School of Earth and Environment and
UK Future Cities Catapult
FACULTY OF ENVIRONMENT

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Electric Vehicles and the Northern Powerhouse

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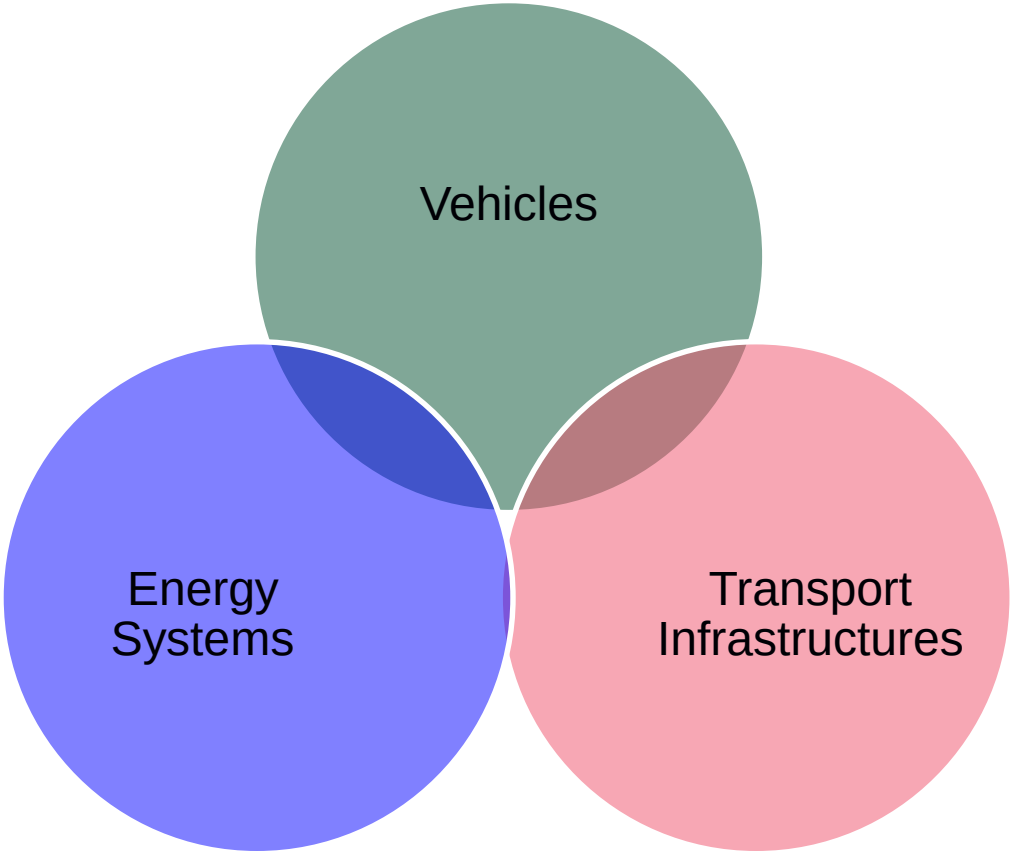
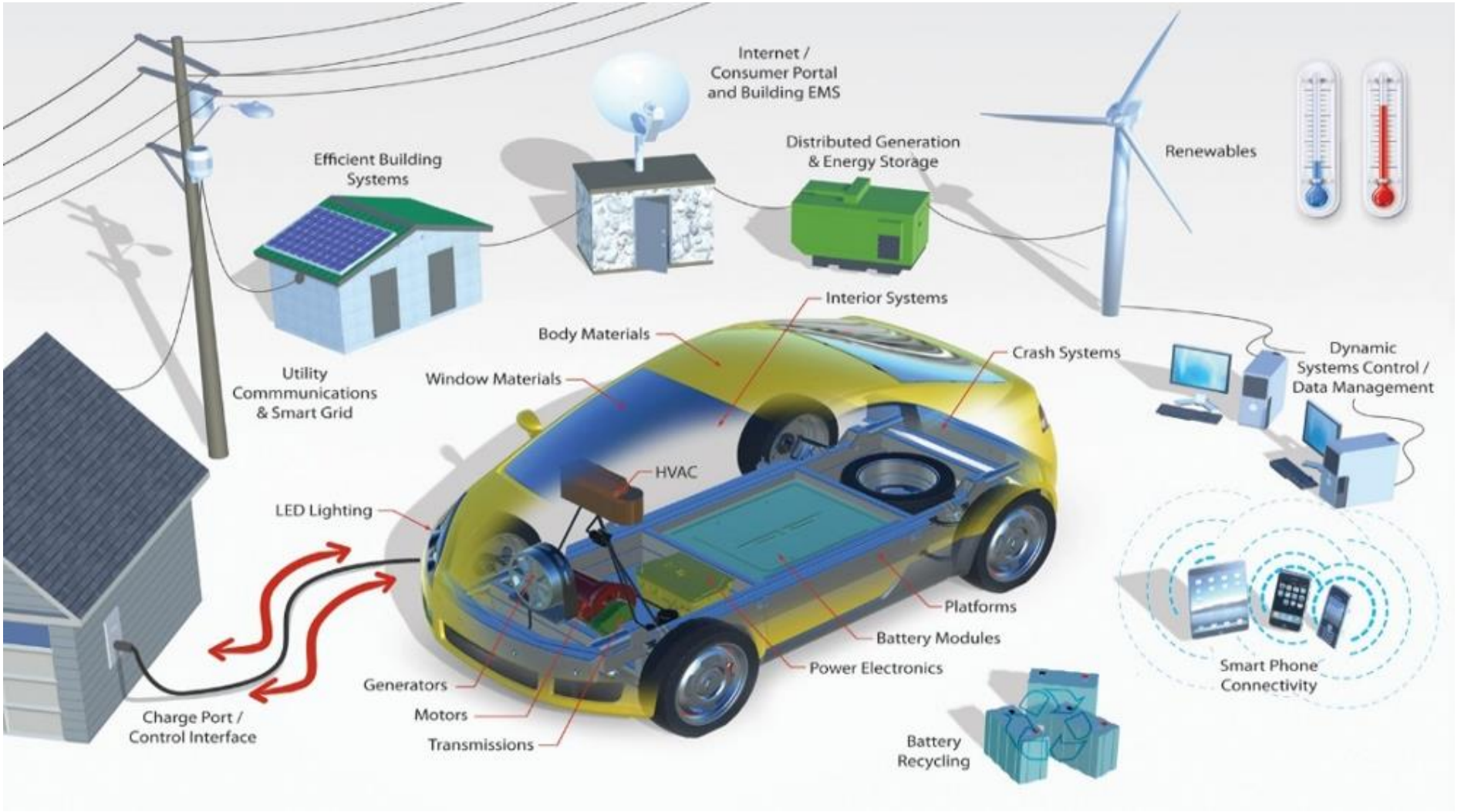
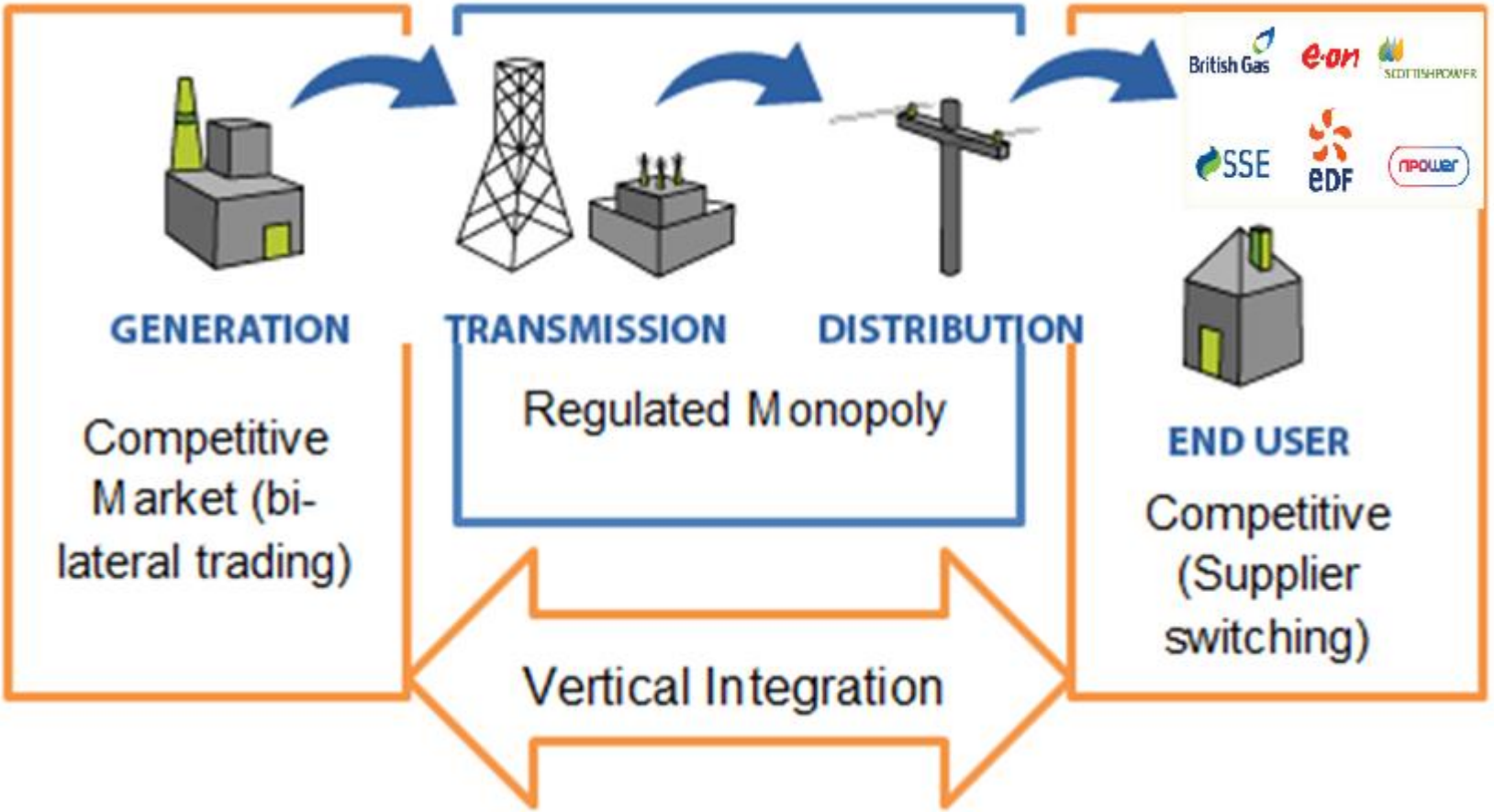

Vehicles
Energy Systems
Transport Infrastructures


Internet / Consumer Portal and Building EMS
Efficient Building Systems
Distributed Generation & Energy Storage
Renewables
Interior Systems
Body Materials
Crash Systems
Utility Commmunications & Smart Grid
Window Materials
Dynamic Systems Control / Data Management
HVAC
LED Lighting
Platforms
Battery Modules
Power Electronics
Smart Phone Connectivity
Generators
Motors
Transmissions
Charge Port / Control Interface
Battery Recycling



Source: adapted from http://ucahelps.alberta.ca/images/uca-electricity.gif

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Infrastructure Business models, valuation and Innovation for Local Delivery

TRANSITION PATHWAYS

Local Electricity Supply: Opportunities, archetypes and outcomes

Dr Stephen Hall
and Dr Katy Roelich
March 2015

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Business model innovation in electricity supply markets: The role of complex value in the United Kingdom

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HIGHLIGHTS

- Business models of energy supply markets shape energy transitions.
- The British system misses four opportunities of local electricity supply.
- Nine new business model archetypes of local supply are analysed.
- New electricity business models have complex value propositions.
- A process for policy response to business model innovation is presented.

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ABSTRACT

This research investigates the new opportunities that business model innovations are creating in electricity supply markets at the sub-national scale. These local supply business models can offer significant benefits to the electricity system, but also generate economic, social, and environmental values that are not well accounted for in current policy or regulation. This paper uses the UK electricity supply market to investigate new business models which rely on more complex value propositions than the incumbent utility model. Nine archetypal local supply business models are identified and their value propositions, value capture methods, and barriers to market entry are analysed. This analysis defines 'complex value' as a key concept in understanding business model innovation in the energy sector. The process of complex value identification poses a challenge to energy researchers, commercial firms and policy-makers in liberalised markets; to investigate the opportunities for system efficiency and diverse outcomes that new supplier business models can offer to the electricity system.

1. Introduction

To achieve energy transitions, technological and business model innovation must co-evolve with policy and system regulation (Foxon, 2011). However, much of the literature on technical and business model innovation neglects the retail or 'supply' element of the energy value chain. In liberalised markets the dominant supply business model has been the corporate utility, selling units of energy to consumers in national markets (Hannon et al., 2013). Very little has been done by the energy research community to examine challenges to this dominant supply model, or the national scale at which it operates. Supply business models on smaller scales (from city-region to neighbourhood) have the potential to: expand the penetration of renewable energy, accelerate demand management, drive energy efficiency, and re-localise energy value. However, there has been no systematic analysis of the business models that can realise these opportunities, or understanding of why they remain uncommon in liberalised markets. Electricity supply business models that are designed to operate sub-nationally, pose a number of challenges to policy-makers, regulators, and mainstream utilities.

This paper is structured as follows: Section 2 describes the literatures on business model innovation in the energy sector, focussing on the *value proposition* and *value capture* elements of the business model concept to frame four research questions. Section 3 describes the study methodology. Section 4 presents our results. Section 5 considers how the notion of 'complex value' is useful in understanding these business model innovations and describes how a complex value framing poses new questions for energy policy. Section 6 concludes with recommendations for policymakers across liberalised markets.

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0301-4215/

Diagram: The current archetype

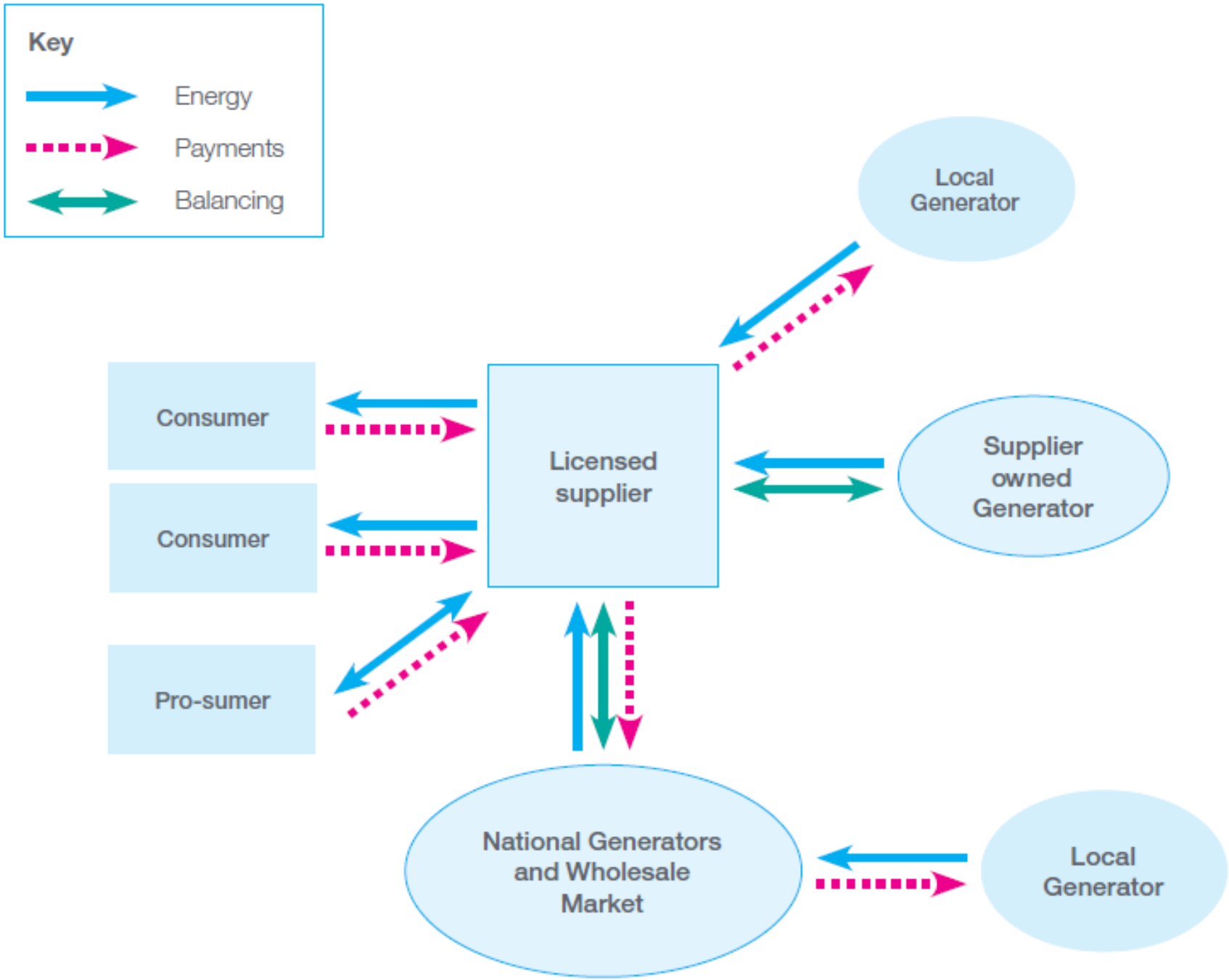
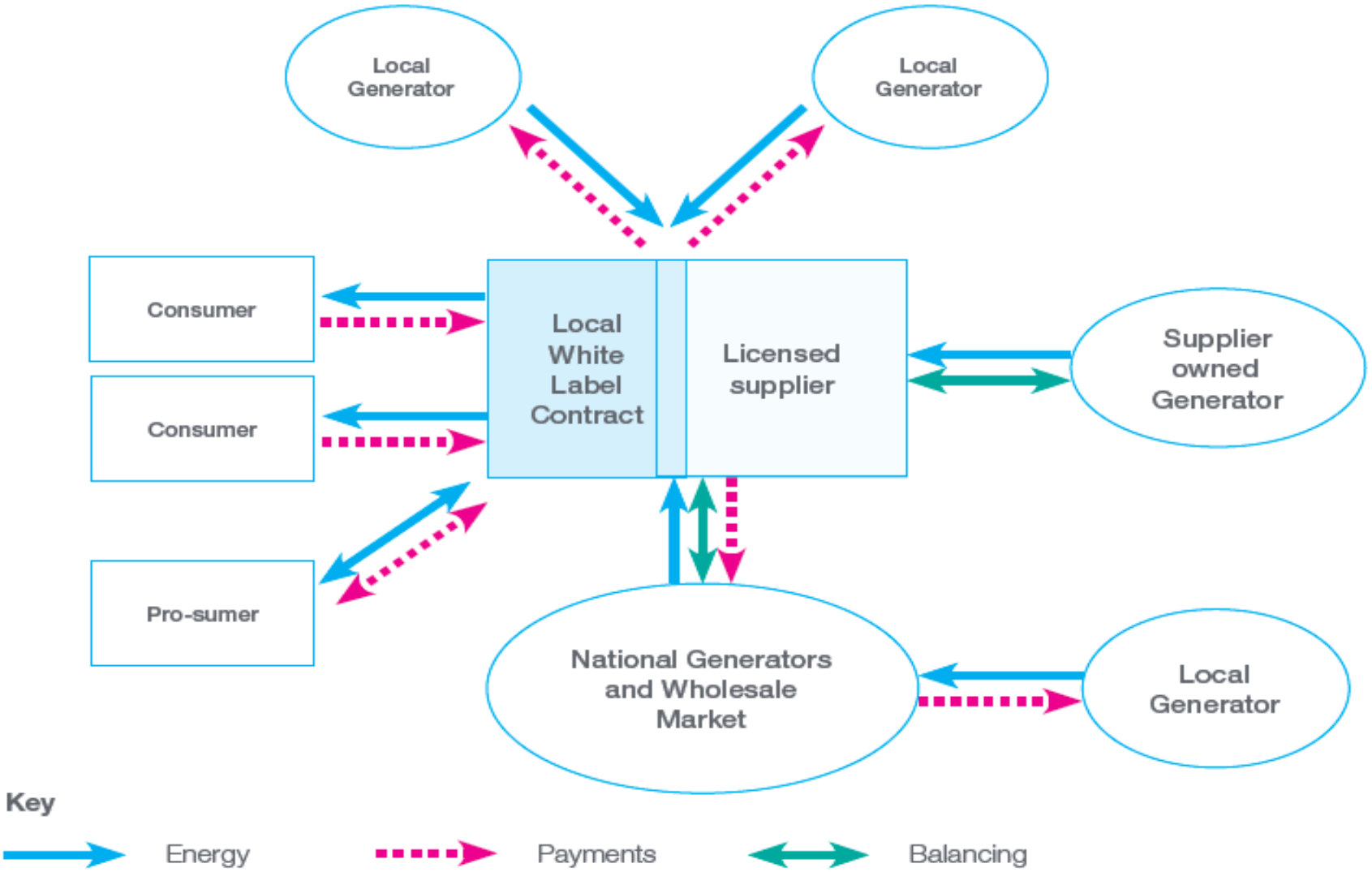
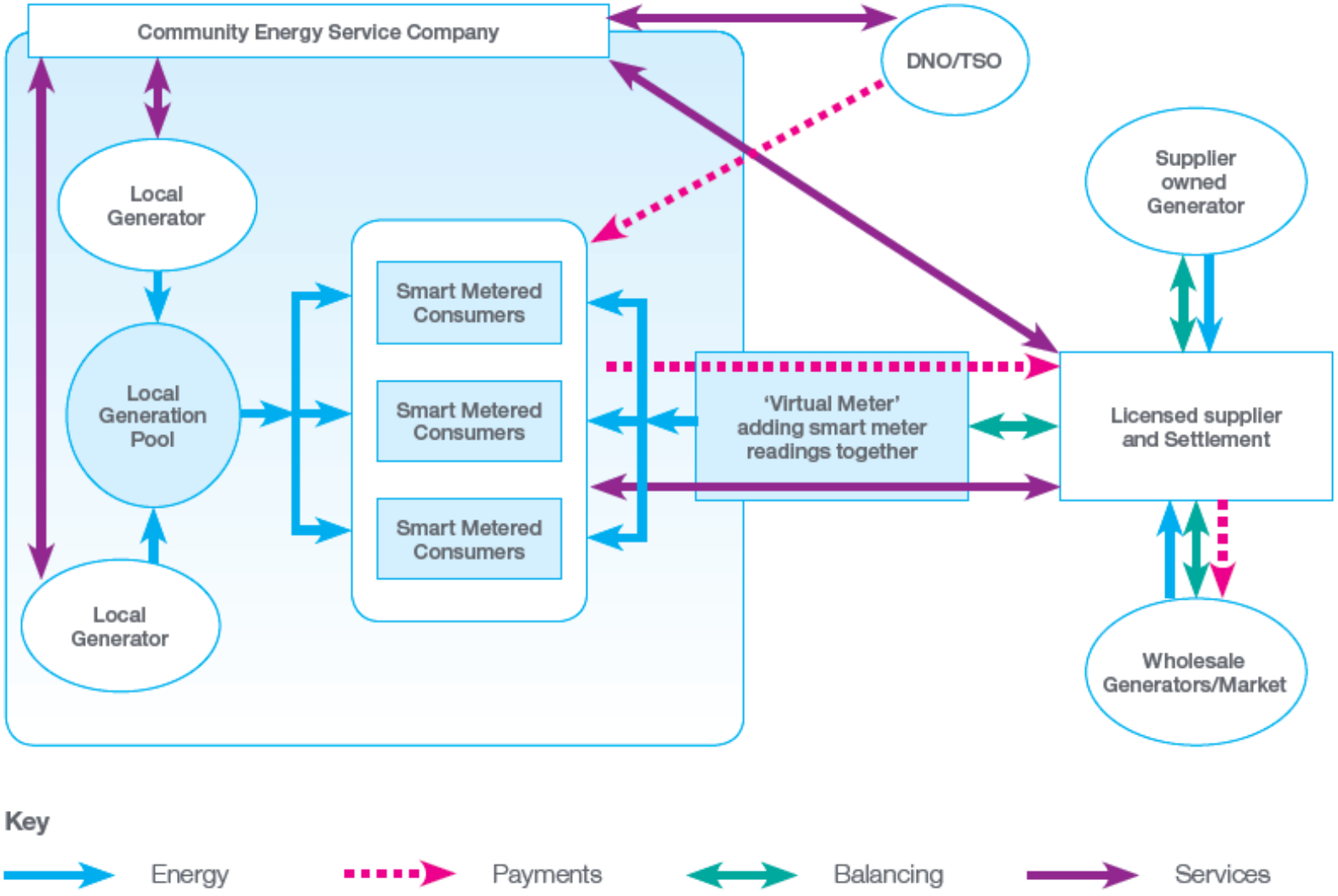


Diagram: Local white label archetype




Community Energy Service Company
DNO/TSO
Local Generator
Supplier owned Generator
Local Generation Pool
Smart Metered Consumers
Smart Metered Consumers
Smart Metered Consumers
'Virtual Meter' adding smart meter readings together
Licensed supplier and Settlement
Local Generator
Wholesale Generators/Market
Key
Energy
Payments
Balancing
Services

Value propositions: Operating reserve, Frequency response, Capacity markets, Peak avoidance, Network reinforcement, Time of use pricing.

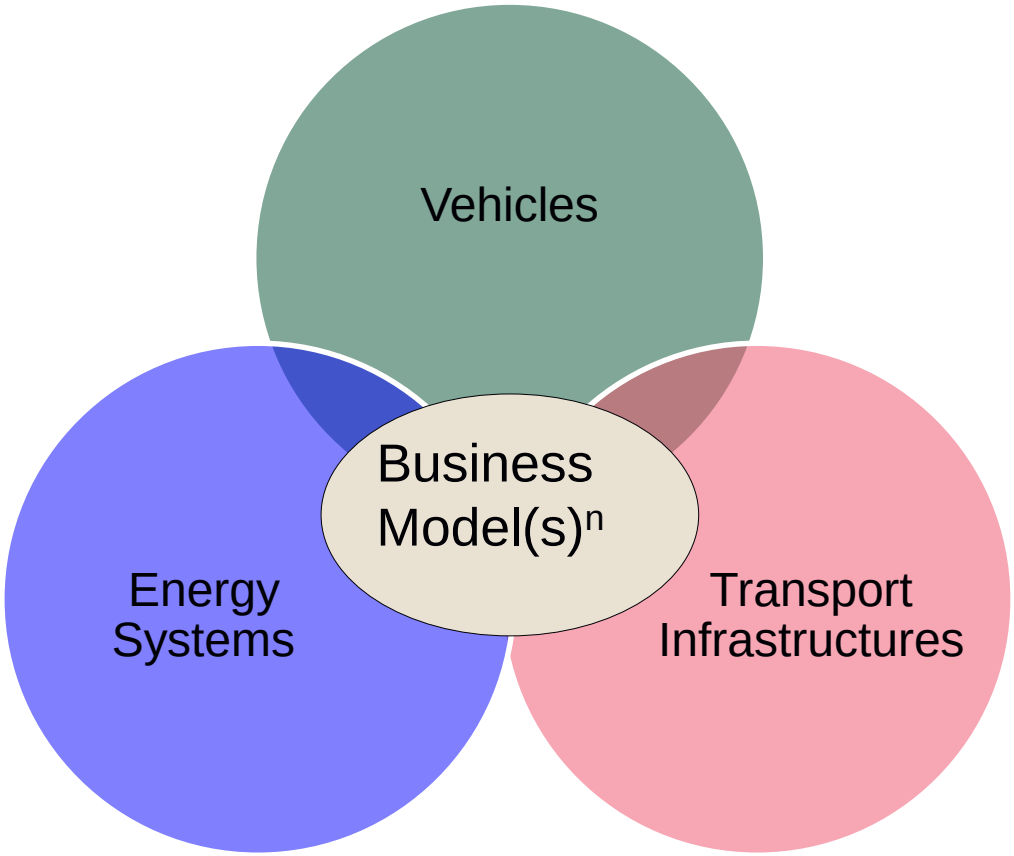
Technical Innovation: Smart Charging, Vehicle to Home, Vehicle to Grid, Vehicle to compound, second life battery, RE Self consumption.

Business models: Local aggregation, national aggregation, white labelling, local balancing, virtual net metering, EV tariffs, ToU pricing, pool and sleeve, peer 2 peer.

Value Proposition

Technical Enabler

Value Capture (revenue structure)



For Vehicle Manufacturers

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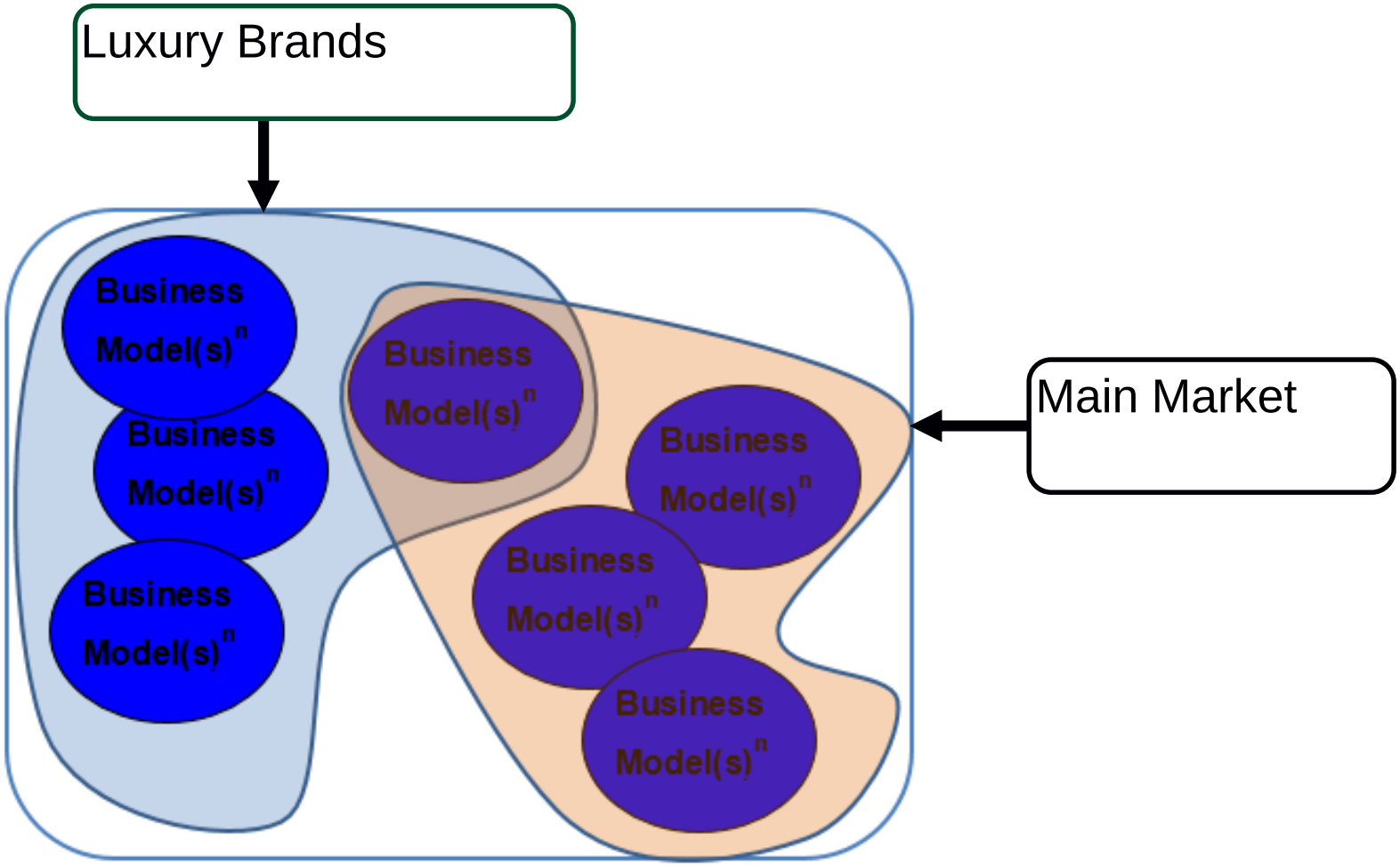

For Utilities

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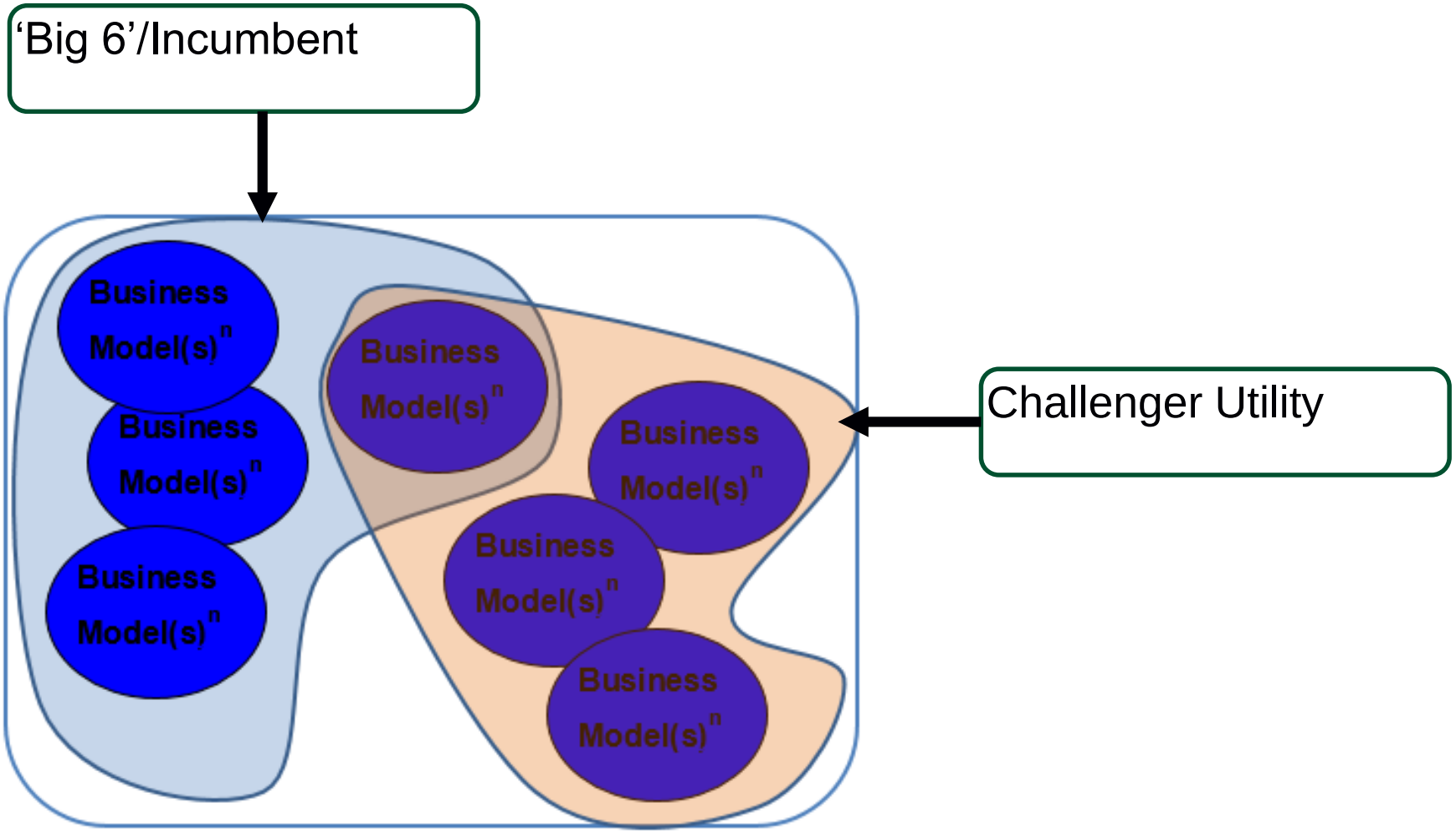

For Cities

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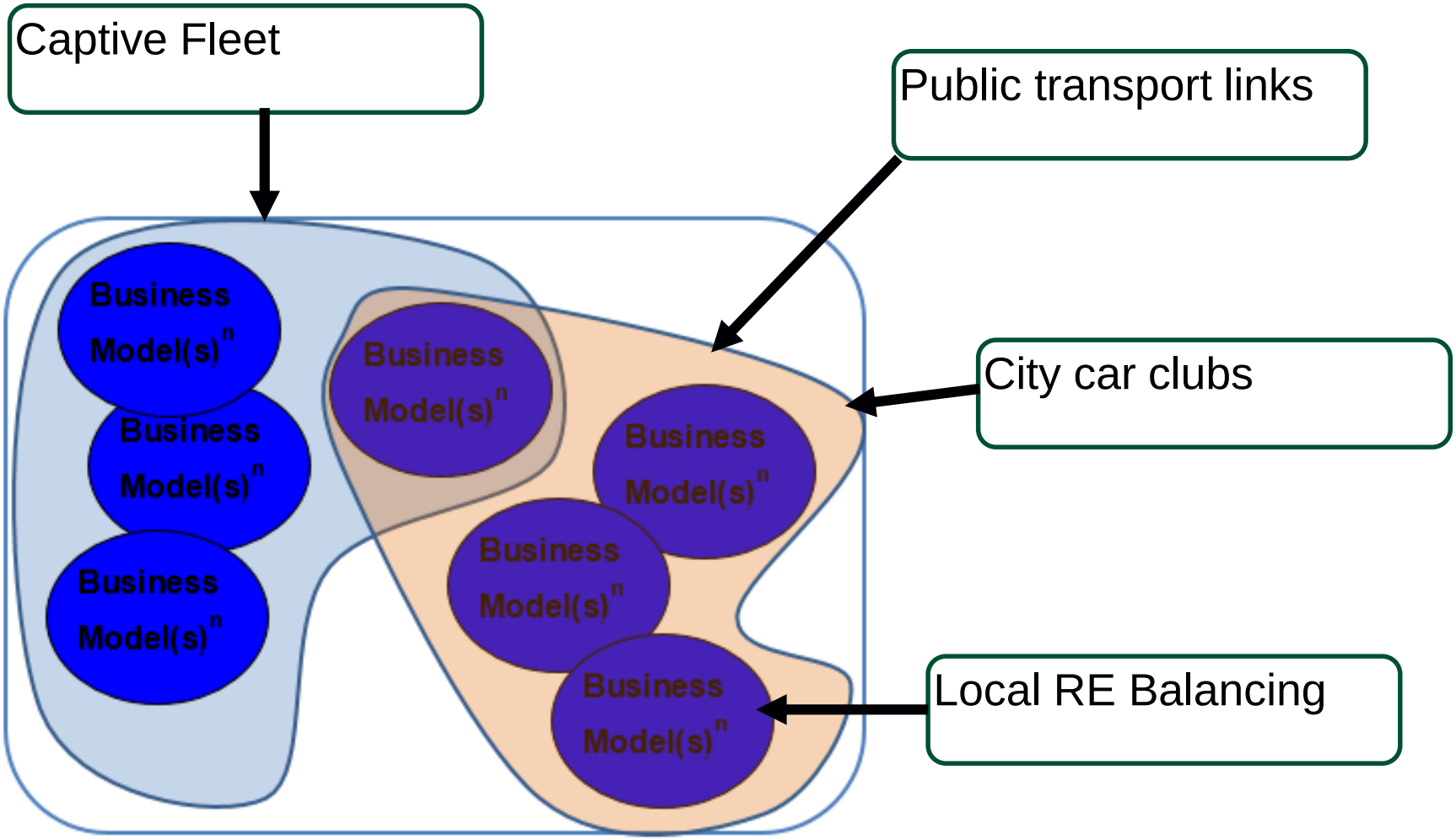

Pathways

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1. Centralised Utility + Luxury Brand = White label tariff & V2H
2. Mass Market + Centralised Utility = White label tariff & V2G
3. Challenger brand + Municipal Utility = Local tariff & RE Sleeving
4. (x+y) = (a&b)
5. (a&b) = (x=y)
6. (a&?) = (?+x)… etc

Public Infrastructures- Rapid Charge Hubs

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http://zerocarbonista.com/2008/05/23/more-on-transport-petrol-stations-of-the-future/

Public Infrastructures - Vehicle Vending

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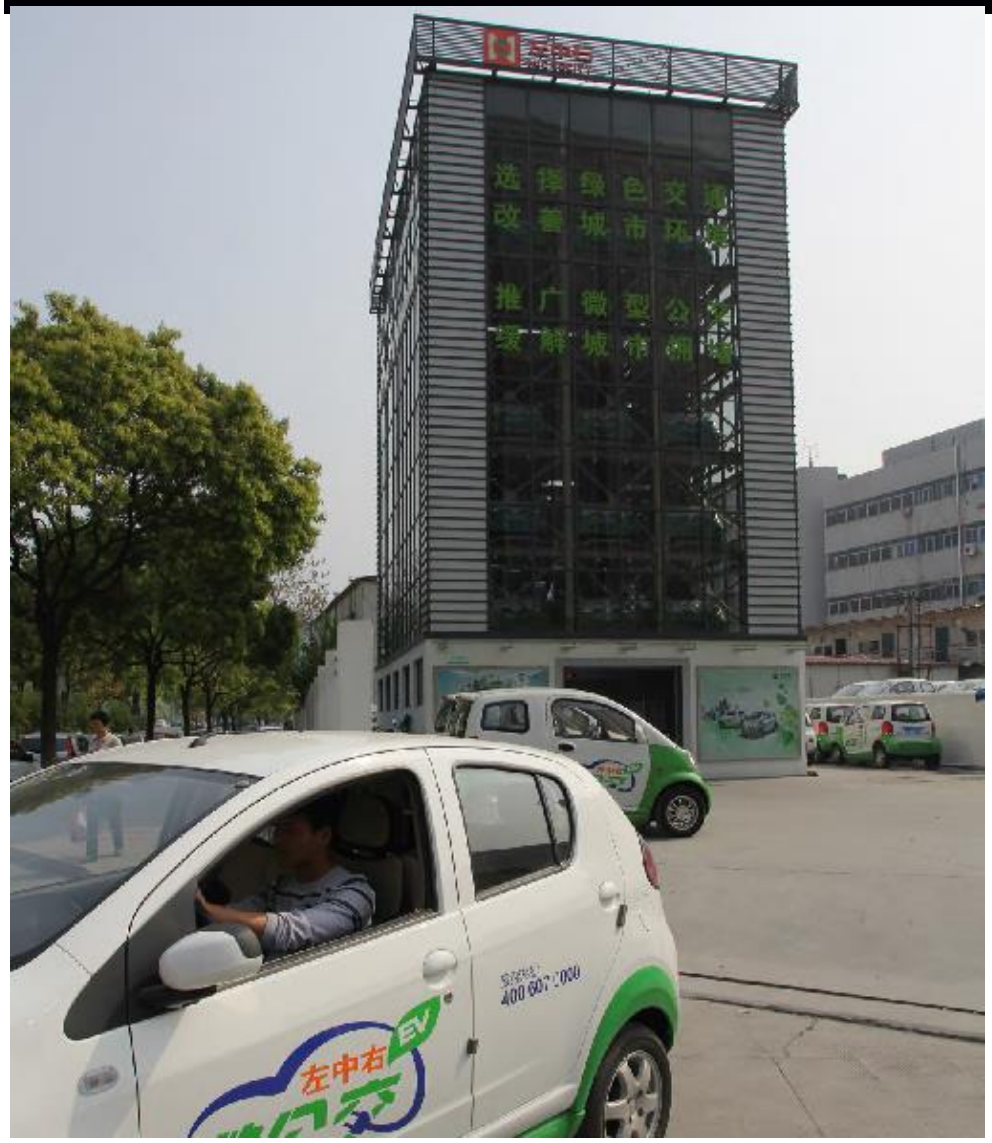

Public Infrastructures - Mobility service provider

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http://www.theavenuestory.com/blog/how-to-get-around-paris-velo-metro-bus-taxi-boat-pick-your-way/

Time of Use Pricing

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Energy tariffs for electric vehicle users

Off-Peak Saver Tariff

Charge your electric vehicle at a lower cost for longer and discover even more savings with our smart meter

British Gas' innovation in the electric vehicle market doesn't stop with charger installations. To help our customers continue to get the most from their electric vehicles - for less - we've introduced a special tariff.

With our special Off-Peak Saver Tariff[1] you'll be able to charge at a cheaper rate over a period of 20 hours every day.

Source: https://www.britishgas.co.uk/energy-saving-products/electric-vehicles/energy-tariffs-for-electric-vehicle-users

Municipal Utilities

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http://www.togetheragency.co.uk/work/client/robin-hood-energy/outdoor-advertising

Municipal Utilities

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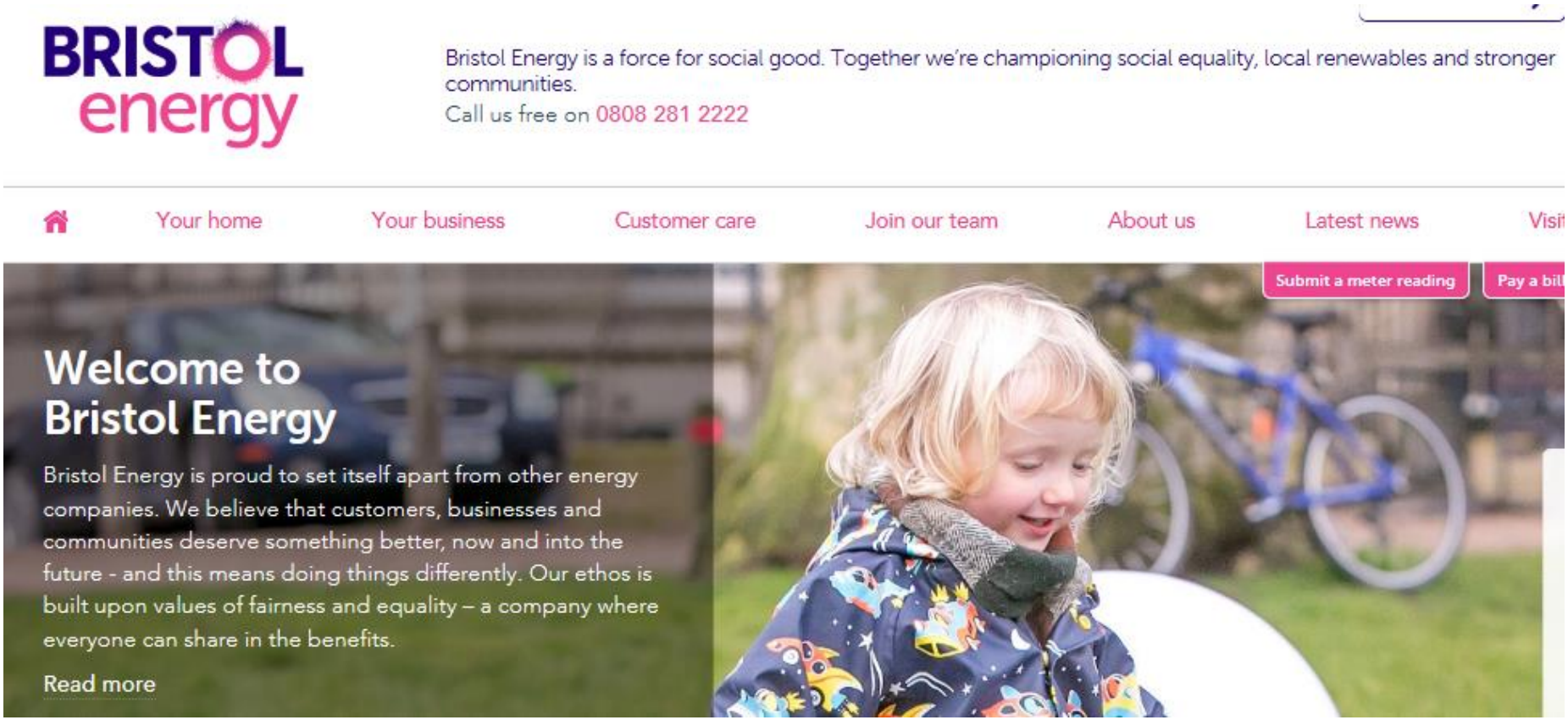

https://bristol-energy.co.uk/

Vehicle to Home

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39_BI-DIRECTIONAL CHARGING

Kitakyushu, Japan → EVs as a Power Supply

BI-DIRECTIONAL CHARGING

2,800

BI-DIRECTIONAL CHARGERS
DISTRIBUTED IN JAPAN BY NISSAN.[1]

// Average daily electricity use of a Japanese household is approximately 10~12kW.

// The capacity of the Nissan LEAF's lithium-ion battery is 24kW, and thus is able to provide two days worth of electricity to a household unit when the battery is fully charged.

// By 2020, Navigant Research predicts that nearly 200,000 electric vehicles will be equipped with bi-directional charging capabilities.

Source: EV City Casebook; 50 Big ideas shaping the future of electric mobility, Urban Foresight (2014).

Vehicle to Grid

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Nissan Pilots Vehicle-To-Grid Technology In Denmark

William Pentland
CONTRIBUTOR
I write about energy and environmental issues.

FULL BIO >

The automobile industry just took a small, but significant step into the stationary electric power business.

Nissan, the Japanese car maker, and the Enel Group, one of the largest power companies in Europe based in Rome, signed an agreement to conduct a first-of-its-kind pilot project that will allow grid operators to leverage electric vehicles to manage the electric power grid.

The pilot will deploy Vehicle to Grid (V2G) technology that integrates electric vehicles into the power grid by allowing them to supply electricity to the grid. The V2G system is expected to provide grid operators with greater flexibility and enhanced stability.

http://www.forbes.com/sites/williampentland/2015/12/08/nissan-pilots-vehicle-to-grid-technology-in-denmark/#625662a1977d

Methods

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Literature review

21 Semi-structured elite interviews with vehicle manufacturers, transport planners, infrastructure providers, energy utilities and government.

2 x business model innovation workshops (University of Leeds, Urban Innovation Centre London)

Analytical phase is live.

Public Charging Current Archetype

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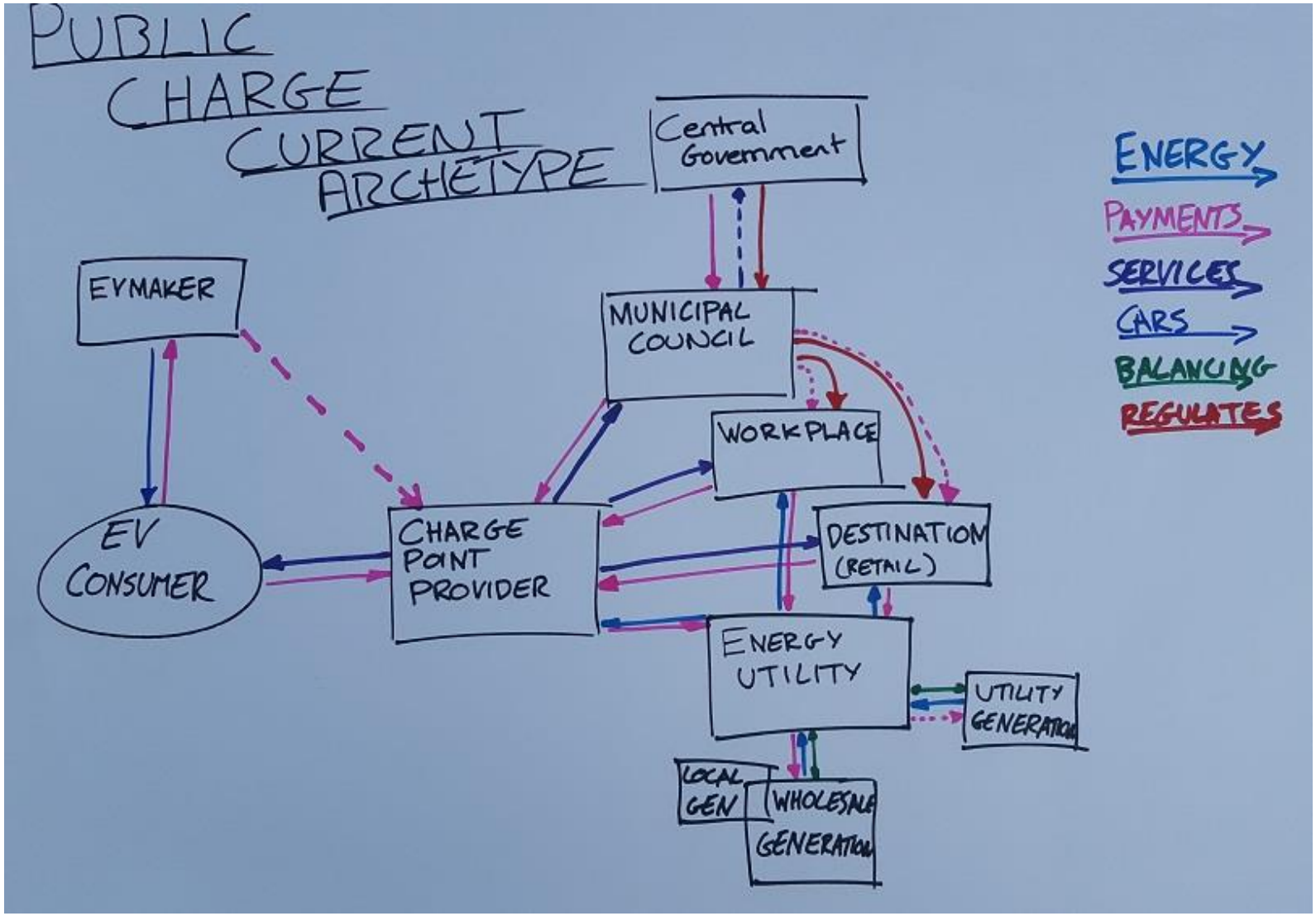

Rapid Charge Hubs

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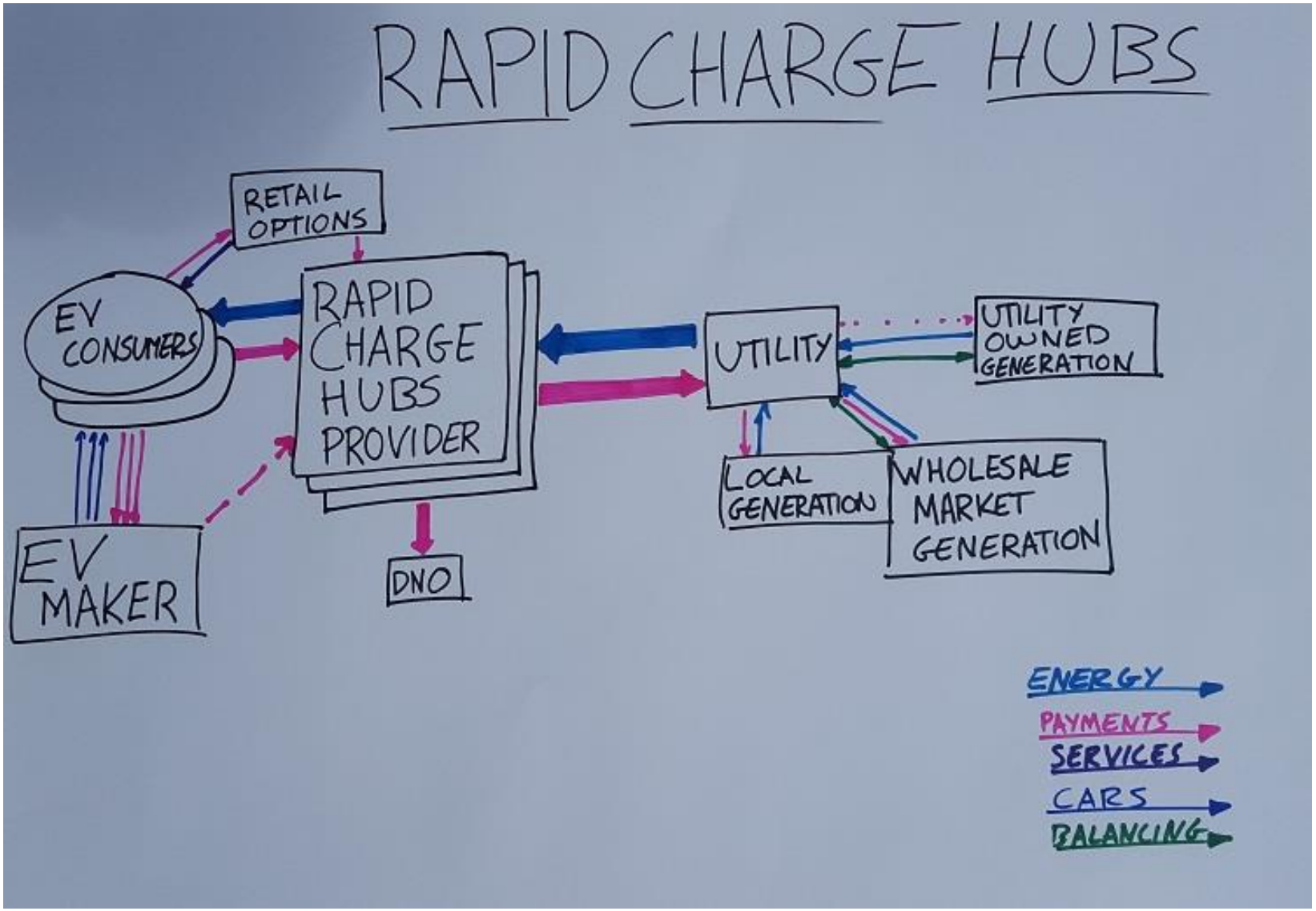

Smart Car Share Compound

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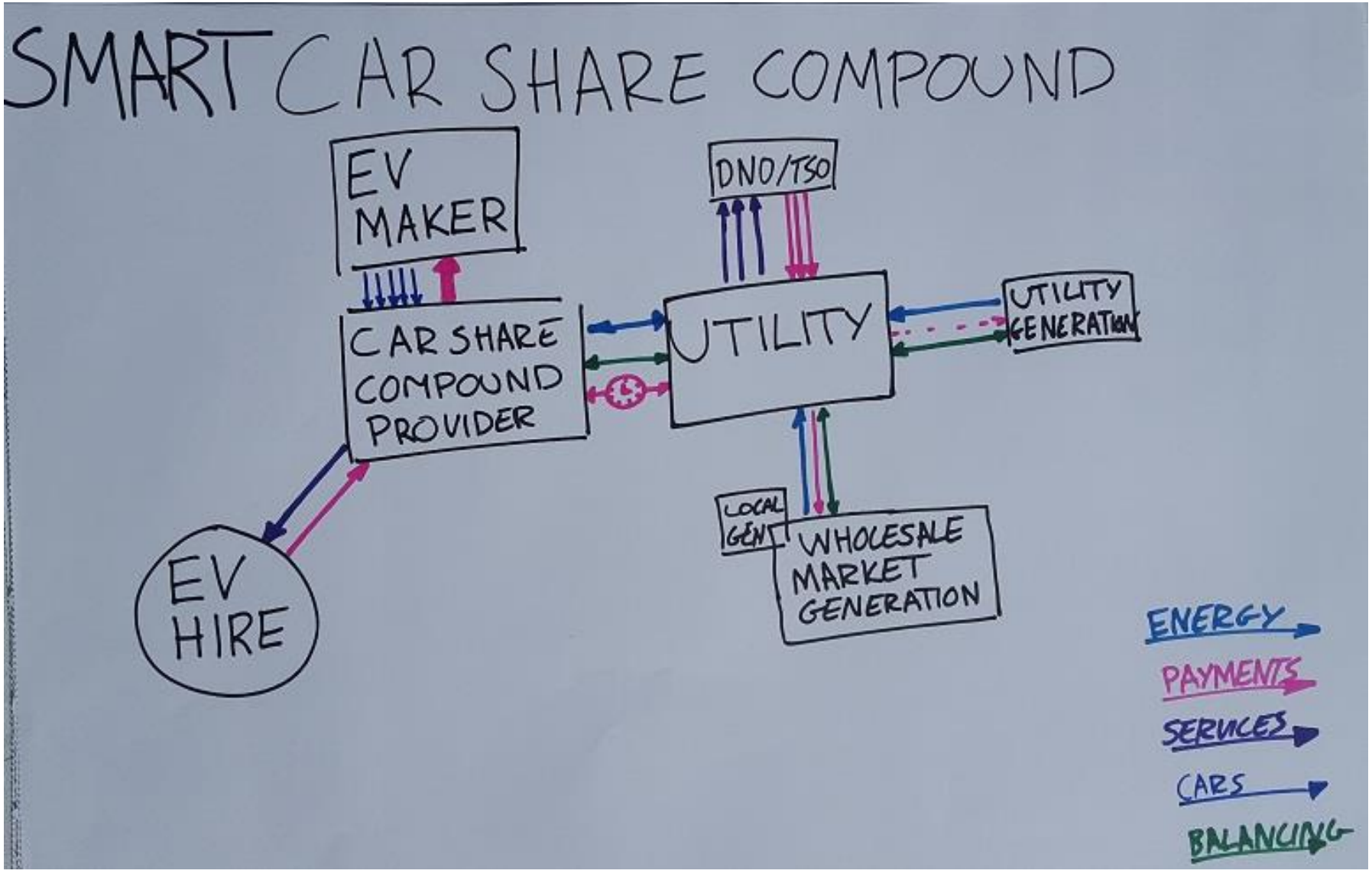

E-Mobility Service

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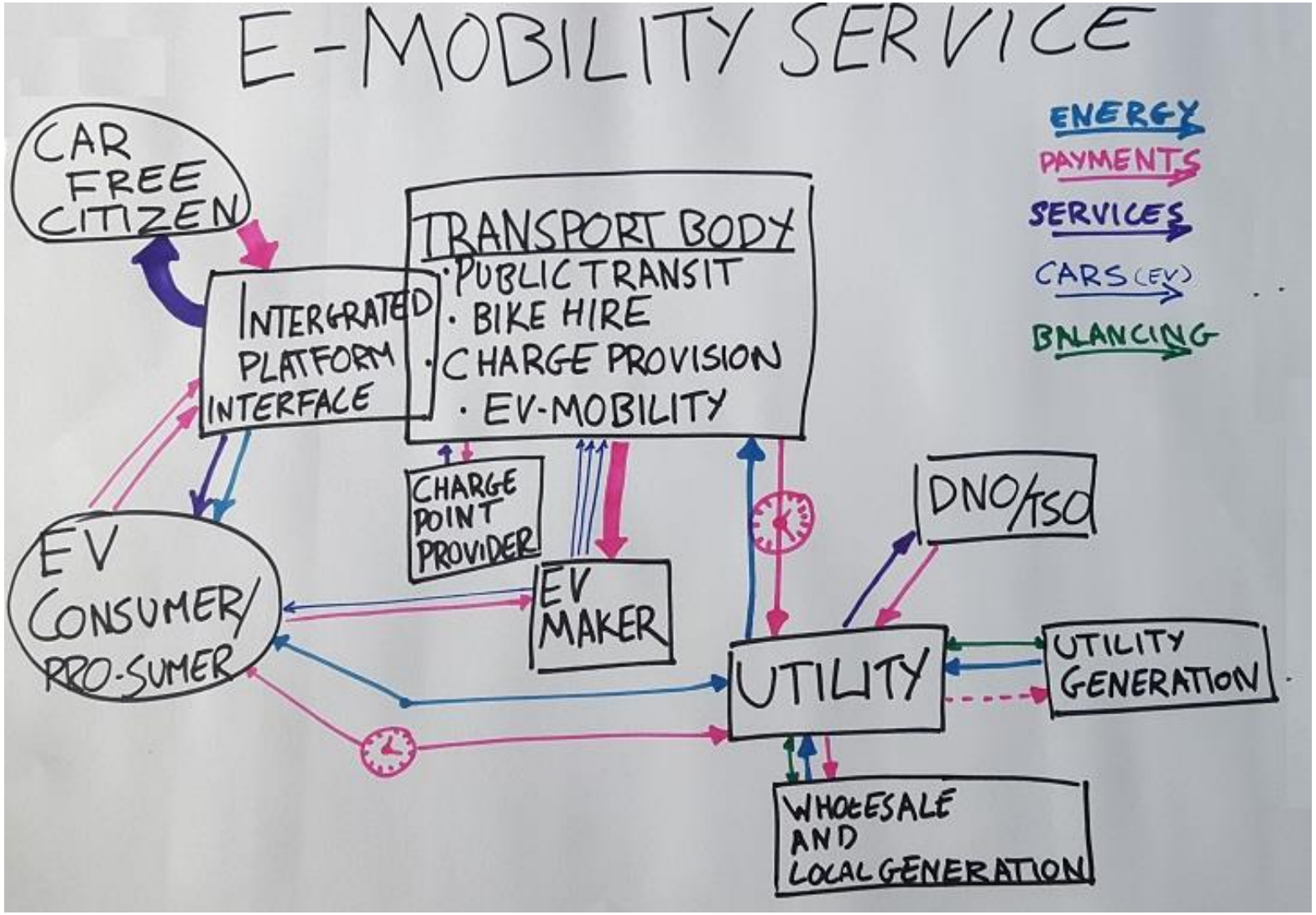

Activity 2: The Current Archetype

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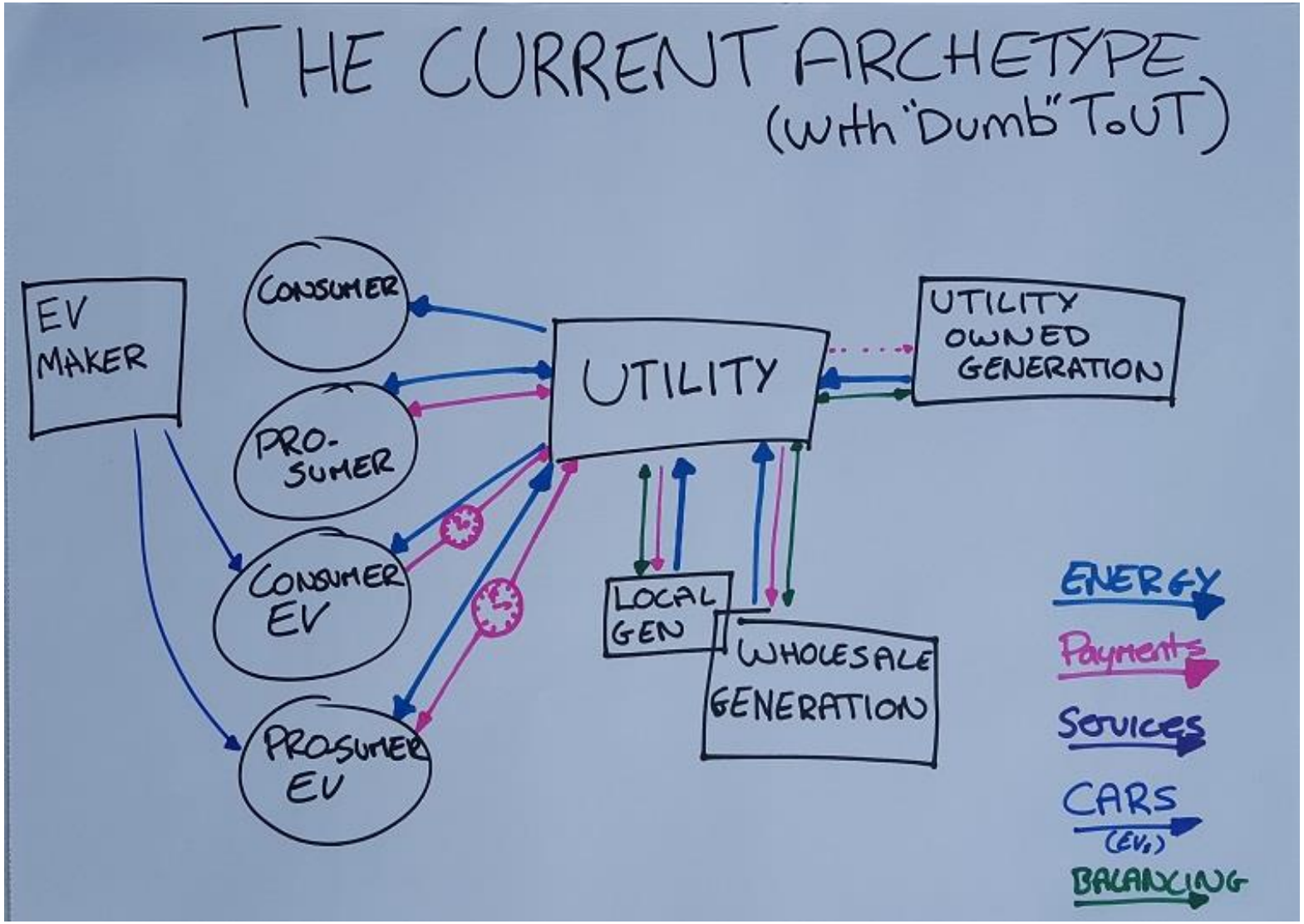

The Smart Utility

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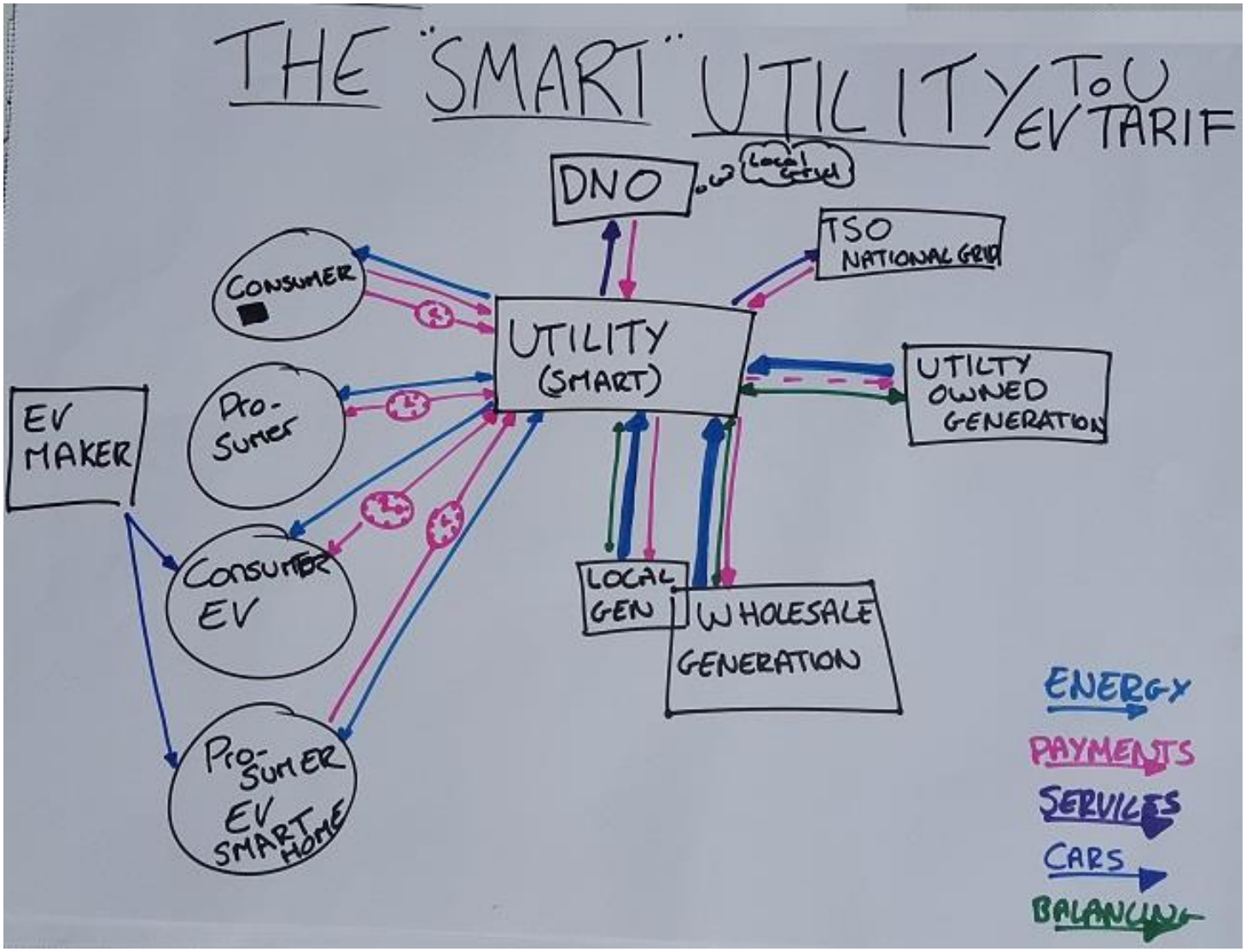

EV White Label

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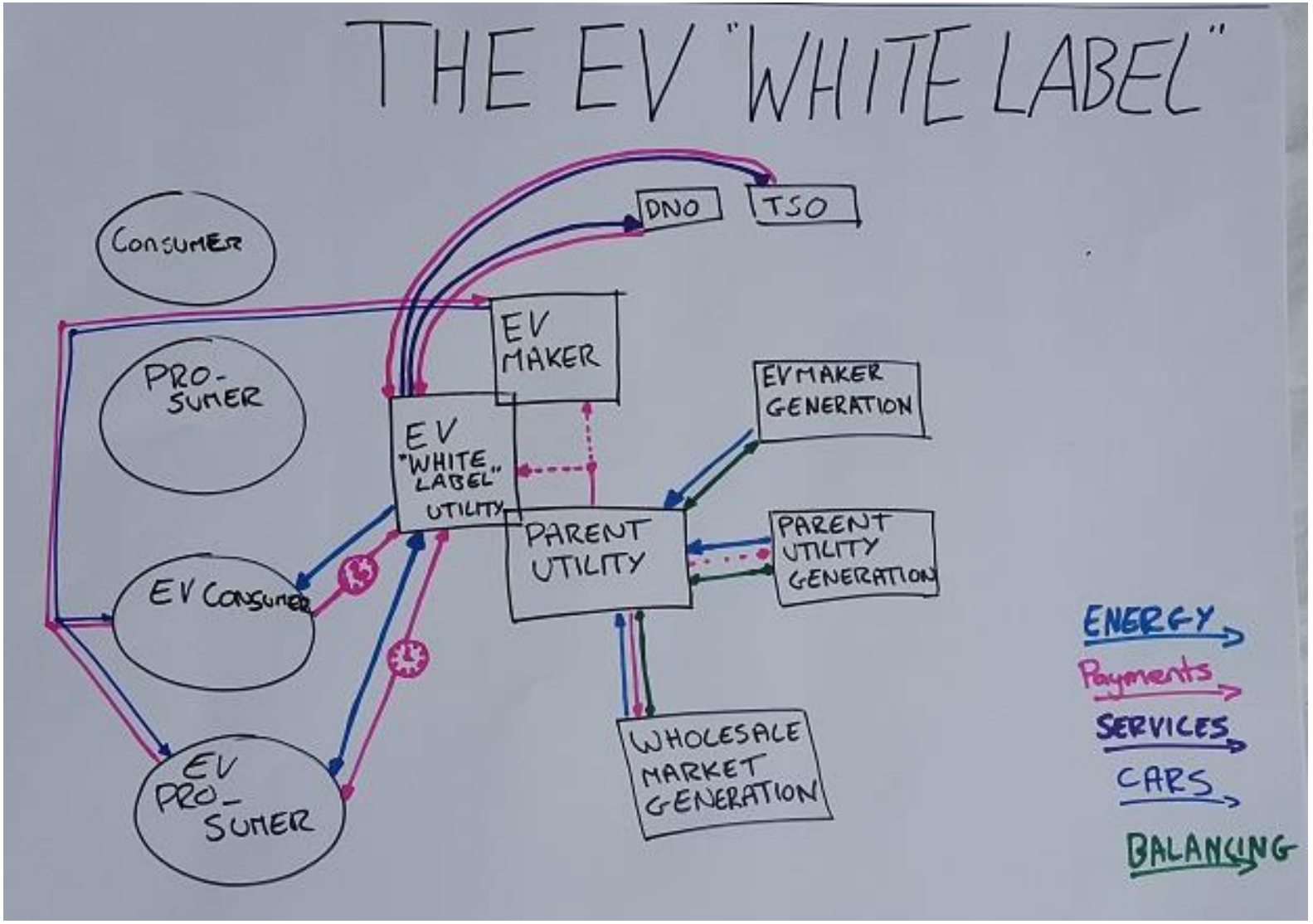

The Mobility Utility

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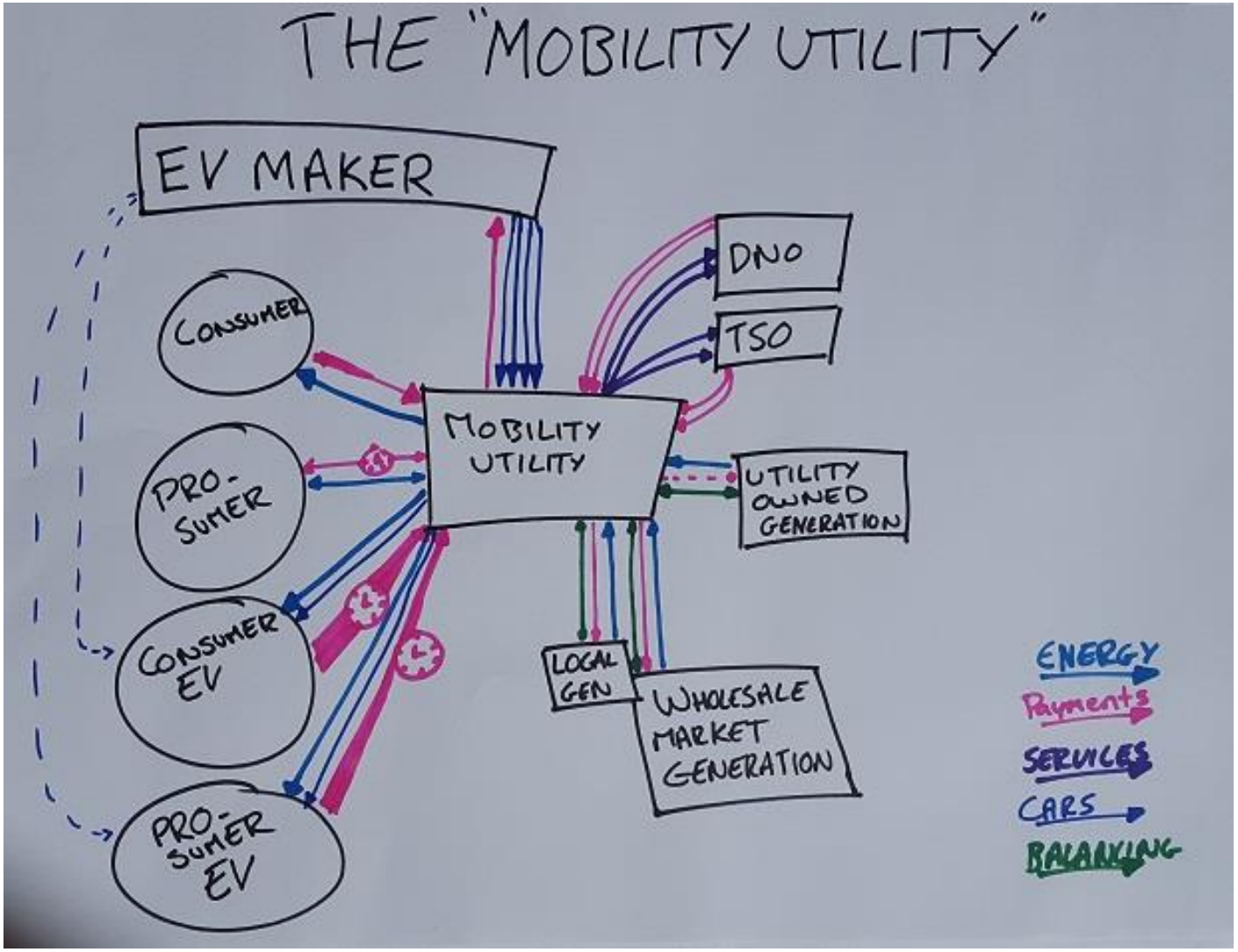

The Municipal Mobility Utility

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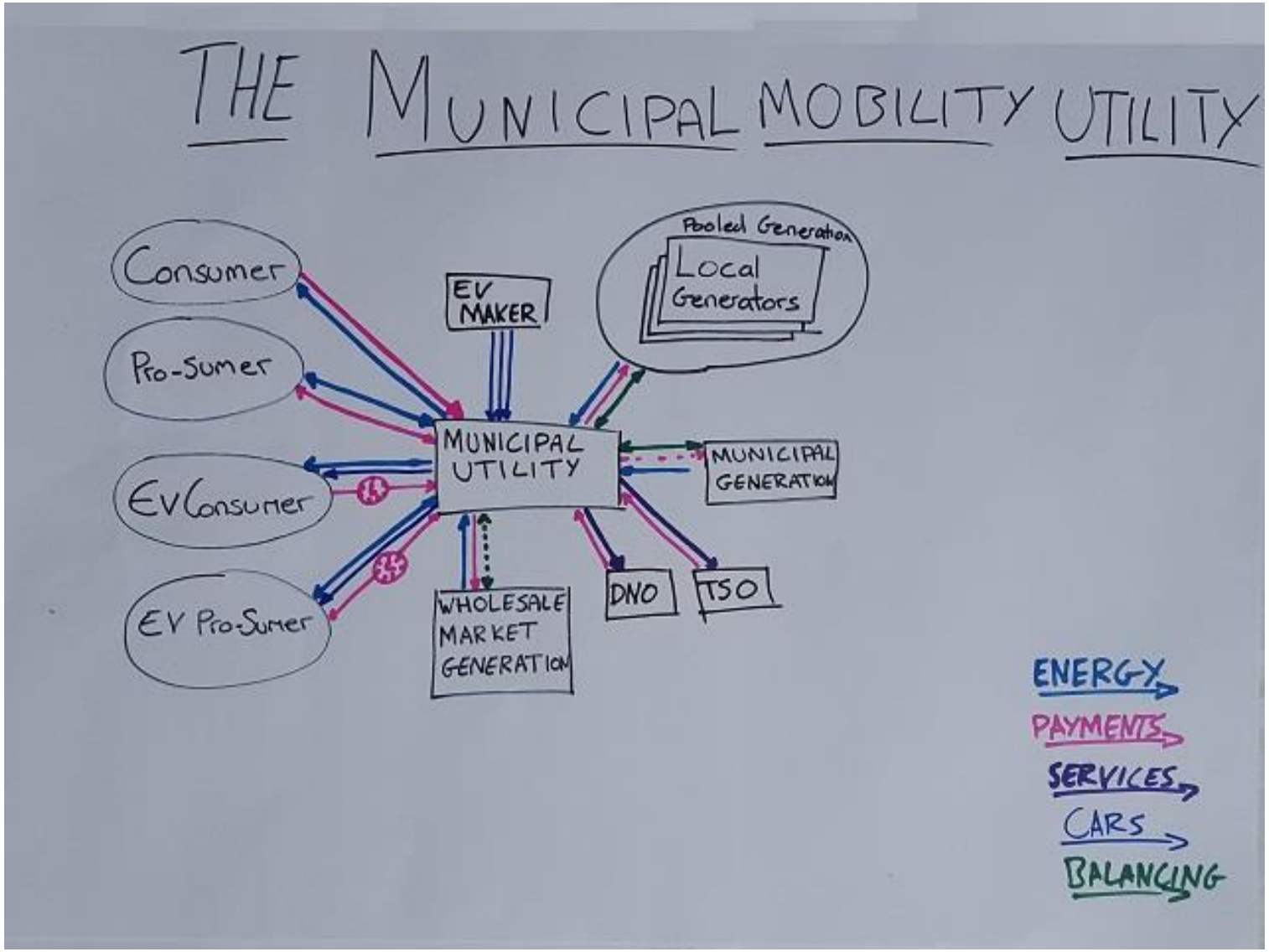

The Multi Service Model

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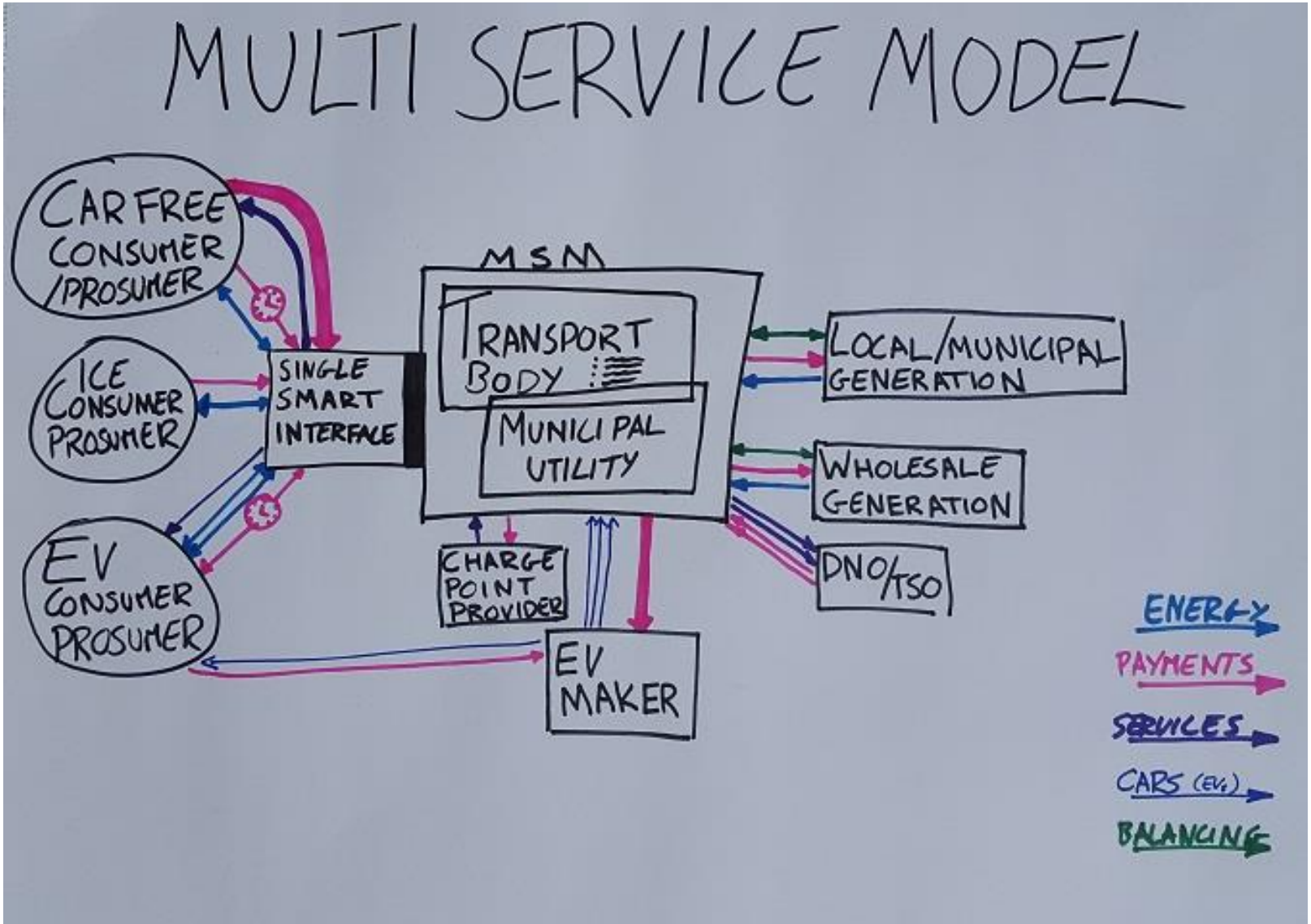

Early Findings

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Provision across Northern Powerhouse cities is hugely uneven.

There is no commercial business case for public charging for electric vehicles.

There are multiple commercial business cases for destination and workplace charging yet these remain ‘dumb’ and niche.

We are at a tipping point for mobility innovation but there is huge uncertainty over the magnitude of value propositions.

Challenger city utilities are well placed to exploit new value propositions.

Systemic infrastructural effects.

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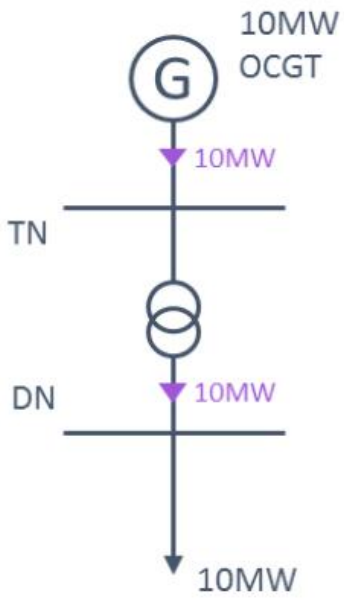
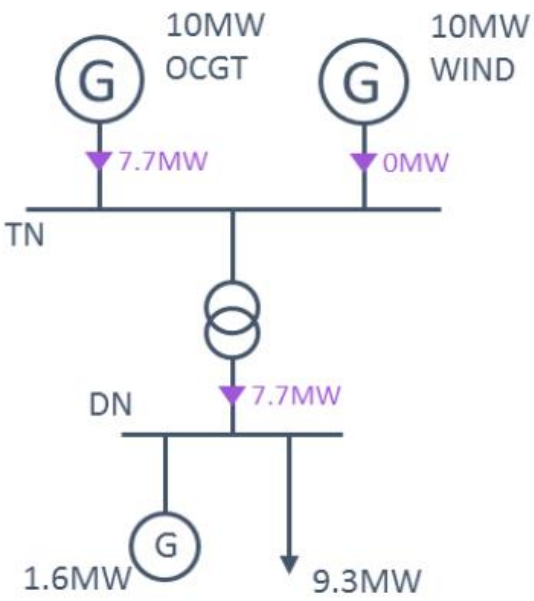
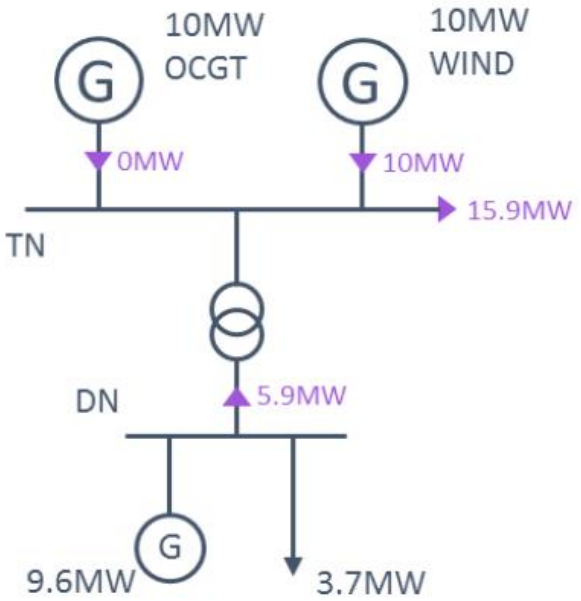


A) Baseline



B) High Capacity, Max Demand



C) High Capacity, Max Export

Systemic effects

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EV penetration means new business models WILL emerge for linking transport and energy systems.

These new business models will make most sense operated at the city scale.

Combined with local electricity supply business models this will challenge BOTH Transmission infrastructure revenues and incumbent utilities.

Recommendations

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