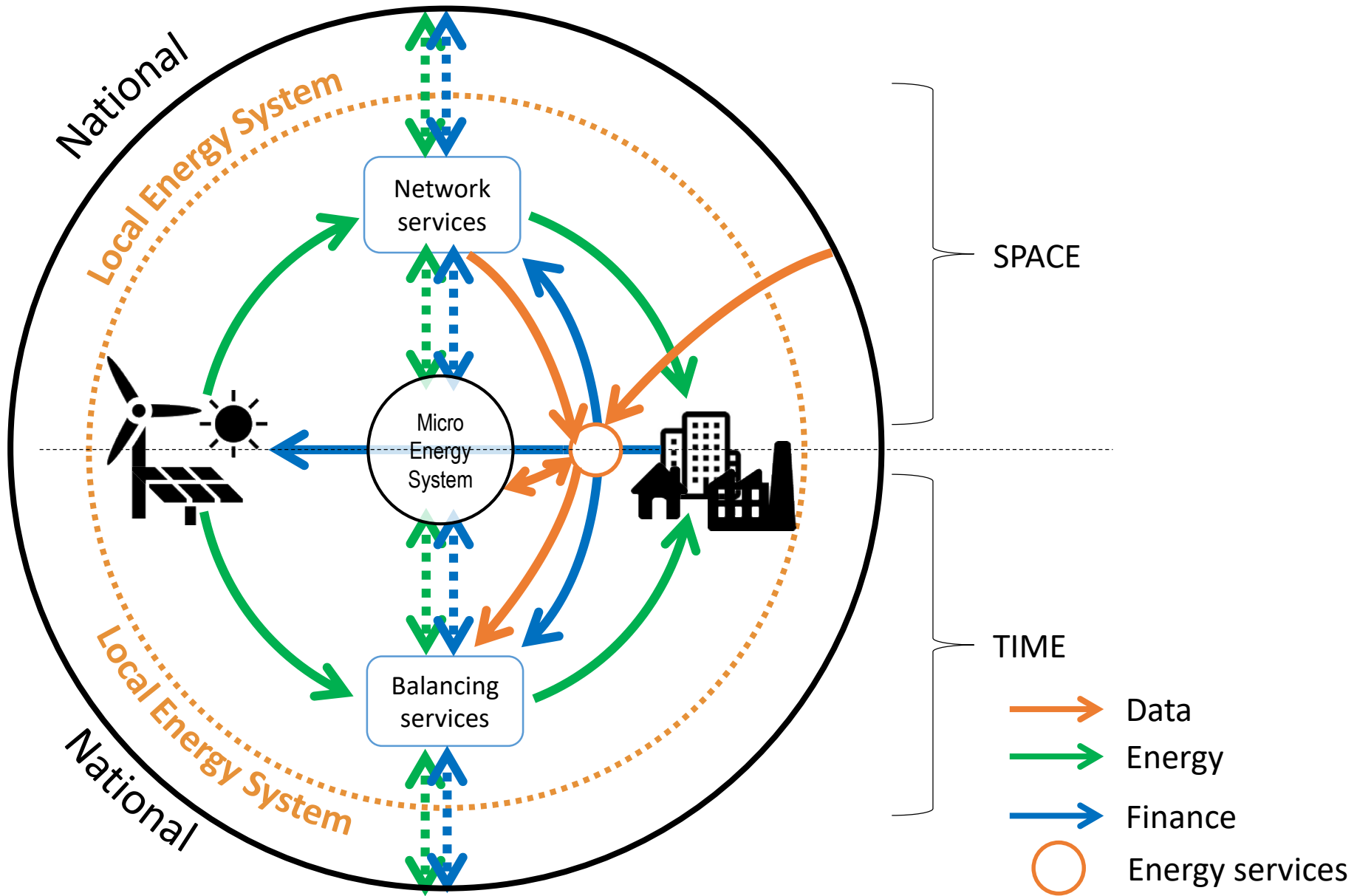


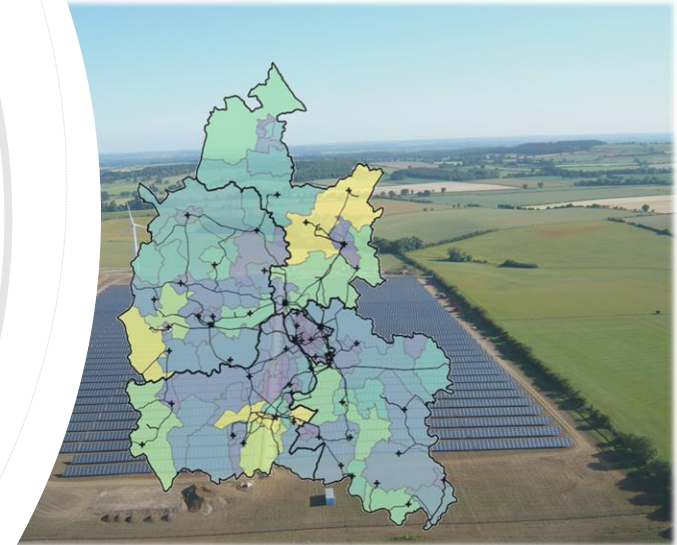


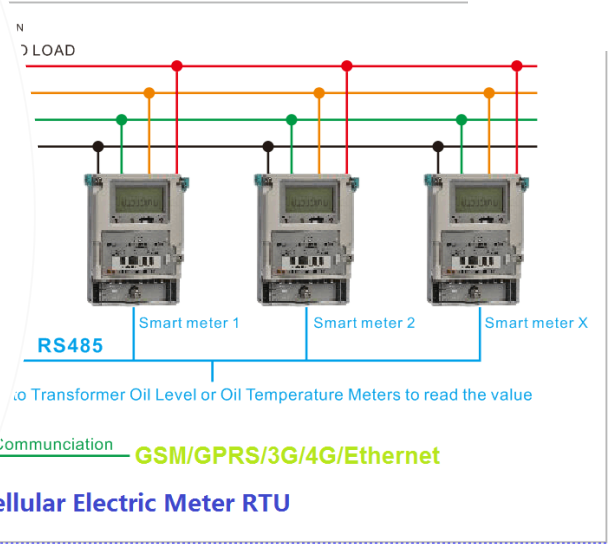
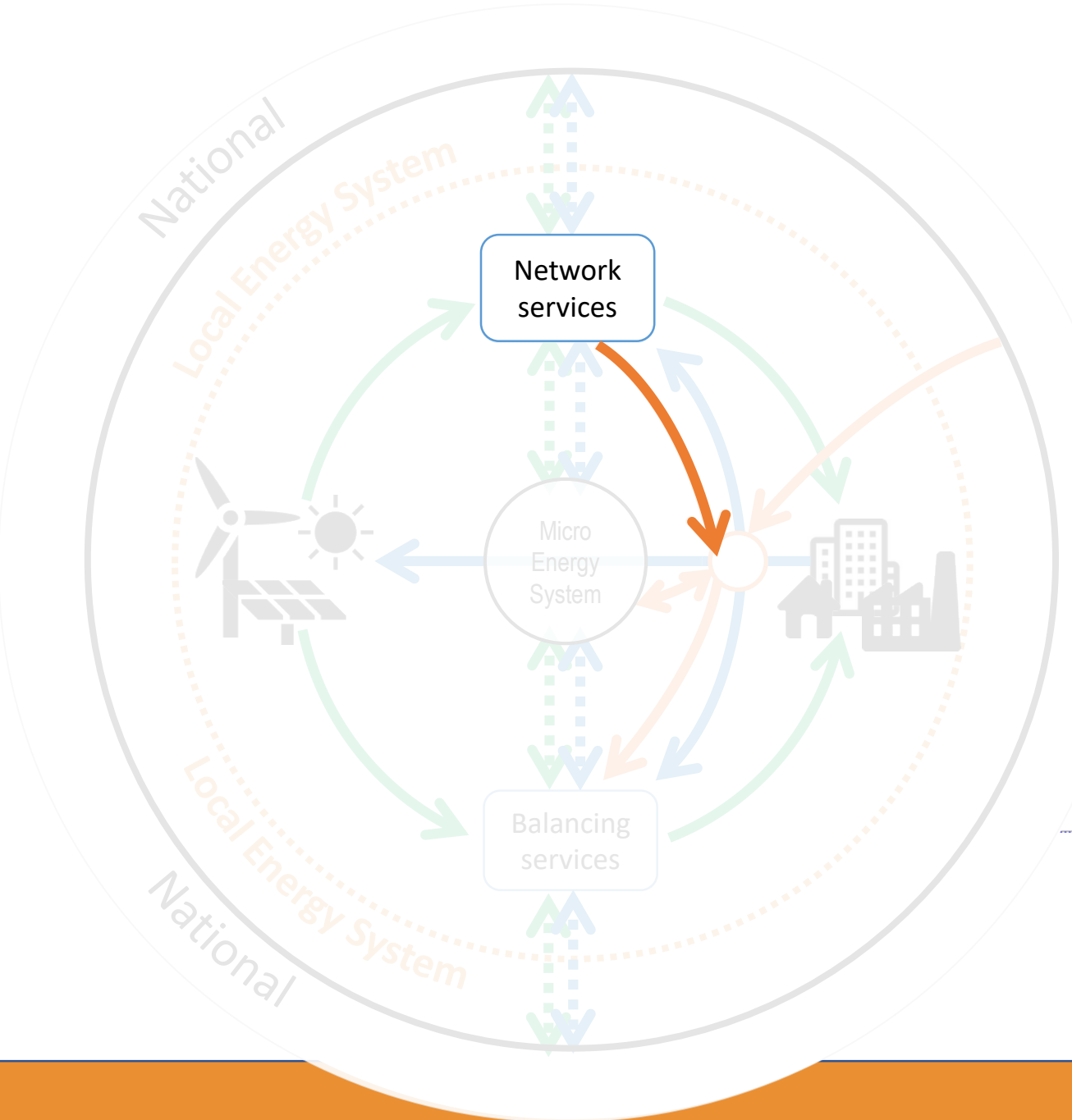










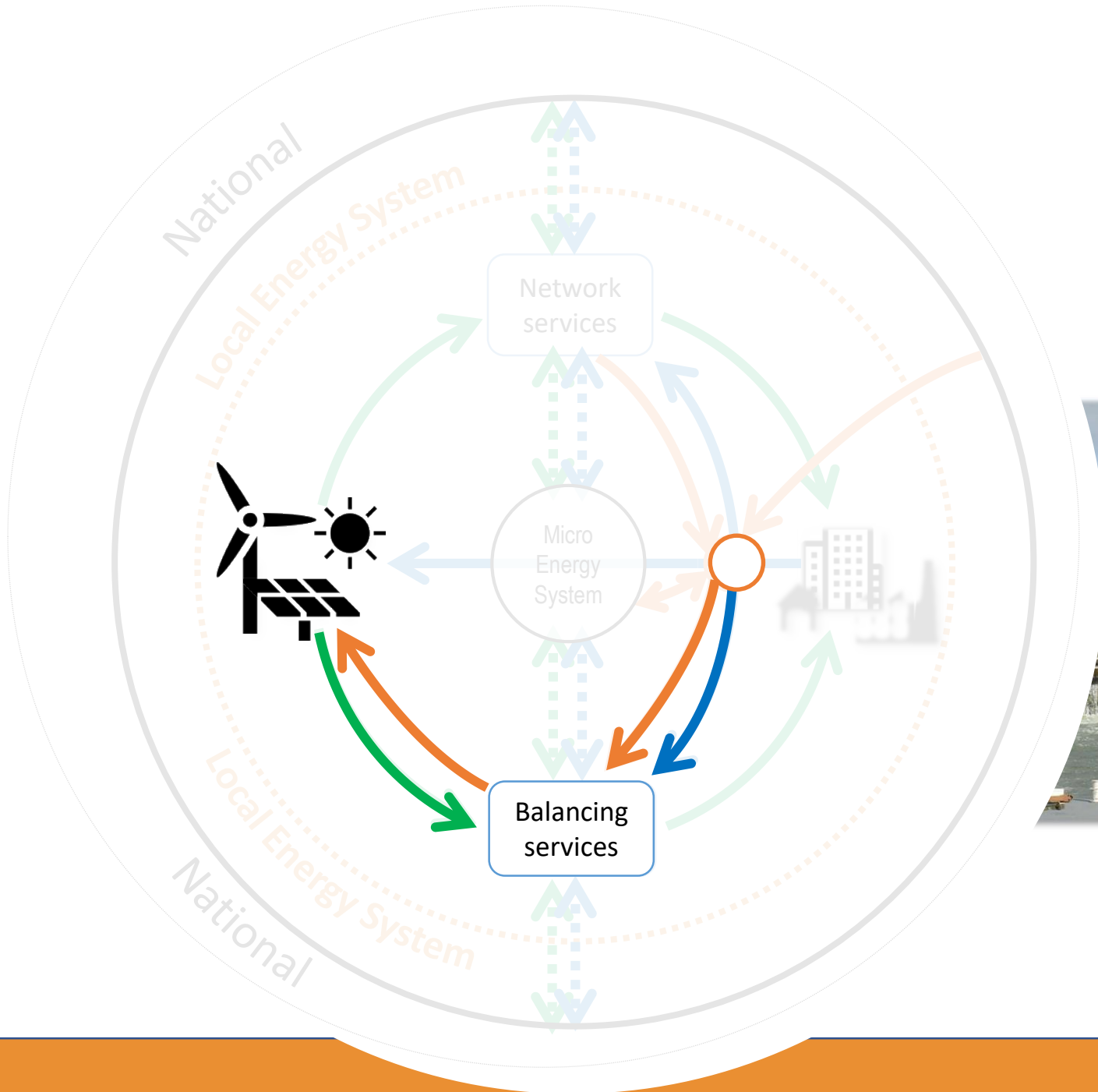




**piclo**<sup>®</sup>





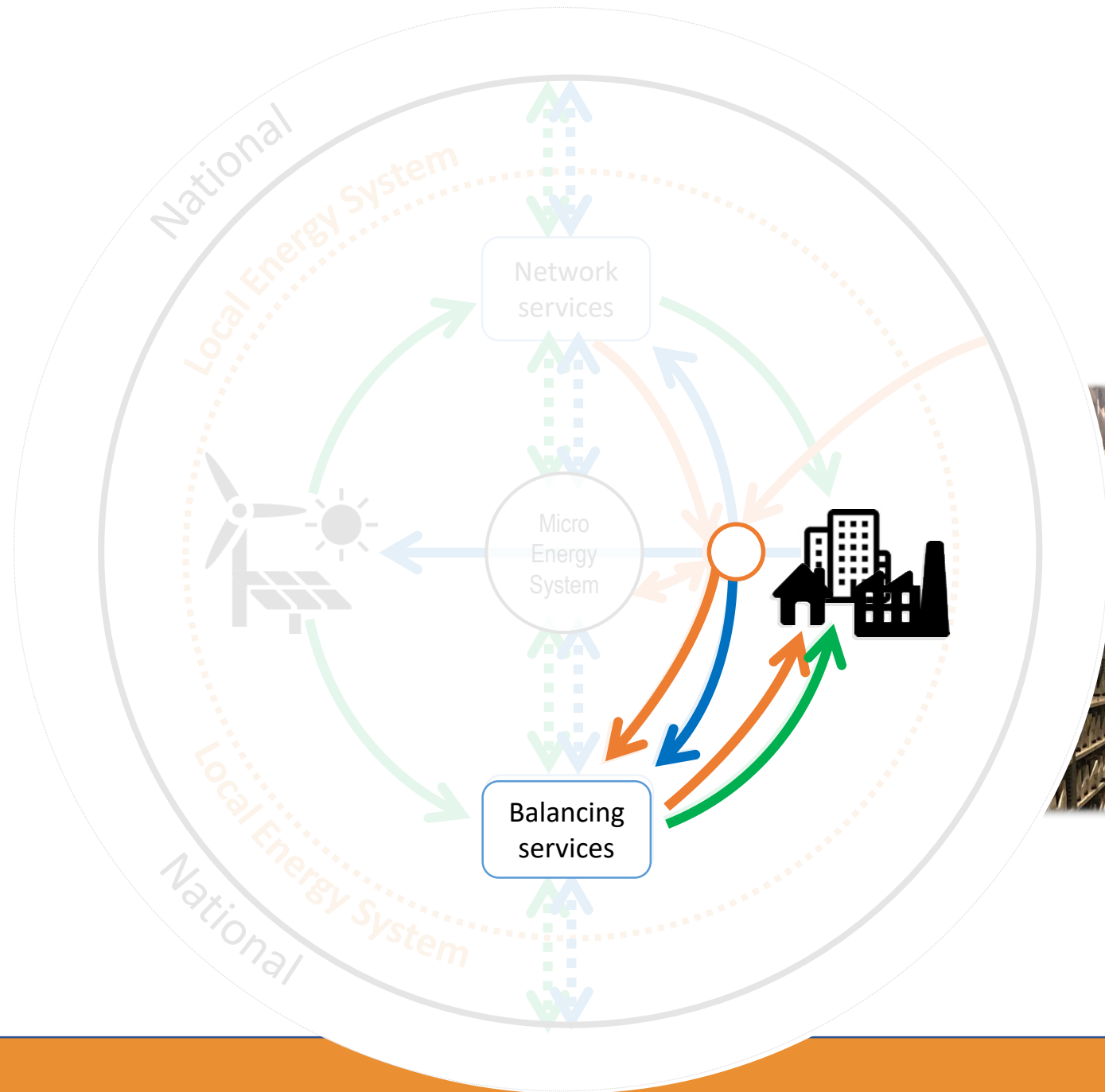


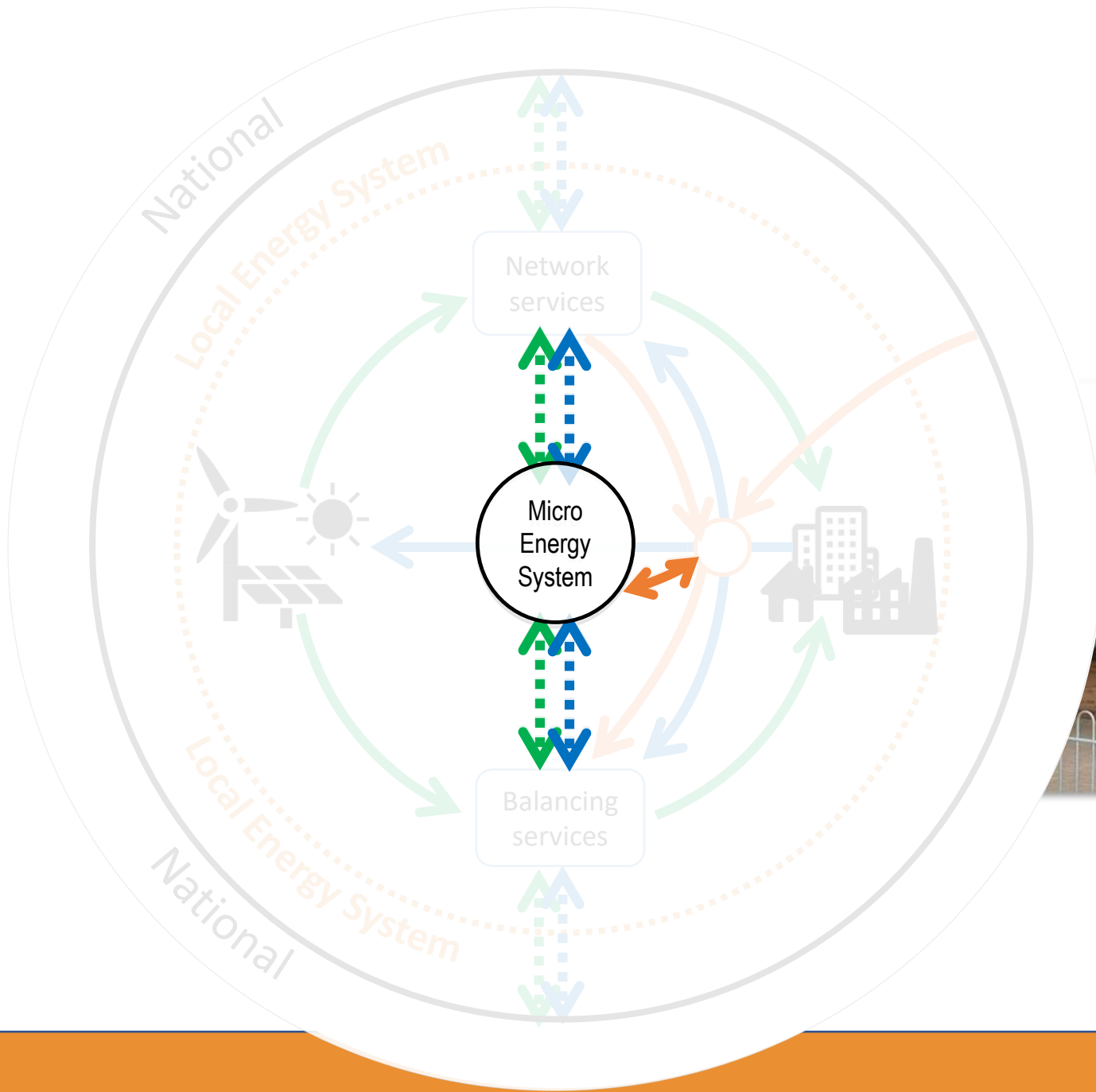


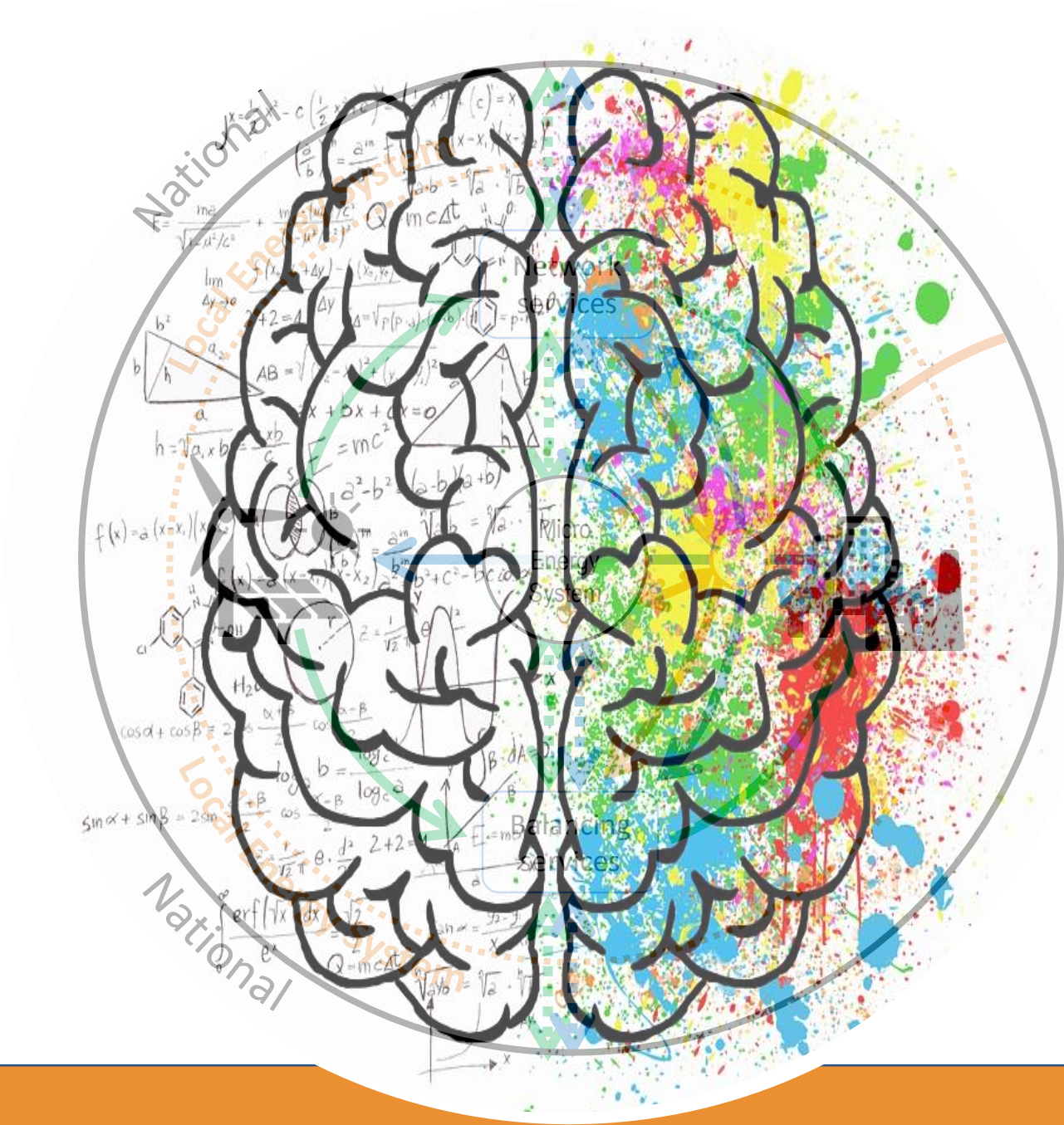
NUVVE





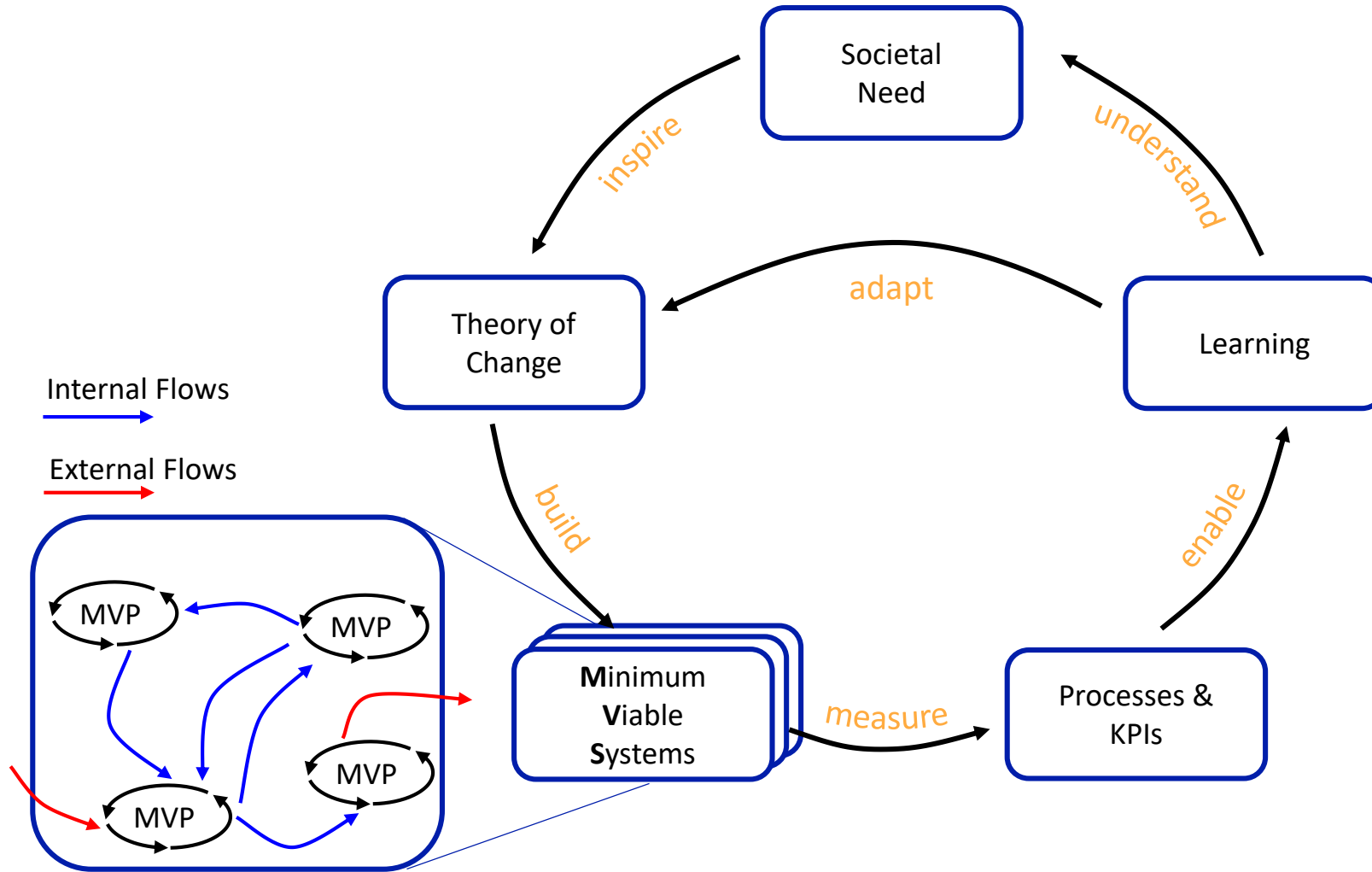


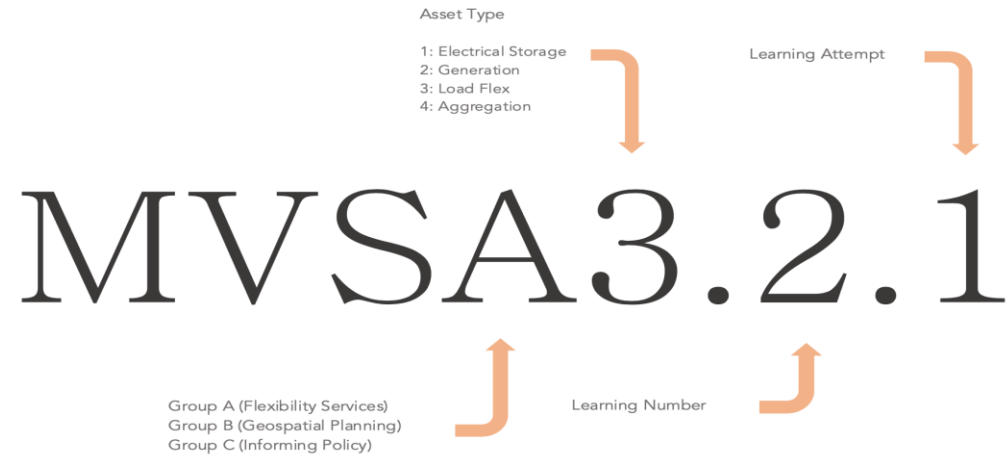




OXFORD  
**BROOKES**  
UNIVERSITY

# Agile System Development





### Group A – Flexibility Services

Electrical Storage: Oxford Cowley Bus Depot

Flexible Generation: Sandford Hydro Lock

Load Flex: Oxford Behind the Meter

Aggregation: Distributed Flexible Assets

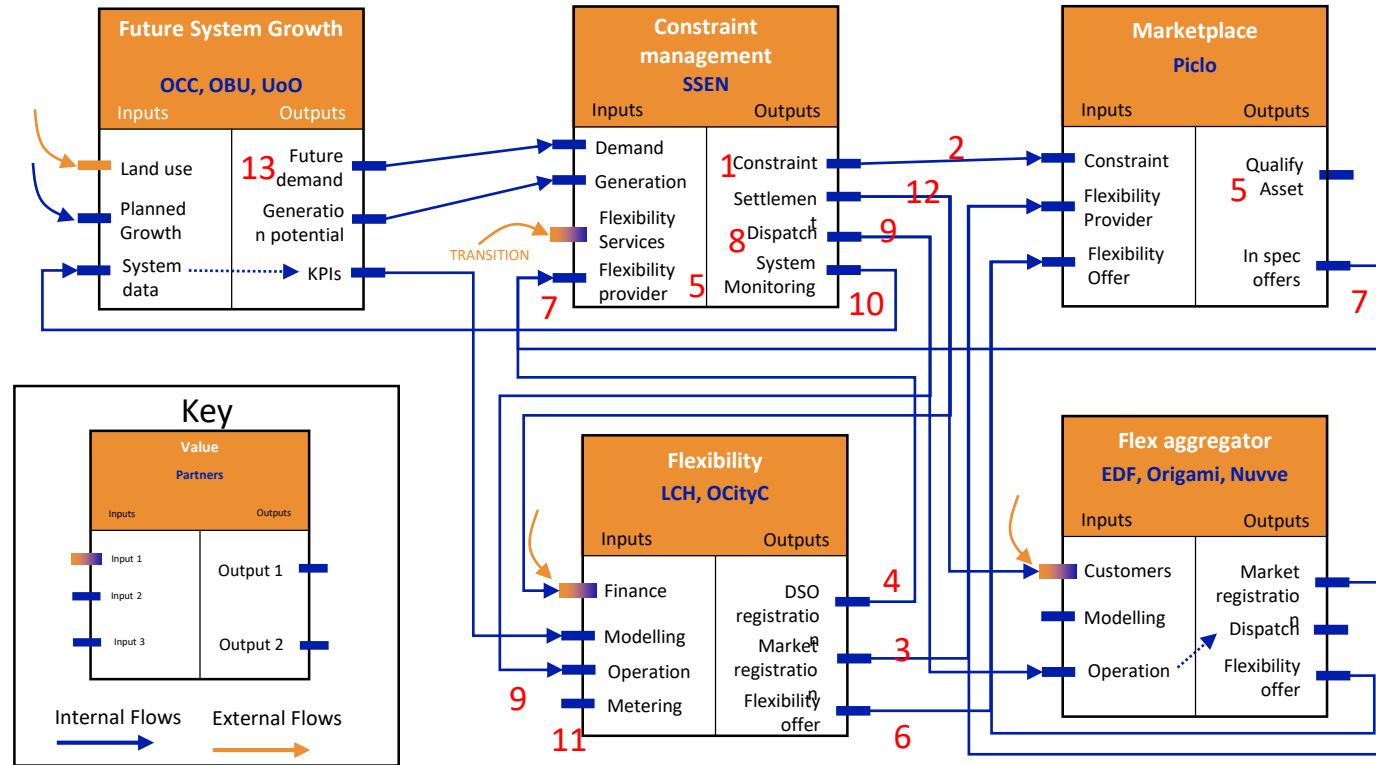
### Group B – Geospatial Planning

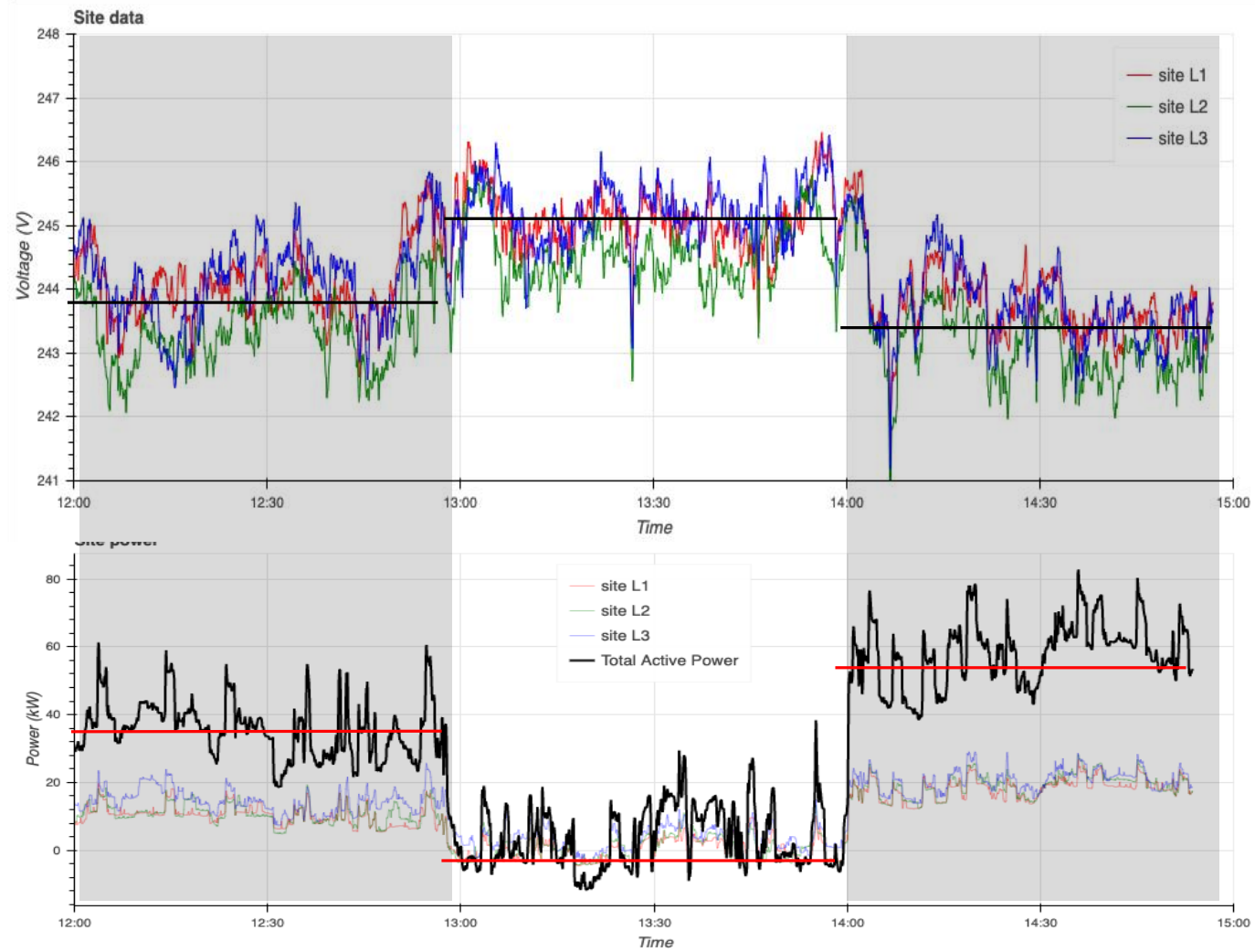
Integrated Land Use Mapping Tool

### Group C – Informing Planning

Oxfordshire Cotswold Garden Village Energy Plan

# Minimum Viable System: Flexibility Services





# Immediate next steps ...

## 1. Identify value of the flex

- Issues re voltage / current / losses / aging - TX & Feeder

## 2. Improve Process Maturity

Automation vs manual

## 3. Test Dispatch by State (e.g. voltage)

- Bang-bang vs. Continuous

## 4. Energy Sales (how to buy and sell within distribution system)

- Partial supply
- Within secondary and primary substation
- Virtual pipeline (distribution payment) - separate funding mechanism (not duos charges)
- Losses
- Marginal long run costs
  - Leasing assets (i.e. leasing panels)
  - Peer 2 (pool / peer)
- Per service - e.g. hot water, ev etc.

## 1. Governance and Capital Funding (over £100million) - pre package opportunities

- Local authority (land and energy planning)
- DSO (connections etc.)
- Civic / community
- Research / Knowledge gathering team
- Fund manager (for fund)

## 2. Fast Followers

- Identify suitable Local Authorities and DNO's



???

What will be the appropriate governance structures?



What will the appropriate business models be?



How can we accelerate the transition?





Maximising prosperity of local energy systems

Funding was provided through the Government's modern industrial strategy by Innovate UK, part of UK Research and Innovation.



# Lunch





## Work Package 2 Overview



Maximising prosperity of local energy systems





Piclo is the lead of WP2. We will use the Piclo Flex Marketplace in project LEO, providing a special innovation environment of the platform, to trial trading of new DSO flexibility services between the DSO and other project participants. As part of Project LEO Piclo will look to add new features and automate the end-to-end interactions between participants and the Piclo Platform.

In Project LEO, Nuvve will be integrating with Piclo Flex to aggregate and optimizes electrical vehicles situated behind the meter at the edge of the distribution grid. By connecting in unidirectional and bi-directional electric vehicles, customers can save money on their bills or generate some revenue by bidding in their flexibility. Project LEO will demonstrate that unidirectional and bidirectional EVs in Oxfordshire can participate in DSO markets. This unlocks real value from the vehicles participating in local flexibility markets and combines flexible vehicle resources with other assets such as microgrids, solar, battery storage, and large flexible loads.

EDF Energy is one of the flexibility providers with its platform Powershift, providing flexibility by aggregating storage and decentralised generation for grid services. This platform could interact with the Piclo Flex Platform to deliver services for the DSO. Our current focus of the WP 2 is to ensure a seamless interconnection with the various pieces of the market platform.

Origami is providing expert knowledge on the market operation and commercial requirements for development of flexibility services to enable the transition from DNO to DSO and move towards a more reliable and efficient energy system. As one of the technology platform providers on Project LEO, Origami also offers a commercial solution for the automatic dispatch and monitoring of flexible energy assets in near real-time. Origami also provides a real-time feedback loop to minimise the cost of delivery of flexibility services to DSOs. Origami is also a project partner on TRANSITION and FUSION innovation projects.

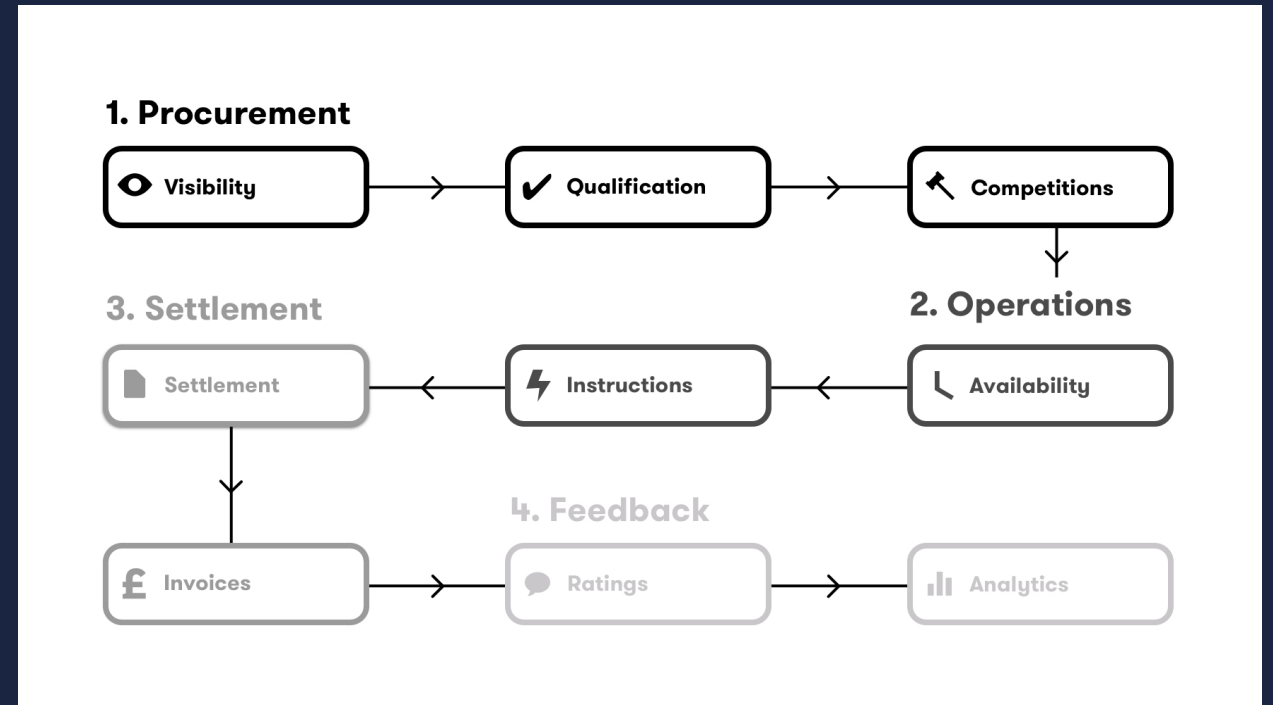
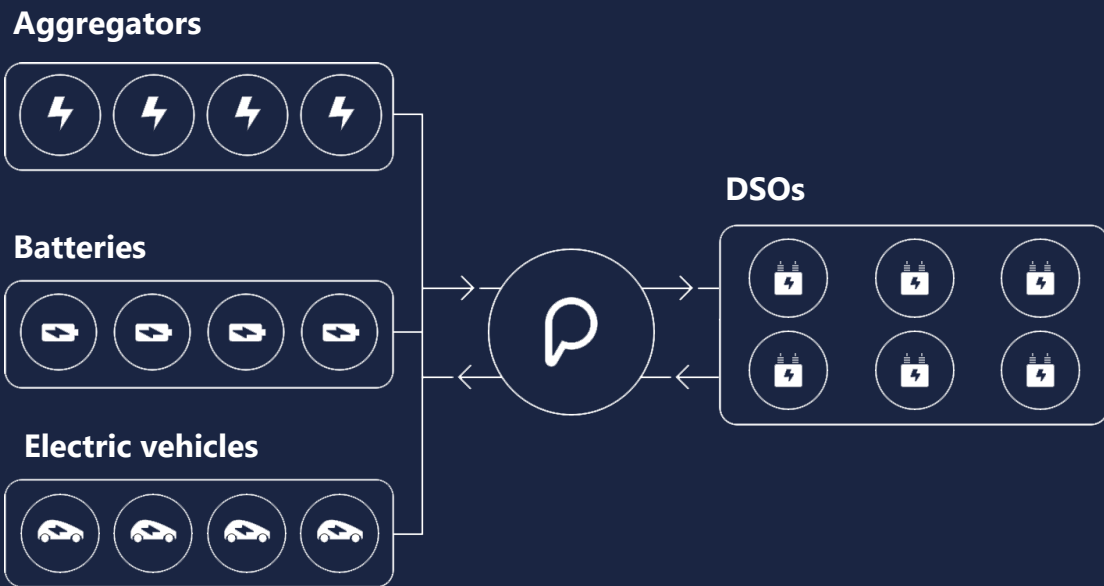


# WP2 Focus

As a work package consisting of 4 players that are all active in flexibility markets, we will use this expertise to drive innovation that will continue to lower the barriers of entry into flexibility markets

- Increase the participation by different types of players
- Generate new value streams for participation
- Automated end-to-end fulfilment of the full flexibility process
- Introduction of new flexibility services
  - DSO facilitated services (Authorised Supply Capacity trading and Off-setting)

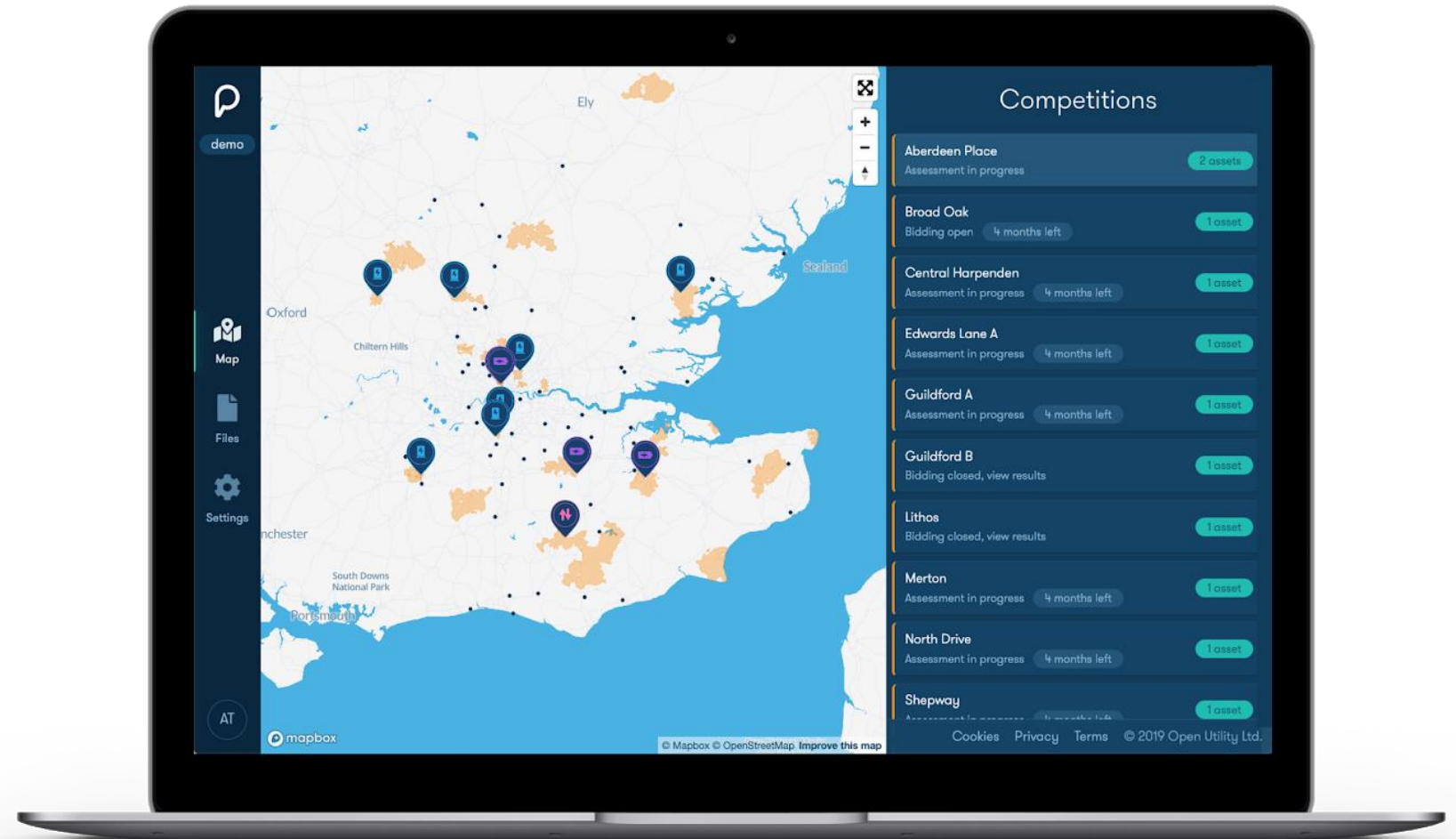
# Flexibility process



# DSO's advertise needs for Flexibility

An online procurement platform optimised for locational flexibility services contracts:

- Self-service platform to specify and advertise requirements for flexibility
- Automatic qualification of matching flex providers and assets.
- Transparent online auctions and notification service



# Flex Providers Bid

**Aberdeen Place**

14 Jun 2019 17:10 Competition open | 14 Jun 2019 17:20 Competition close

Status: Assessment in progress

Qualification close: 14 Jun 2019 17:08

Need type: Reinforcement deferral

Need: Generation turn up / Consumption turn down

Connection: 11 kV or below

Buyer: System Operator (UKPN)

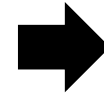
Competition type: Availability Utilisation

ABPB\_W19/20 - Window 1  
3 MW, 660 hours available

Qualifying assets  
2 assets, 2 MW total capacity

2 No. Assets | 2 MW Capacity

View Bids



**Aberdeen Place**

Service period: ABPB\_W19/20

Contract start	Contract end	Contract hours	Total need	Asset Capacity	split
1 November 2019	31 January 2020	09:00 - 19:00	3 MW	2 MW	split
Capacity	Maximum runtime	Availability offer	Utilisation offer		
1 MW	01:00:00 D HH:MM:SS	200 £/MW/h	400 £/MWh		

Service period: ABPB\_S2020

Contract start	Contract end	Contract hours	Total need	Asset Capacity	split
1 June 2020	31 August 2020	09:00 - 19:00	3 MW	2 MW	split
Capacity	Maximum runtime	Availability offer	Utilisation offer		
1 MW	01:00:00 D HH:MM:SS	300 £/MW/h	475 £/MWh		

Service period: ABPB\_W20/21

Contract start	Contract end	Contract hours	Total need	Asset Capacity	split
1 November 2020	31 January 2021	09:00 - 19:00	4.1 MW	2 MW	split
Capacity	Maximum runtime	Availability offer	Utilisation offer		
MW	D HH:MM:SS	£/MW/h	£/MWh		

# MVS Participation

- 5 competitions have been run on the LEO Piclo Platform
- 54 flexibility assets have been uploaded by LEO partners
- Next stage will be to include other WP2 partners to trial new end-to-end functionality

The screenshot displays the LEO Piclo Platform interface. On the left is a dark sidebar with navigation icons for 'LEO', 'Map', 'Manage', 'Settings', and 'KD'. The main area shows a map of the region around Reading, UK, with a yellow highlighted area. A data popup for a 'Hydro' asset is centered on the map. The popup contains the following information:

Hydro		
Piclo Ref	Ex. Meter ID	Im. Meter ID
d69b3q4	2000056722549	2000056722530
0.4 MW	-	11 kV
Ex. Active Power	Im. Active Power	Connection
0.2 MVar	-	Operational
Ex. Reactive Power	Im. Reactive Power	Status

At the bottom of the popup, it states 'Not qualifying'. On the right side of the interface, a 'Competitions' sidebar is visible, which contains the message: 'No live competitions. More coming online soon, please check back later. Email [support@picloflex.com](mailto:support@picloflex.com) if you have any questions.'

# Current Challenges

- Is there enough value in DSO flexibility alone to drive investment?
  - Report by Graham Oakes and Element Energy investigating the potential size and value of different markets
- Inconsistency in terminology, processes, and requirements across the different DSO's and ESO.
  - How do we keep up with all the work that is being done across the ENA, innovation projects, business as usual teams?



Maximising prosperity of local energy systems

Funding was provided through the Government’s modern industrial strategy by Innovate UK, part of UK Research and Innovation.





## Project LEO: WP3 Plug-in Projects



Maximising prosperity of local energy systems

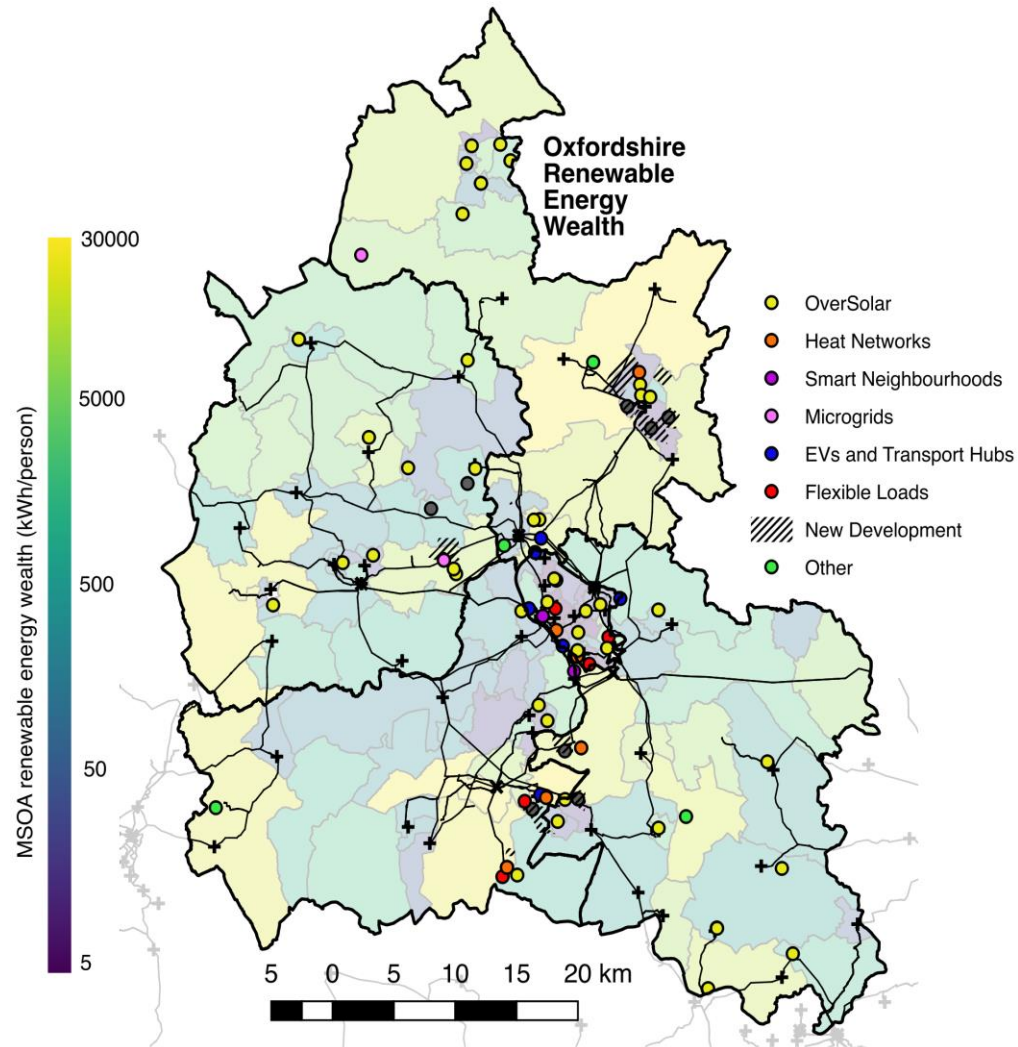




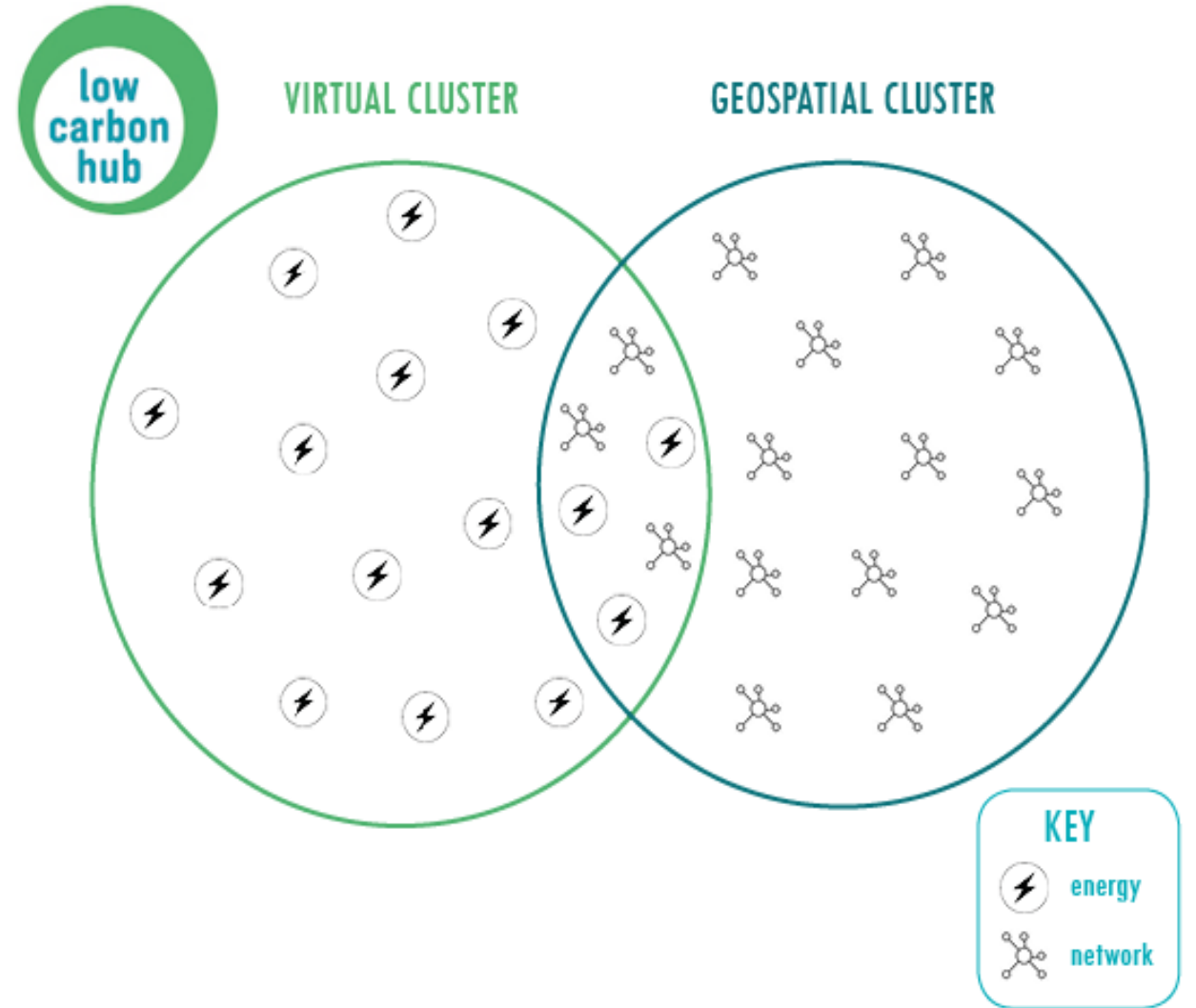
# Background



# Our job in LEO



<https://creativecommons.org/licenses/by/4.0/>  
Scot Wheeler 2019



# Our opportunity from LEO



MARKET INTERFACE

PORTFOLIO MANAGEMENT/DECISION MODULE

CONTROL/DISPATCH

V  
P  
P  
D  
E  
R  
  
P  
O  
R  
T  
F  
O  
L  
I  
O

VIRTUAL POWER PLANT

DATA MANAGEMENT

CONNECTION AND COMMUNICATIONS INTERFACE

G  
E  
N

FLEX  
DEMAND

STORAGE

# Challenges

- Regulation
  - Planning
  - Building control
  - Charities Act 2011
  - Ofgem
- Engagement
  - Multiple actors across stakeholder organisations
  - Involvement and acceptance by the local community
  - Lack of agency at the local level – need for local governance framework
- Grid edge
  - MPANs not geographic; substations not monitored
  - Post-FiT no record of what installations are where
  - Regulatory impediments to peer-peer trading
- Lack of base case business model post-FiT
  - Compounded by social enterprise models of raising finance

# Oxfordshire Programme



Kyle Murchie

22 January 2020



**Scottish & Southern**  
Electricity Networks

# Key Industry Trends – The 4Ds

## Decarbonisation

### Renewables and Electrification

- 50% of generation to be renewable in UK by 2030\*
- Prepare for 100% EV sales by 2030\*

\*(NIC Infrastructure Assessment 07.2018)

## Decentralisation

### Distributed Energy Resources & Systems

- Smaller renewable embedded generation
- Demand side response
- Storage
- Community Projects
- Whole System

## Digitalisation

### Digital Systems & Data

- Aggregators
- Asset and Flexibility Registration
- Digital Mapping
- SMART Meters
- Sensors, Monitoring
- Internet of Things
- Open Data
- Data Analytics & AI

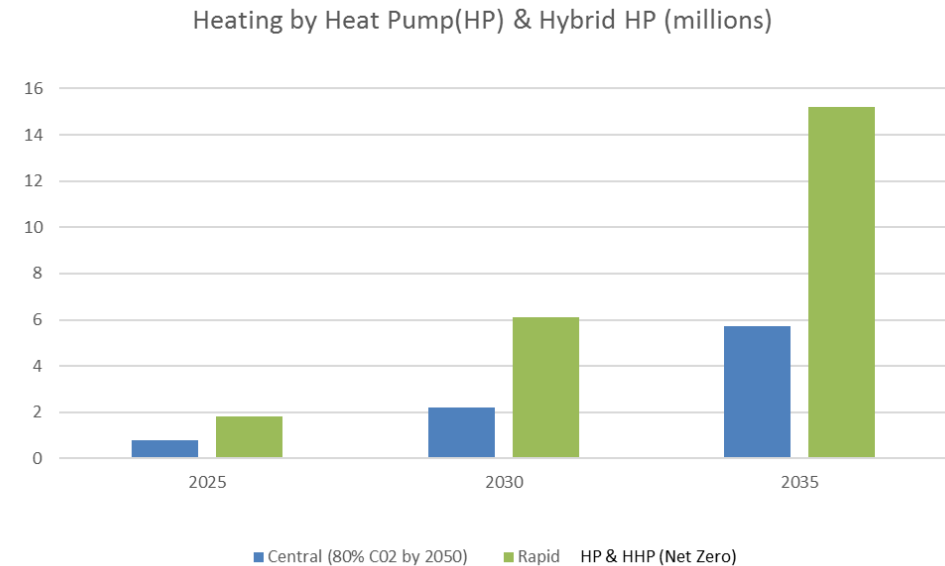
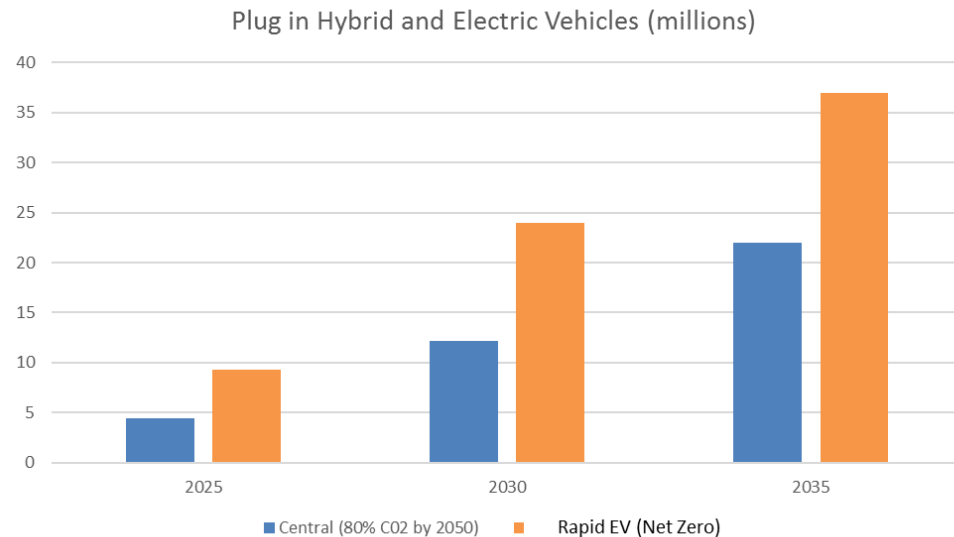
## Democratisation

### Prosumers and Customer Participation

- Trust in Energy
- Social Media
- Fuel Poverty
- Community Energy
- Participation in Local Markets
- Value of Lost Load?

# The Network's Low Carbon Revolution

The UK Net Zero Carbon commitment requires a £50bn investment in GB distribution networks by 2035\*

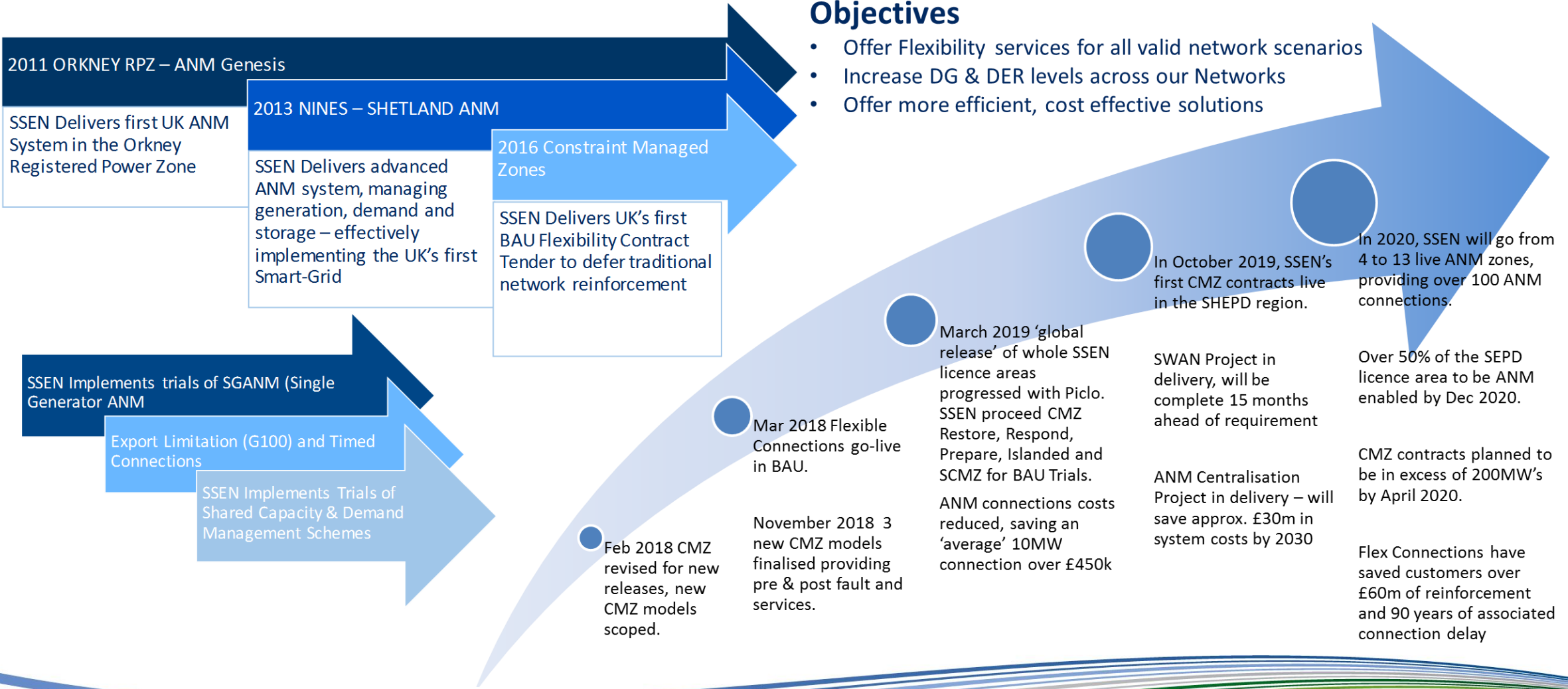


Investment in distribution networks to support increasing numbers of electric vehicles benefits all energy consumers through social benefits of decarbonisation, reduced unit costs of electricity distribution and reduced transport fuel costs as we move away from diesel and petrol.

Multiple decarbonisation of heat pathways are possible including electrification, decarbonised gas and hybrid systems. These solutions will increase distribution electricity demand in varying degrees.

\* Source: Accelerated electrification and GB electricity system', a report by Vivid Economics and Imperial College London for Committee on Climate Change, April 2019

# SSEN Progression to DSO – Flexibility



2011 ORKNEY RPZ – ANM Genesis

SSEN Delivers first UK ANM System in the Orkney Registered Power Zone

2013 NINES – SHETLAND ANM

SSEN Delivers advanced ANM system, managing generation, demand and storage – effectively implementing the UK’s first Smart-Grid

2016 Constraint Managed Zones

SSEN Delivers UK’s first BAU Flexibility Contract Tender to defer traditional network reinforcement

SSEN Implements trials of SGANM (Single Generator ANM)

Export Limitation (G100) and Timed Connections

SSEN Implements Trials of Shared Capacity & Demand Management Schemes

Feb 2018 CMZ revised for new releases, new CMZ models scoped.

November 2018 3 new CMZ models finalised providing pre & post fault and services.

Mar 2018 Flexible Connections go-live in BAU.

March 2019 ‘global release’ of whole SSEN licence areas progressed with Piclo. SSEN proceed CMZ Restore, Respond, Prepare, Islanded and SCMZ for BAU Trials. ANM connections costs reduced, saving an ‘average’ 10MW connection over £450k

In October 2019, SSEN’s first CMZ contracts live in the SHEPD region.

SWAN Project in delivery, will be complete 15 months ahead of requirement

ANM Centralisation Project in delivery – will save approx. £30m in system costs by 2030

In 2020, SSEN will go from 4 to 13 live ANM zones, providing over 100 ANM connections.

Over 50% of the SEPD licence area to be ANM enabled by Dec 2020.

CMZ contracts planned to be in excess of 200MW’s by April 2020.

Flex Connections have saved customers over £60m of reinforcement and 90 years of associated connection delay

## Objectives

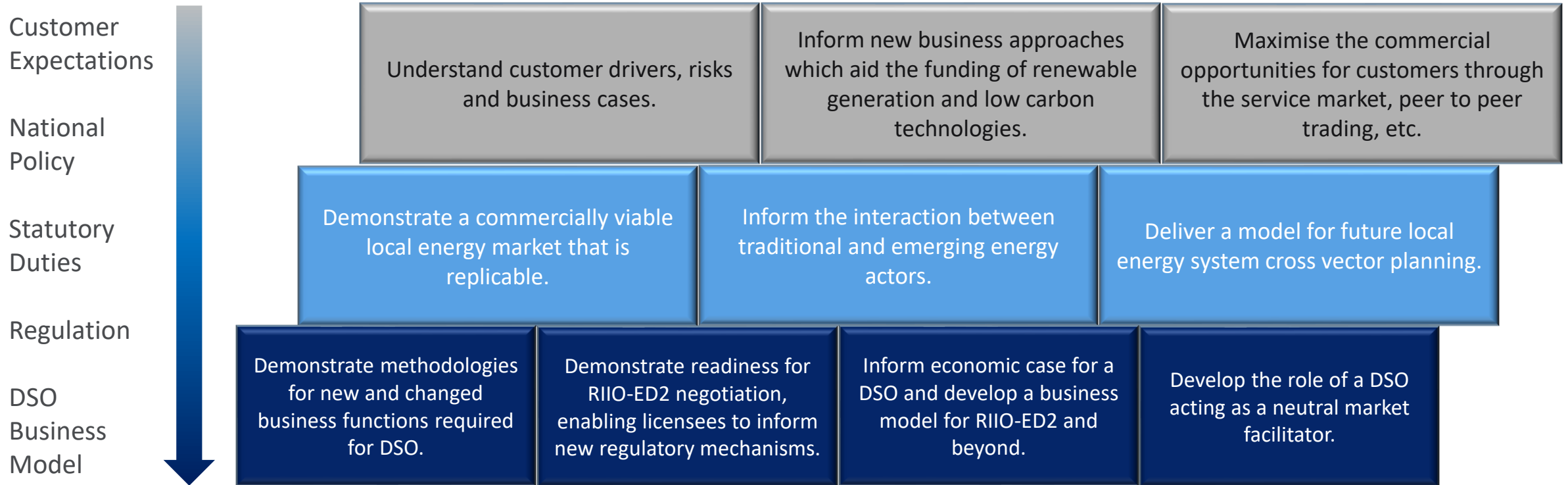
- Offer Flexibility services for all valid network scenarios
- Increase DG & DER levels across our Networks
- Offer more efficient, cost effective solutions



# Real World Test – Key Objectives

“ **LE**  and **transition**  bring together local community aspirations with energy industry drivers”  
Local Energy Oxfordshire Moving to a smart future

The projects provide a £40m programme which is further leveraged by £46m public sector investment.



# Successful Delivery Considerations

The Oxfordshire Projects face a number of challenges which shall be accounted for as part of the combined delivery:



# Timeline

Requirement Phase						Deployment and Trials																
Deliverables	2019					2020				2021				2022				2023				
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Site Selection Methodology		★ Mar 2019																				
System Requirements			★ May 2019																			
Stage Gate						★ Feb 2020																
Deployment - Commercial arrangements									★ July 2020													
Deployment - System / Platform Testing												★ June 2021										
Trial Stage 1														★ Jan 2022								
Trial Stage 2																	★ Sept 2022					★ Sept 2023

# Data Platforms

DNO

TO

ESO

Supplier

Local Energy

Council

WP4



## Grid Management Platform(s)

Forecasting | Power Systems Analysis | Analytics | Contract Management | Scheduling | Activation / Dispatch | Settlement Management

WP5



## Whole System Coordinator

WP5



## Market Facilitation

WP5



## Flexibility Exchange(s)

Visibility | Procurement | Settlement

WP2



## Technology Platform(s)

Value Optimisation | Aggregation | Flexibility Trade

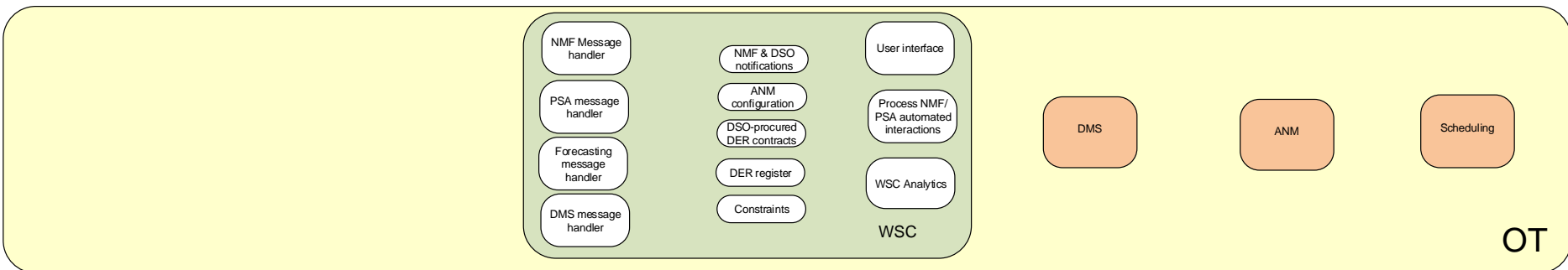
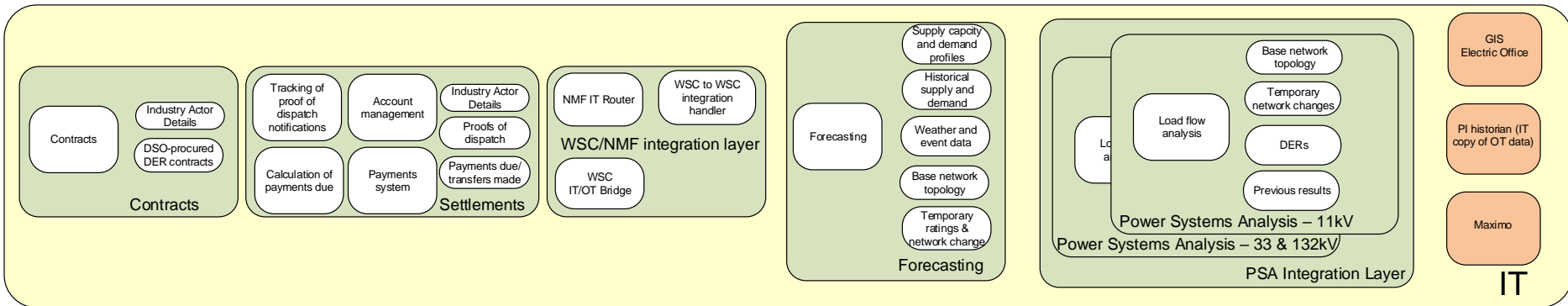
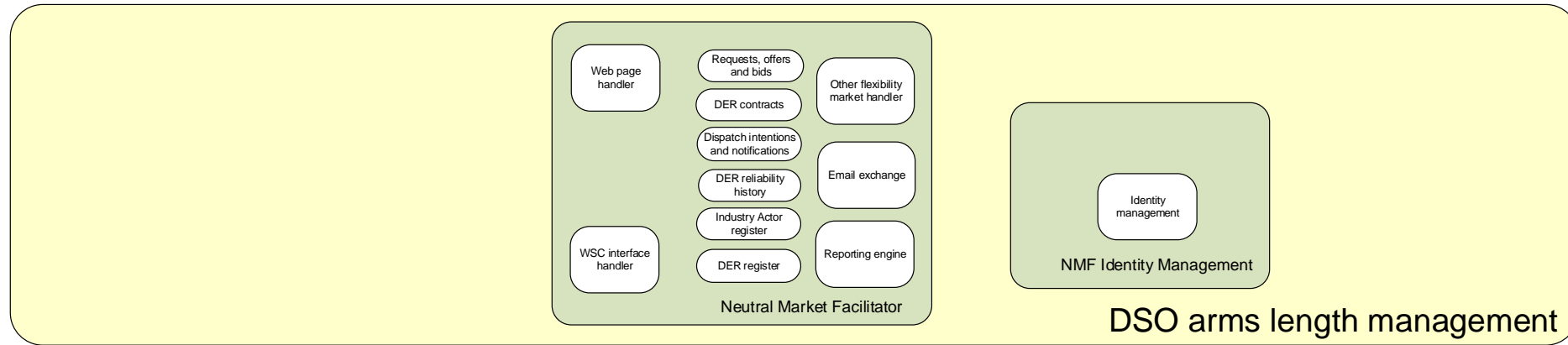
WP2

WP3



# High Level Design

transition Moving to a smart future have developed a High Level Design which will developed into a Detailed Design in 2020.



# Local Markets

In 2020 TRANSITION proposes to hold a Simulation Series, building on the success of the Market Rules Simulation events.

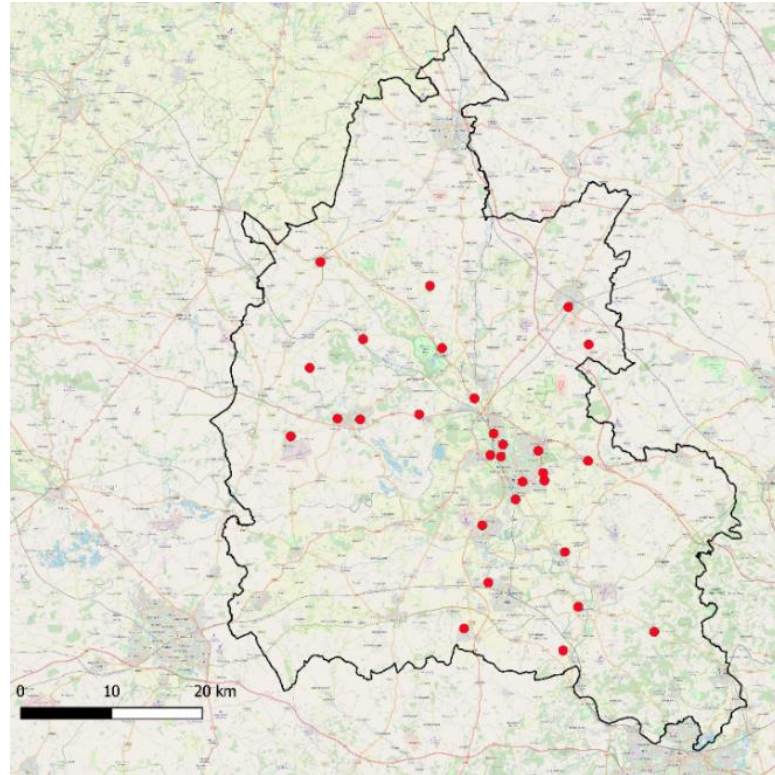
- Learn from other markets such as Balancing Mechanism;
- Use this opportunity to develop rules specifically for the viable use cases;
- Outputs from Market Rules Simulation have already passed into ON WS3 Unintended Consequences, Access & Forward Looking Charges and the development of project use cases;
- Plan up to three further simulation events in 2020, exploring the possibility of gamification;
- TRANSITION and the other DSO demonstrator projects EFFS and FUSION are committed to coordinating procurement activities planned for 2020. This includes the procurement of consultancy services.



# Trial Planning

The Oxfordshire Projects are presently in the process of planning upcoming tests and longer term trials of the local ecosystem.

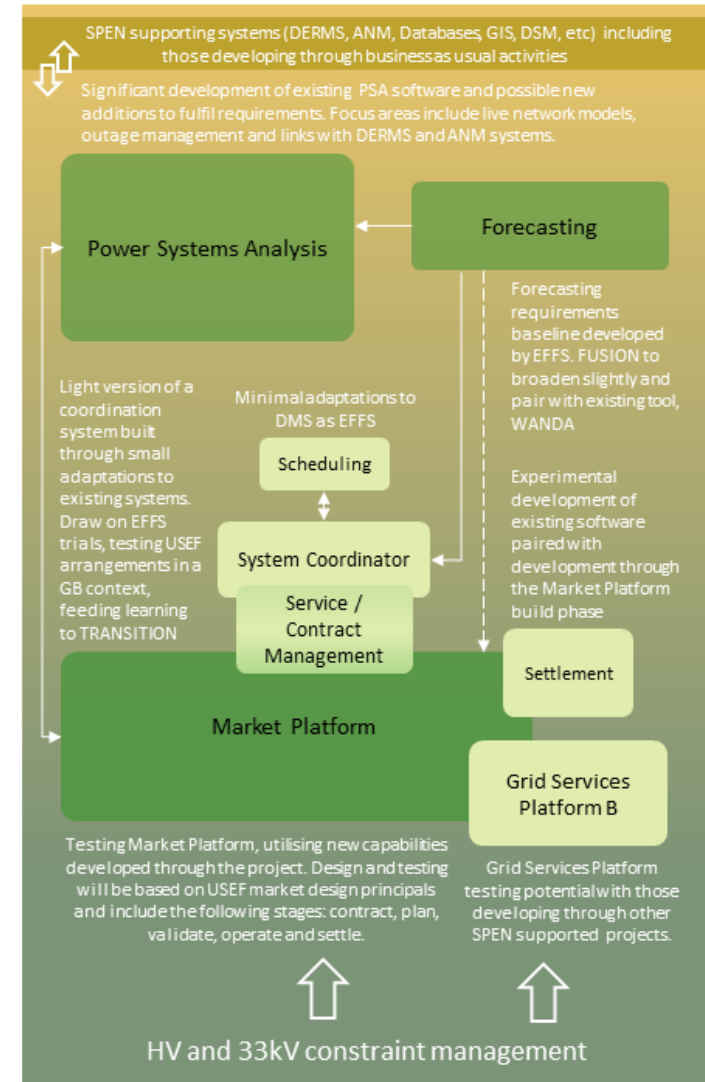
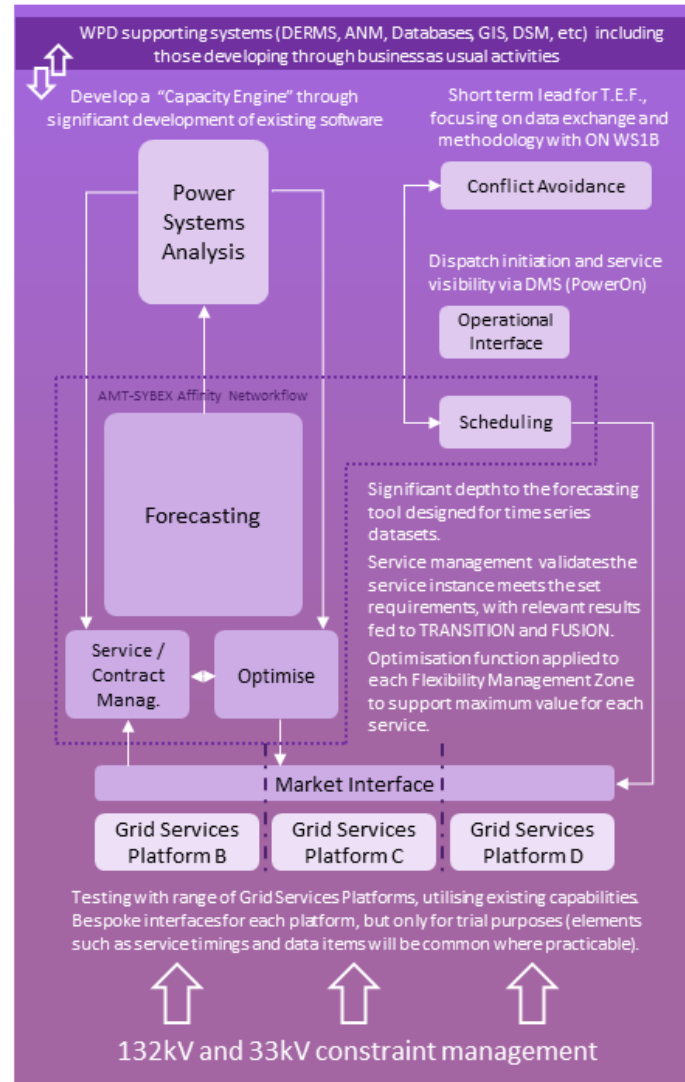
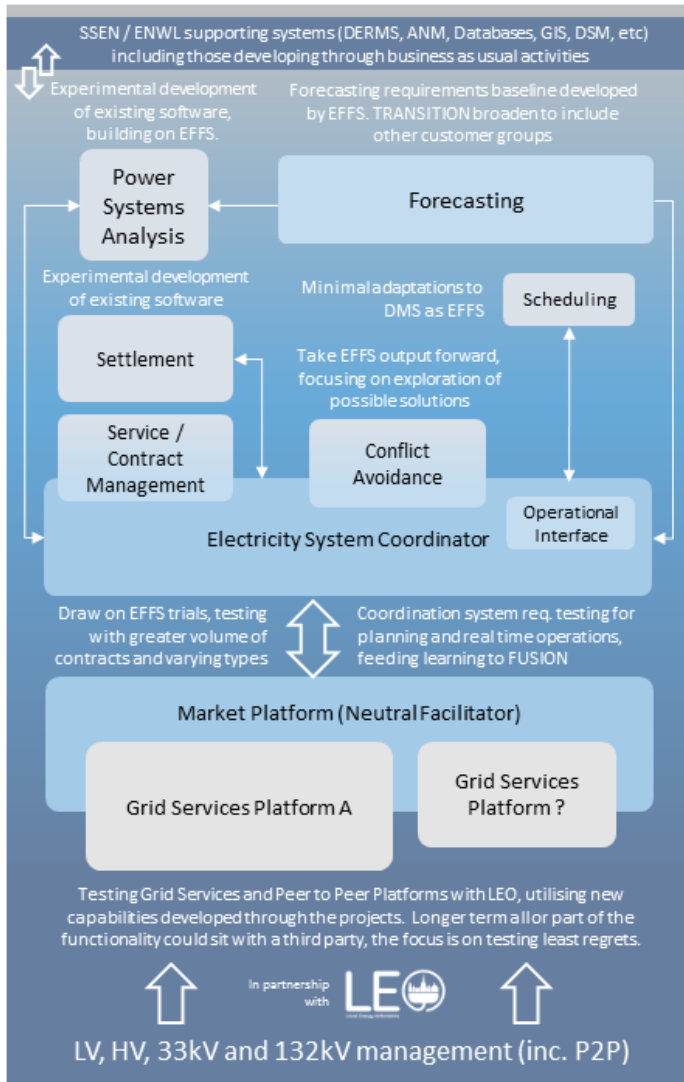
- More than 80 customer assets currently in consideration;
- Selection process conducted in partnership as an Oxfordshire Programme;
- Stage 1 complete, with Stage 2 workshop taking place on 30<sup>th</sup> and 31<sup>st</sup> January 2020;
- Many variables in addition to the Grid and Peer to Peer Services are being considered for future tests and trials;
- Atkins and Origami Energy are supporting development, with a Trial Strategy due to be published in February.



Trial 1			
Purpose: Alleviate 11kV Constraint at ...			
Variable	Option 1		
	Run 1	Run 2	Run 3
Season	Spring	Spring	Spring
Day of week	Saturday	Saturday	Saturday
Time of day	6.30pm	6.30pm	6.30pm
Duration	2 hours	2 hours	2 hours
Location	TBC	TBC	TBC
Service	Peak Management	Peak Management	Peak Management
Network Conditions	Thermal	Thermal	Thermal
Power Increase / decrease	Decrease	Decrease	Decrease
Service Declaration	Week Ahead	Week Ahead	Week Ahead
Dispatch Notice	Day Ahead	Day Ahead	Day Ahead
Response Time	10 seconds	10 seconds	10 seconds
Cancelation / Stop Issued	No	No	No
Site Prerequisites	None	None	None
Asset Type	Free	Free	Free
Connection Voltage	Free	Free	Free
Customer Type	EV Charging	EV Charging	EV Charging
Availability Payment	None	None	None
Utilisation Payment	£20/MWh	£20/MWh	£20/MWh
Alternative Payment	None	None	None
Reinforcement	None	None	None
Forecasting active	Yes	Yes	Yes
Forecasting version	1.6	1.6	1.6
WSC active	No	No	No
WSC version	0	0	0
NMF active	Yes	Yes	Yes
NMF version	2.1	2.1	2.1
Flex Exchange(s) active	Yes	Yes	Yes
Flex Exchange(s) version	4.3	4.3	4.3
Technology Platform(s) active	No	No	No
Technology Platform(s) version	0	0	0
Sample rate of LV monitors	Half hourly	Half hourly	Half hourly
Sample rate of HV monitors	Half hourly	Half hourly	Half hourly

# Industry Partnership

**transition** Moving to a smart future is collaborating with other industry projects to ensure learning can lead to enduring solutions facilitating the move to a smart grid architecture.



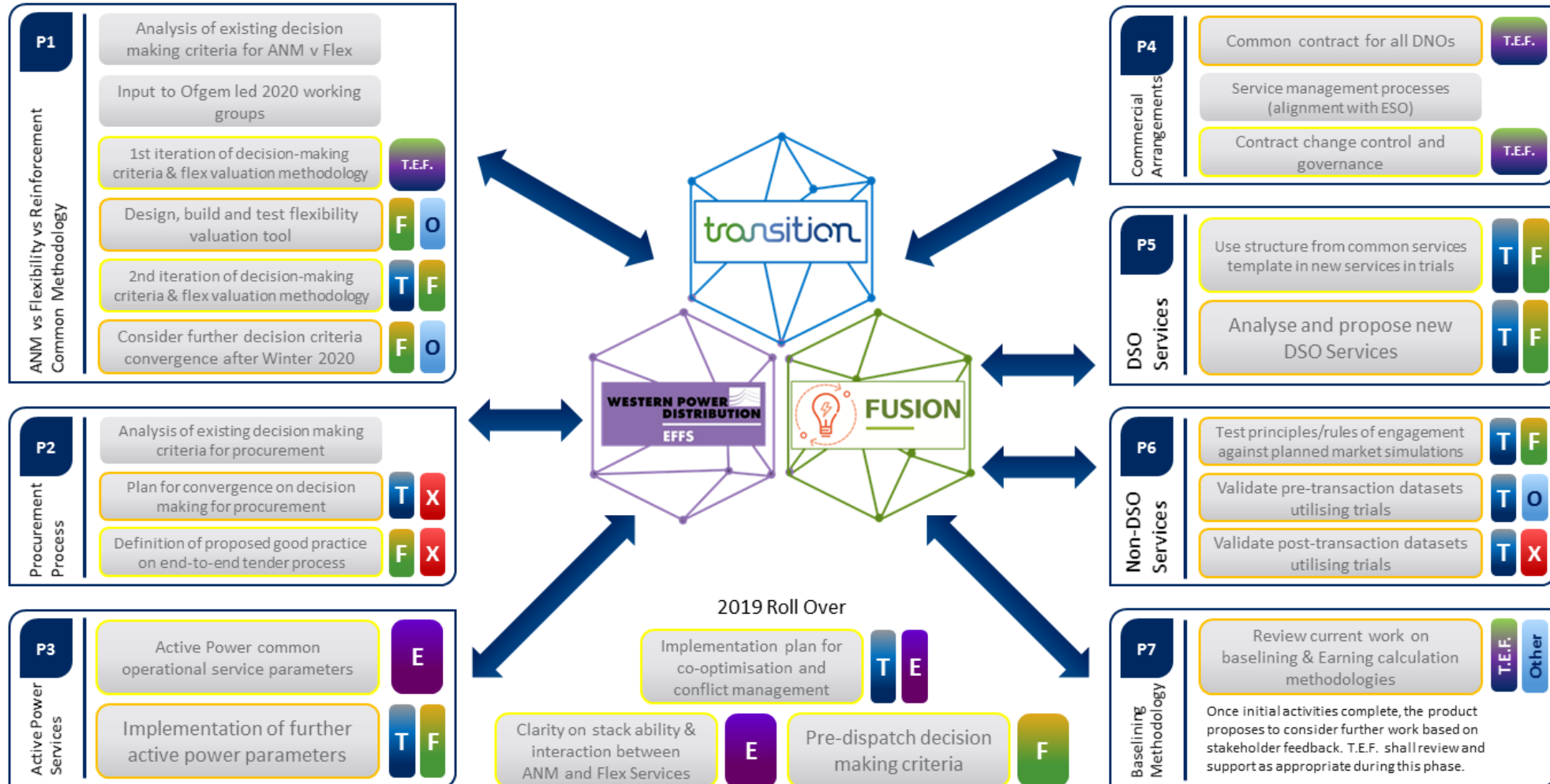


# Industry Partnership



and transition shall directly feed into the ENA Open Networks Project in 2020.

## Flexibility Services (ONP WS1A)



# Real World Test – FY2019/20 Outputs

**LEO** and **transition** have delivered a number of industry significant outputs during FY 2019/20.

We are keen to share all core project outputs, thus these are added to the project websites once approved: <https://ssen-transition.com/library/> and <https://project-leo.co.uk/>

DOCUMENT NAME  
Services in a Facilitated Market

DOCUMENT NAME  
Neutral Market Facilitator Requirements Specification

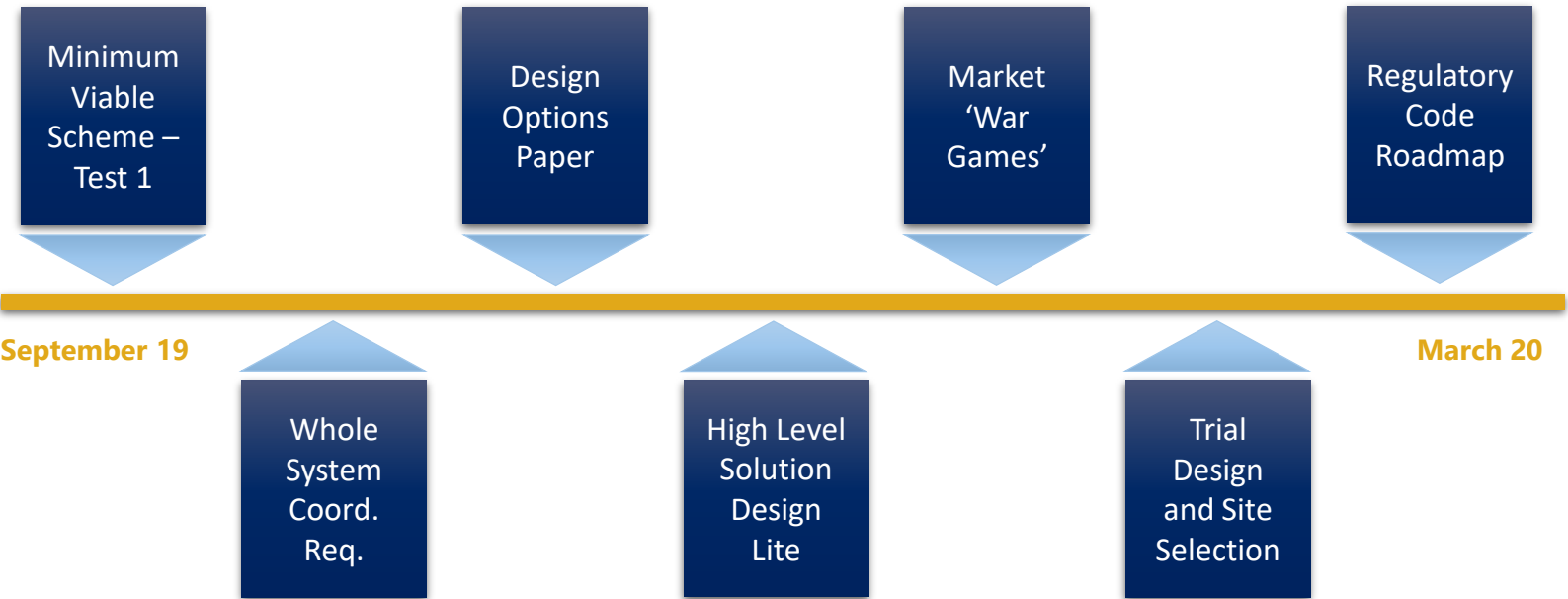
DOCUMENT NAME  
Neutral Market Facilitator Data Exchange and Governance

Project LEO Newsletter

Complete



Ongoing



# Where can you support?

## Change Management

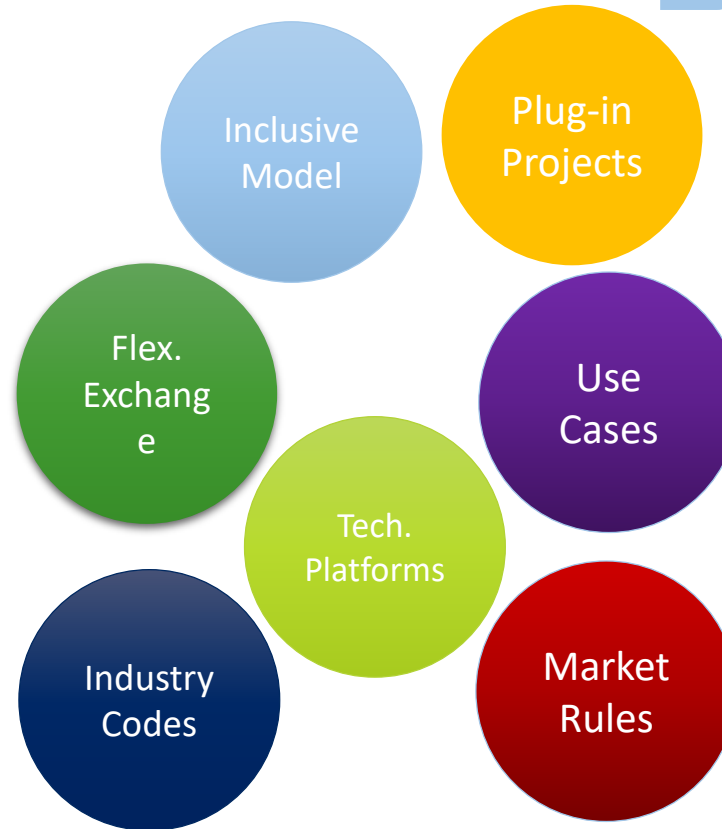
1



Forecasting	Data Visibility
Power Systems Analysis	LCT LV Investment Trigger
Analytics	LV Connectivity Model
Settlement Management	Maintenance
Scheduling	LV Network Visibility/Control
Activation / Dispatch	Flex. Requirem. Visibility
Contract Management	Conn. Agreement Management

## 'EcoSystem' Requirements

2



## Industry Collaborations

3



# Reflections and Next Steps

