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Office for Low Emission Vehicles

Electric Vehicle Energy Taskforce

Work Package One: A common strategic understanding of the requirements of the energy system to support mass EV uptake

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Background

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Work Package 1 – The Task

A common strategic understanding of the requirements of the energy system to support mass EV uptake

- There are a wide range of stakeholders from different sectors involved in ensuring the GB energy system is ready for and able to best exploit the mass take up of electric vehicles.

- Work Package 1 aims to provide a perspective on the following:
  - Gaining a common understanding of the relative importance of the impacts that need to be addressed (e.g. reducing peak demand, reducing network reinforcement).
  - Establishing where financial benefits accrue, and risk is held, under different investment approaches.
  - What the appropriate balance is between regulation and market mechanisms to encourage innovation.
  - Holistic view of the energy system and how it may evolve. How to account for wider energy system changes, for example, decarbonising heat and decentralised power generation. [Scenario(s)]
  - How to ensure that the needs of EV and energy users are simultaneously met.

Work Package 1 – The Questions

Work Package 1 should consider the following specific questions:

1. How can we ensure that the local network effects of EV uptake in the near term (i.e. before smart meters and smart tariffs are fully offered) and long term are managed in an effective and efficient way?
2. What are the barriers for EVs (in terms of smart charging and V2G) accessing the energy markets?
3. Are changes required to metering/supply arrangements to accommodate new innovative business models associated with EV charging infrastructure, whilst ensuring that consumers' interests are protected?
4. How applicable are international examples (e.g. California, Norway) to GB in terms of overcoming network constraints and the adoption of smart charging?

Work Package 1 – The Questions

Work Package 1 should consider the following specific questions:

5. Where do the investment opportunities lie, including for smart and V2G? Is intervention required? Are there opportunities to optimise costs or improve amenity that aren't being progressed? Are interventions needed to help overcome barriers?

6. How can we ensure that EV charging works in harmony with other changes to the energy system, such as decarbonising heat (especially if we don't know what these changes will be)?

7. What can be agreed about the shared long-term vision for the energy system requirements for mass EV uptake (e.g. the market arrangements, where the benefits will accrue and where costs should fall)?

Approach

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Engagement

- 26th October 2018 – Kick Off – Scoping Workshop held at the ENA with WP1 volunteers
- November 2018 –Project Team and Volunteer Group formed to develop a literature list of the current landscape with respect to the questions set
- December 2018 – Literature review conducted and library developed to show where evidence exists to answer the questions and where potential gaps exist. Initial set of principals and positions developed from this work.
- 10th January 2019 – Literature Review – Principles and Positions workshop held at the ENA with WP1 Volunteers
- 11th February 2019 – Positions tested and stretched with the wider EVET stakeholder group
- 19th February 2019 – WP1 Volunteer group – workshop to develop Principles and Positions further
- 22nd February 2019 – EVET Stakeholder Webinar for wider input into the development of the positions.

Thank you to the following organisations for their input and engagement thus far in the work:

BEAMA, BEIS, Cornwall Insight, Delta Energy & Environment, EA Technology, ELEXON Ltd, Energy Networks Association, Gemserv, Greater London Authority, Innogy, Millhouse Power, National Grid(SO), National Grid(TO), Newcastle Uni(CESI), Nuvve, Ofgem, OLEV, Renewable Energy Association, Ricardo Energy & Environment, Tesla, UK Power Networks, Western Power Distribution

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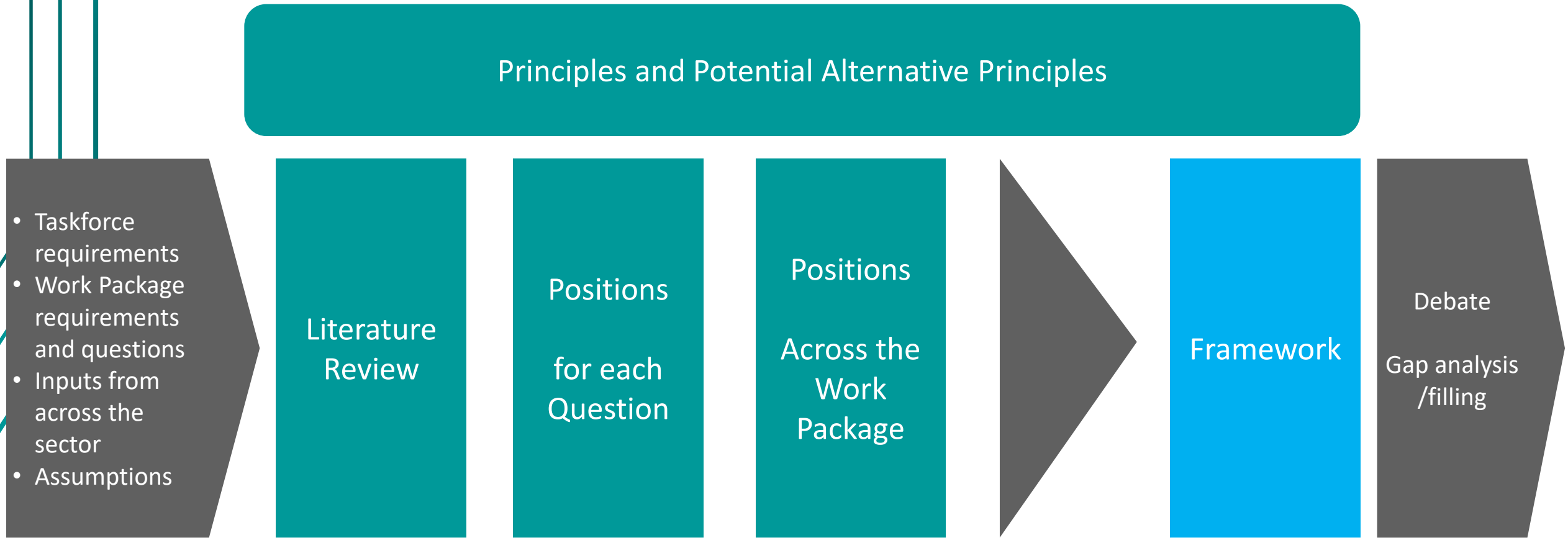
Approach



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Approach

- Taskforce requirements
- Work Package requirements and questions
- Inputs from across the sector
- Assumptions

Literature Review

- In-depth literature review to understand and describe the current landscape with respect to Work Package 1's aim- to develop "a common strategic understanding"
- 90+ sources
- Drawing on evidence generated by many parties in different forms including pilot projects, surveys, reports, and consultations.
- "Living" library

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Debate

Gap analysis /filling

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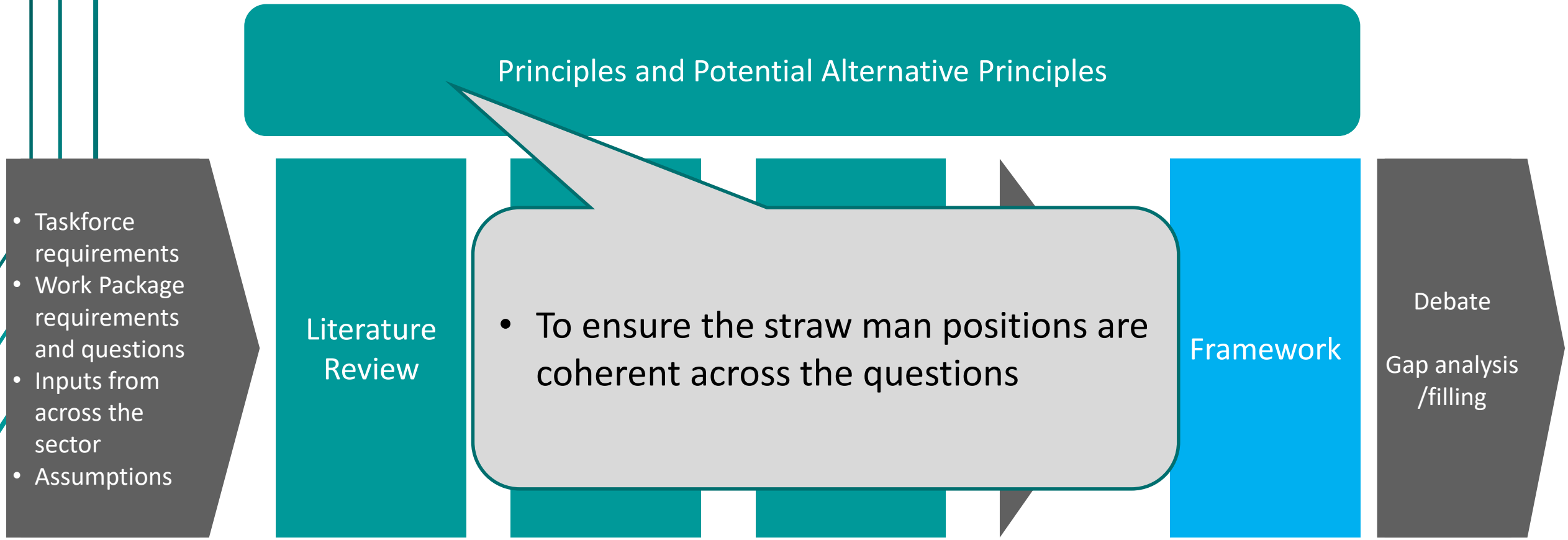

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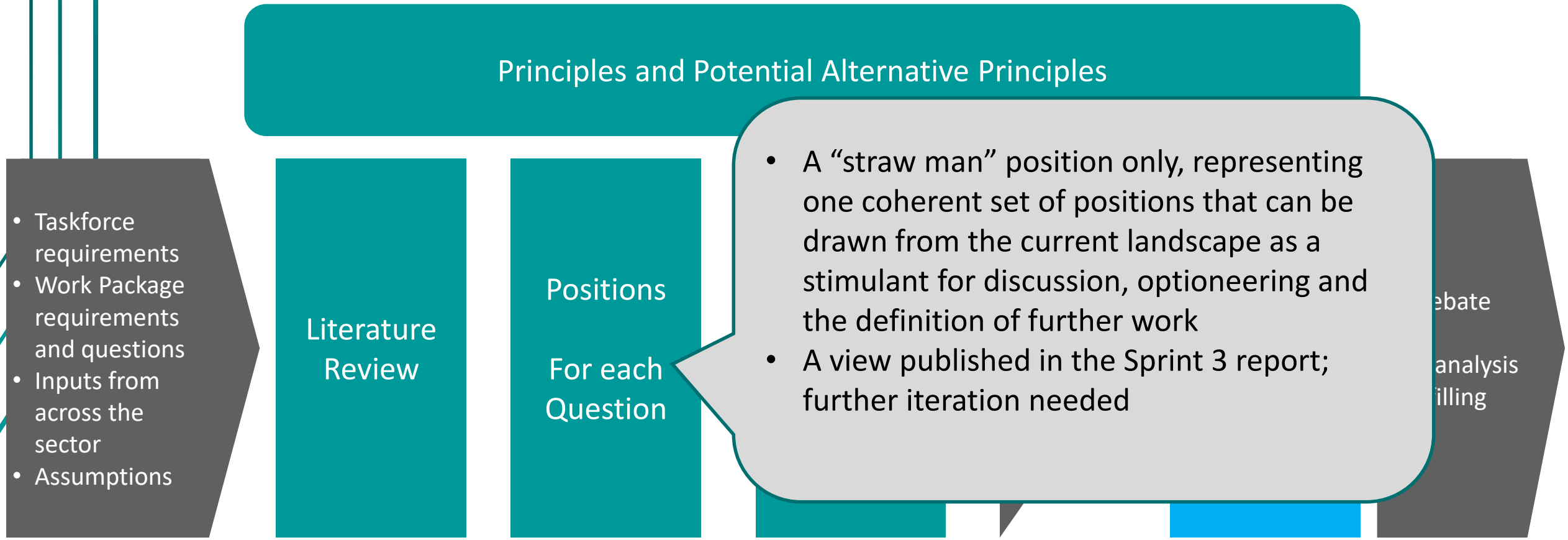
Principles

1. Priority is given to avoiding the electricity system becoming the bottleneck to mass EV uptake.
2. The electricity system should support activities that enable overall decarbonisation and cost benefits across transport and heat to be realised.
3. Managing a successful ICE-EV transition is essential to future economic growth.
4. Leveraging flexibility of electricity demand is key to both maximising the contribution of zero-carbon generation and minimising electricity network capacity constraints.
5. Customer choice should be maximised wherever practicable
6. The social/societal impact of energy policy decisions related to ICE-EV transition must be fully considered.
7. The overall market design should allow a wide range of market participants and business models to compete.
8. The best overall outcomes will be obtained by taking a holistic perspective on the future of the energy system.

Potential Alternative Principles

1. The inherent flexibility of different demand types is ignored.
2. Maximising low carbon mileage is the main underlying driver (which does not necessarily lead to prioritising mass EV uptake).
3. Minimising the short-term cost of readying the energy system for EVs is prioritised.
4. The focus of ongoing work should purely be on EVs, where there is clear policy and specified objectives.

Approach



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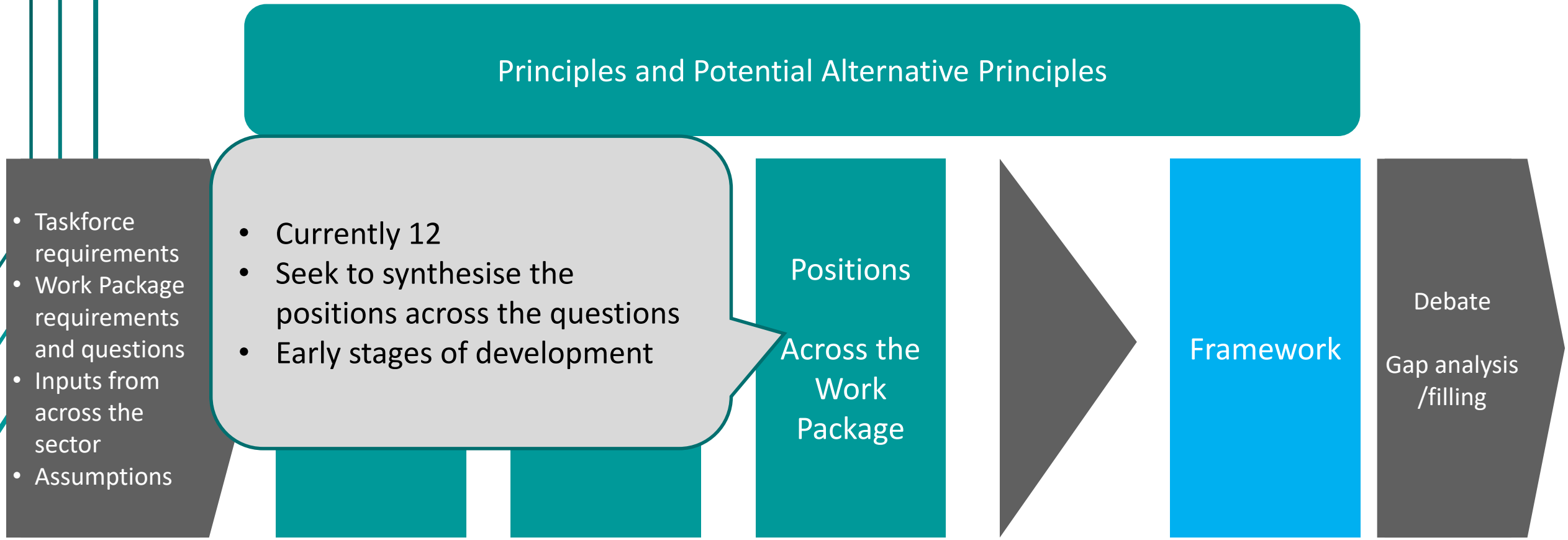
Approach



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International

How applicable are international examples (e.g. California, Norway) to GB in terms of overcoming network constraints and the adoption of smart charging?

- Norway: interesting emerging information regarding lessons learnt, network resilience and *e*-heating e.g. less focus on smart charging – they are moving to three phase LV networks – limitations are being imposed on the size of chargers within domestic properties …
- US: California following introductions through EPRI
- India: building on relationships through BEAMA; Dehli/Bangalore/Calcutta Charter Power
- China: to be followed up via introductions from BEIS

Emerging Findings

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High Level Positions

- High-level positions have been derived following an extensive literature review of projects, trials and other initiatives that are relevant to the ICE-EV transition and the specific questions that WP1 has been tasked to address.

- The documented learning and/or progress statements from these initiatives have been captured through some 76 individual position statements to date. Each of these position statements is linked to at least one referenced source.

- **They are a work in progress – feedback and input is welcome**

High Level Position 1

Leveraging the inherent flexibility of EV charging to mitigate the impact on electricity system peak demand would significantly reduce the need for investment in network and generation capacity – especially over the period 2025-2040 under NG's FES 'compliant' scenarios.

Findings from the Octopus Energy Agile Tariff and earlier R&D trails have shown that domestic peak demand correlation can be reduced through appropriate price signalling and smart energy management mechanisms.

High Level Position 2

Multiple parties incentivising, accessing or exploiting the flexibility of EV charging (e.g. market price-reflective ToU tariffs, network constraint management, system balancing services) requires technical and/or market coordination to maximise synergies (including system service procurement efficiencies) and to avoid conflicts (including double-paying and/or dispatching conflicting signals).

High Level Position 3

Strategic / Anticipatory investment in network capacity will be essential to avoiding network constraints becoming a barrier to EV adoption. It will be important for the RIIO2 regulatory framework to achieve an appropriate balance between asset stranding risk and inadequate capacity risk; Ofgem's work on reforming access and forward-looking charging arrangements will also need to be cognisant of the potential impact of its decisions on strategic / anticipatory investment.

High Level Positions

- Today we'll consider a small number and ask for your questions and comments

- A vote on support or otherwise

A – STRONGLY SUPPORT

B – SUPPORT

C – DISAGREE

D – STRONGLY DISAGREE

E - UNSURE

- **Those that we don't address… a webinar will be held on 22nd February… please register your interest**
- **Your written submissions are welcome**

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High Level Position 4

There are significant variations in current network capacity headroom, and constraints can be very location and voltage level-specific. Hence the need for investment in network capacity will be significantly dependent on where and how future EV charging facilities are provided (home, en-route, destination) and both the energy and peak power requirement at any given location. Advanced forecasts of required future capacity by EV charging infrastructure providers will help ensure coordinated and efficient investment in network capacity.

High Level Position 5

There is a need for an overall strategy on provision of public EV charging infrastructure to ensure that sufficient national coverage is provided, and that range anxiety can be managed. A national strategy is also essential to enabling coordination between provision of public charging infrastructure and the efficient provision of electricity network capacity.

High Level Position 6

The ability of DNOs to access and aggregate smart metering time-series consumption data will be key to monitoring the impact on local networks of trends in home EV charging activity. LV distribution networks which have traditionally been designed on the basis of highly disaggregated domestic electricity energy requirements are particularly susceptible to new types of relatively large and largely coincident demand requirements, such as EV charging and electric space and water heating. Relatively low levels of penetration of unconstrained EV home-charging have the potential to create network overloads and/or voltage management issues on currently highly utilised LV distribution networks.

High Level Position 7

Localised forecasting and monitoring of EV take-up trends will be important to predicting when distribution system tipping points can be expected and hence where and when a change in system development strategy is triggered. A key concern is avoiding stranded investment in additional capacity to support EV charging which subsequently proves insufficient to accommodate electrification of heat.

High Level Position 8

There will be a need for market mechanism and products that encourage EV owners to avoid peak demand periods and make use, where practicable, of low electricity energy price periods when charging their EVs. At the domestic level the availability of such products and incentives is highly dependent on progress with the smart meter rollout and the development of half hourly settlement which will permit time-of-use based energy and network use-of-system charging that provides greater (marginal) cost-reflectivity. This includes appropriate pricing mechanisms that reflect the system value of V2H and V2G and other forms of home generation and energy storage. Contracted DSR opportunities, especially with commercial EV fleet owners, is a further opportunity. However, in the absence of effective market incentives, consideration needs to be given as to the measures that might be necessary to protect against failures of the electricity system due to overload. One option is that DNOs might be forced to apply (at least temporary) limits on EV charging demand including through automated demand time-shifting. However, not all DNOs support this option.

High Level Position 9

The impact of Ofgem's decisions on EV charging behaviour arising from its 'Targeted Charging Review' and 'Reform of Network Access and Forward-looking Charges' will need to be carefully considered, as will societal concerns over the possibility that less aware (and less affluent) customers might find themselves paying higher electricity charges than those who can afford EVs, smart appliances, home energy storage or HEMS, or able to exploit cross-vector arbitrage opportunities. Ofgem's Targeted Charging Review aims to rebalance the way that future 'residual' network charges are levied by moving the demand charge to either a fixed charge set by volume or an agreed capacity charge. Meanwhile Ofgem's proposed reform of network access and forward-looking charges aims to make network charges more (marginal) cost-reflective, encouraging users to adjust their behaviour and/or adopt economic 'behind the meter' or cross-vector arbitrage solutions.

High Level Position 10

Delivery of customers' and stakeholders' future needs will require a whole-system approach to be applied to the electricity system, including touch points with other energy vectors, to ensure available supply and demand-side arbitrage opportunities are exploited. For example, a hybrid gas boiler / heat pump solution to domestic heat coupled with effective measures to exploit the inherent flexibility of EV charging could reduce the need for major reinforcements of electricity networks and the additional generation peaking plant that might otherwise be necessary to accommodate peak demands associated with unusually harsh winter conditions.

High Level Position 11

It is important to recognise the changing energy landscape enabled by digitalisation, **decentralisation and democratisation of energy supply**. Key themes include: heat/comfort as a service; smart heat controls; thermal storage / more cross-vector interactions; growth in cooling demand; reduction in heat demand and/or more efficient low carbon forms of industrial heat. Opportunities surrounding 'beyond-the-meter' home energy systems, including home generation and energy storage; hybrid heating systems; and the capacity of EVs to be used in V2H and V2G mode provide the foundation for future disruptive market models, including local energy communities and peer-to-peer trading. Such opportunities would complement, but clearly not entirely displace, 'before-the-meter' investment in system capacity and capability.

High Level Position 12

The evolution of the DSO model will be important to ensuring that the capability of EV charging flexibility and V2G to provide coordinated distribution and wider power system services is fully exploited and efficiently procured. In the absence of coordination there is potential for inefficient procurement of services (multiple parties paying for a similar service from the same resource) and/or conflicts to arise whereby the dispatch of one service compromises another (for example if an energy storage resource such as an EV battery becomes depleted, making another flexibility service temporarily unavailable) or whereby dispatch creates a conflict with another service (for example EV charging dispatched by ESO for demand turn-up creates a local network constraint which depends on the demand turn-down capability of the same resource to manage the constraint). A number of options (DSO Worlds) are currently under consideration by the ENA Open Networks project which is assessing the relative opportunities and challenges arising from system services being procured or co-ordinated via either the ESO or DSOs.

High Level Positions

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Closing Comments

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Thank you

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