ELECTRICITY NETWORK TRANSFORMATION ROADMAP

2015-25

Technical Enablers:

Driving the energy system of the future

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STANDARDS Australia

ena energy networks association

CSIRO

ENA Members

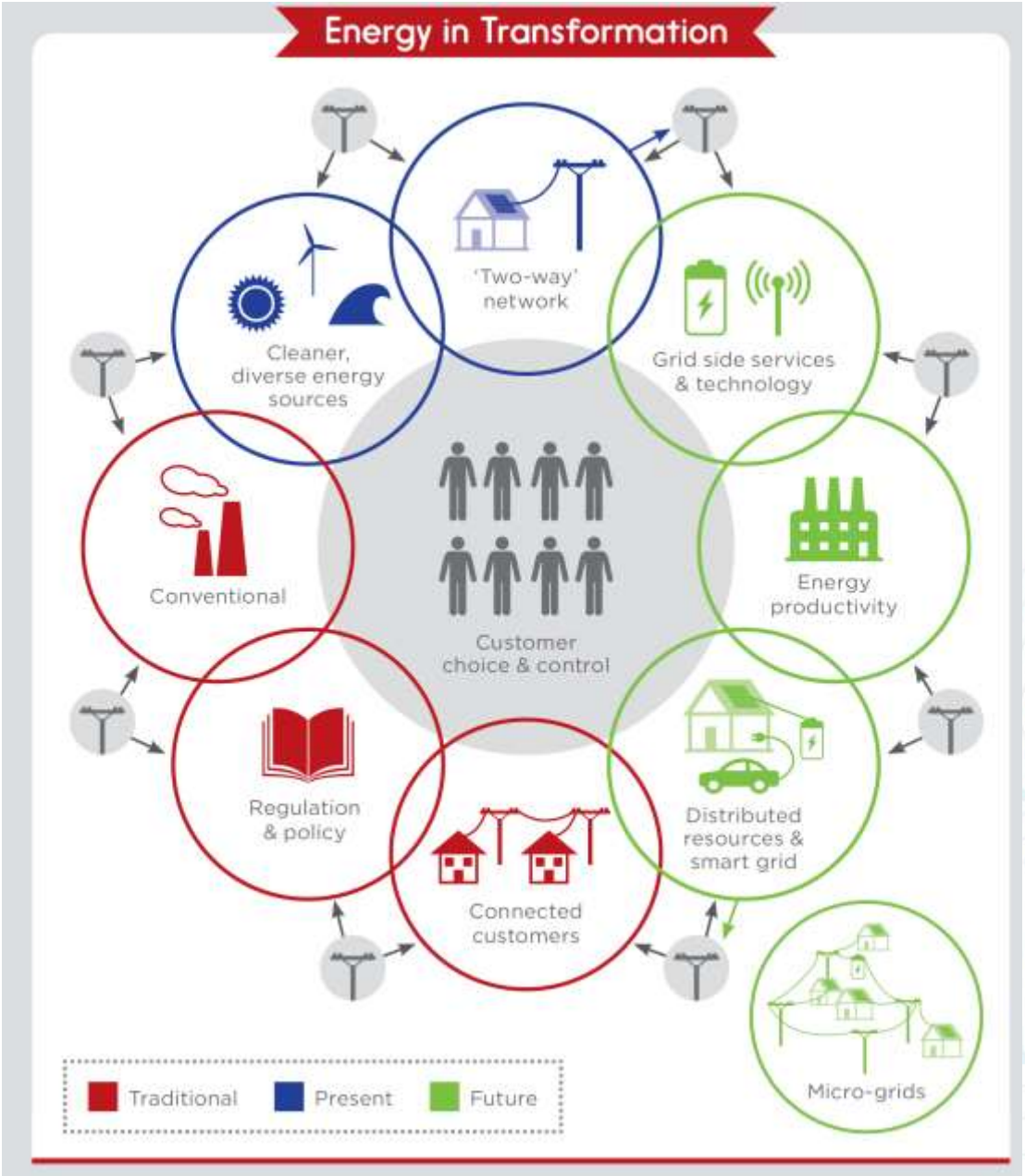
The peak national body representing gas distribution and electricity transmission and distribution businesses throughout Australia.

Twenty-six electricity distribution and transmission and gas distribution network companies are members of ENA.

Technology is disrupting the traditional Energy business model

In many aspects the pace of change in Australia is ahead of other countries

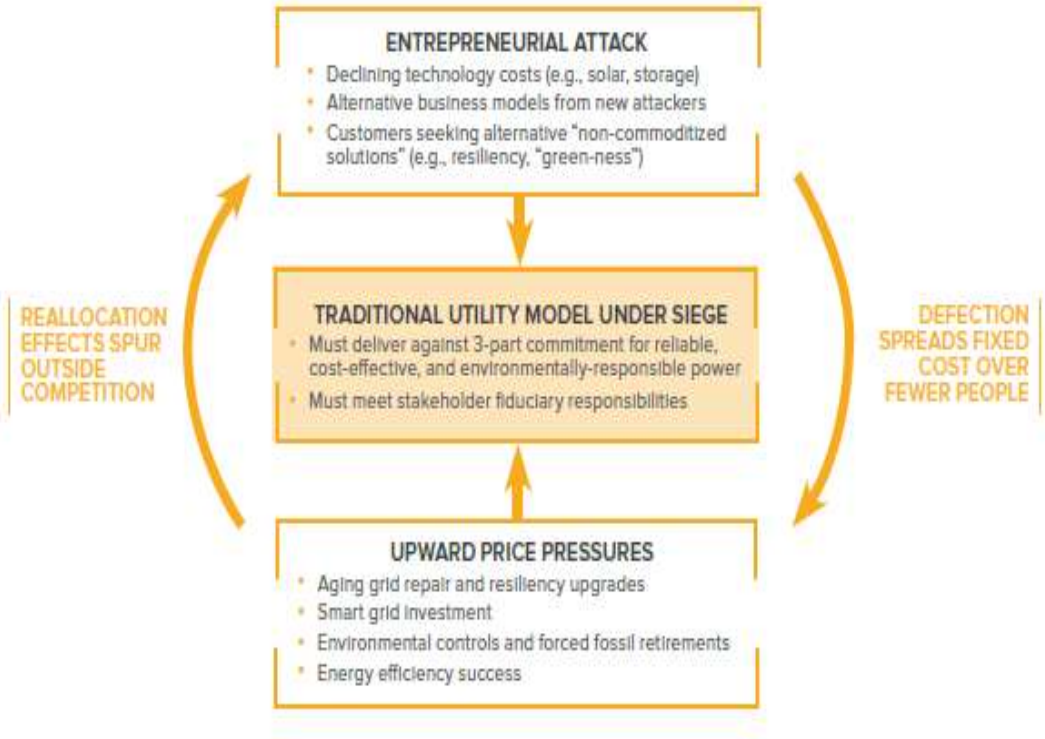
Australian Energy businesses must act now



Energy Supply system facing significant change

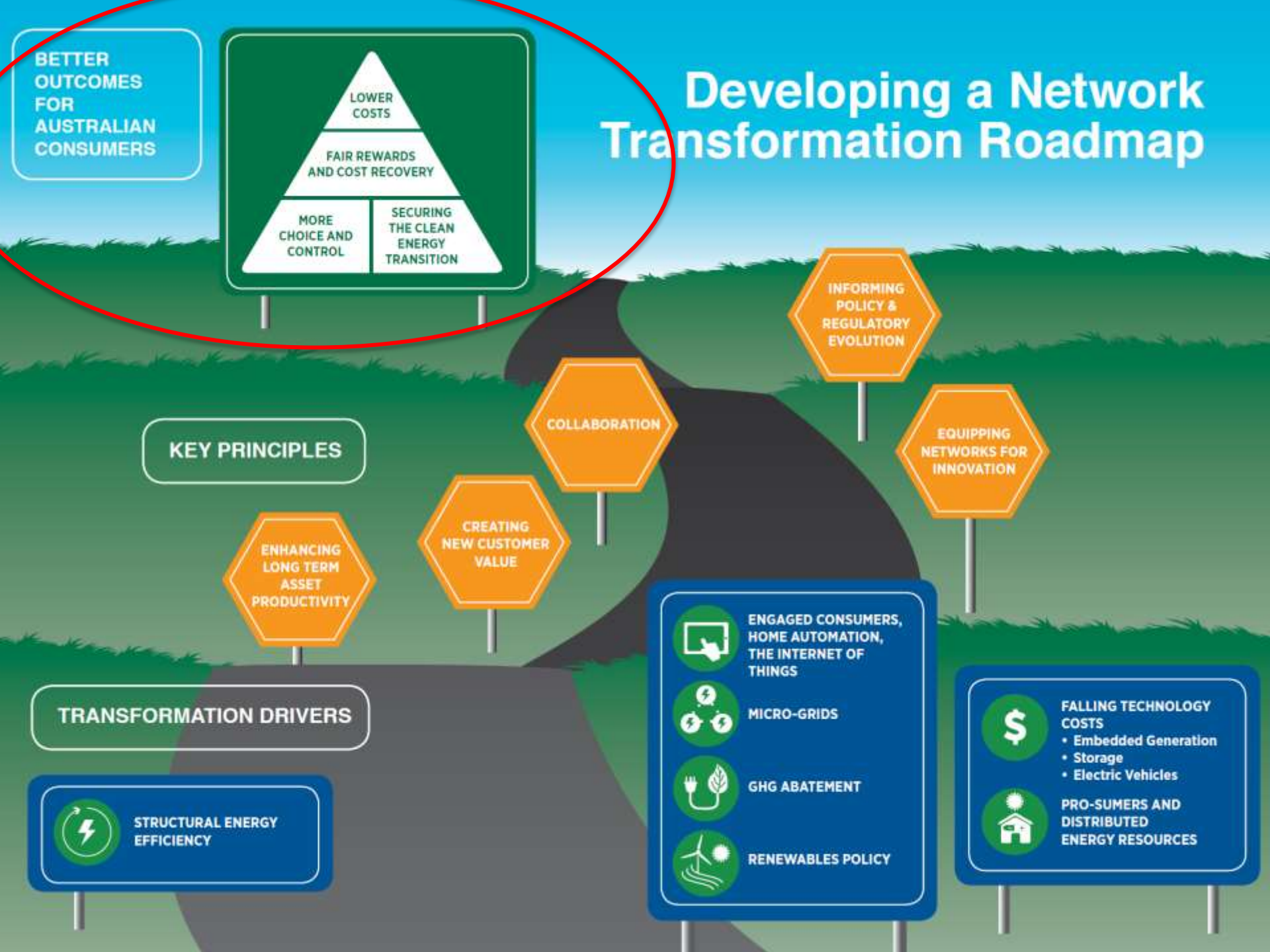
- Energy Efficiency
- Price-elastic Demand
- Falling technology costs
  - Embedded Generation
  - Storage
  - Electric Vehicles.
- Pro-sumers and Distributed Energy Resources
- Engaged Consumers, Home Automation, the Internet of Things
- Micro-grids
- GHG Abatement
- Renewables policy

FIGURE 6: PRESSURE ON TRADITIONAL UTILITY BUSINESS MODELS

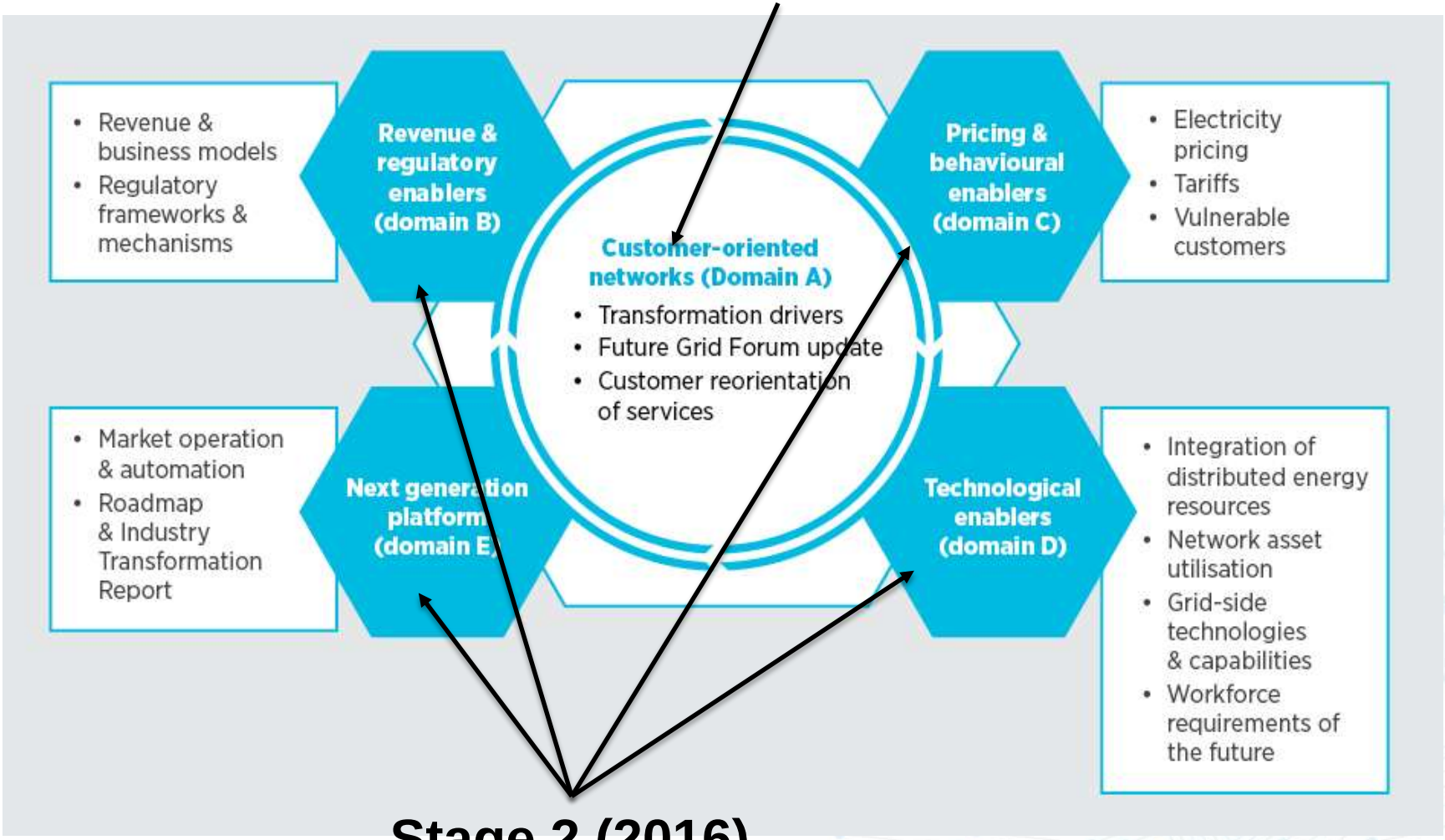


Rocky Mountain Institute – The Economics of Grid Defection, page. 12

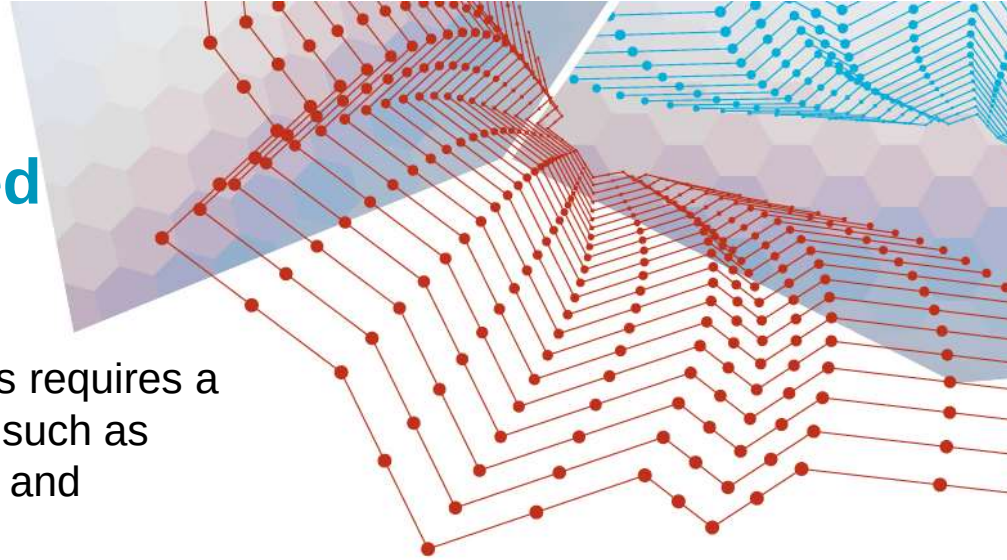
Developing a Network Transformation Roadmap



Areas of Focus – Network Transformation Roadmap



Stage 1: Challenges and Opportunities of Distributed Energy Resources

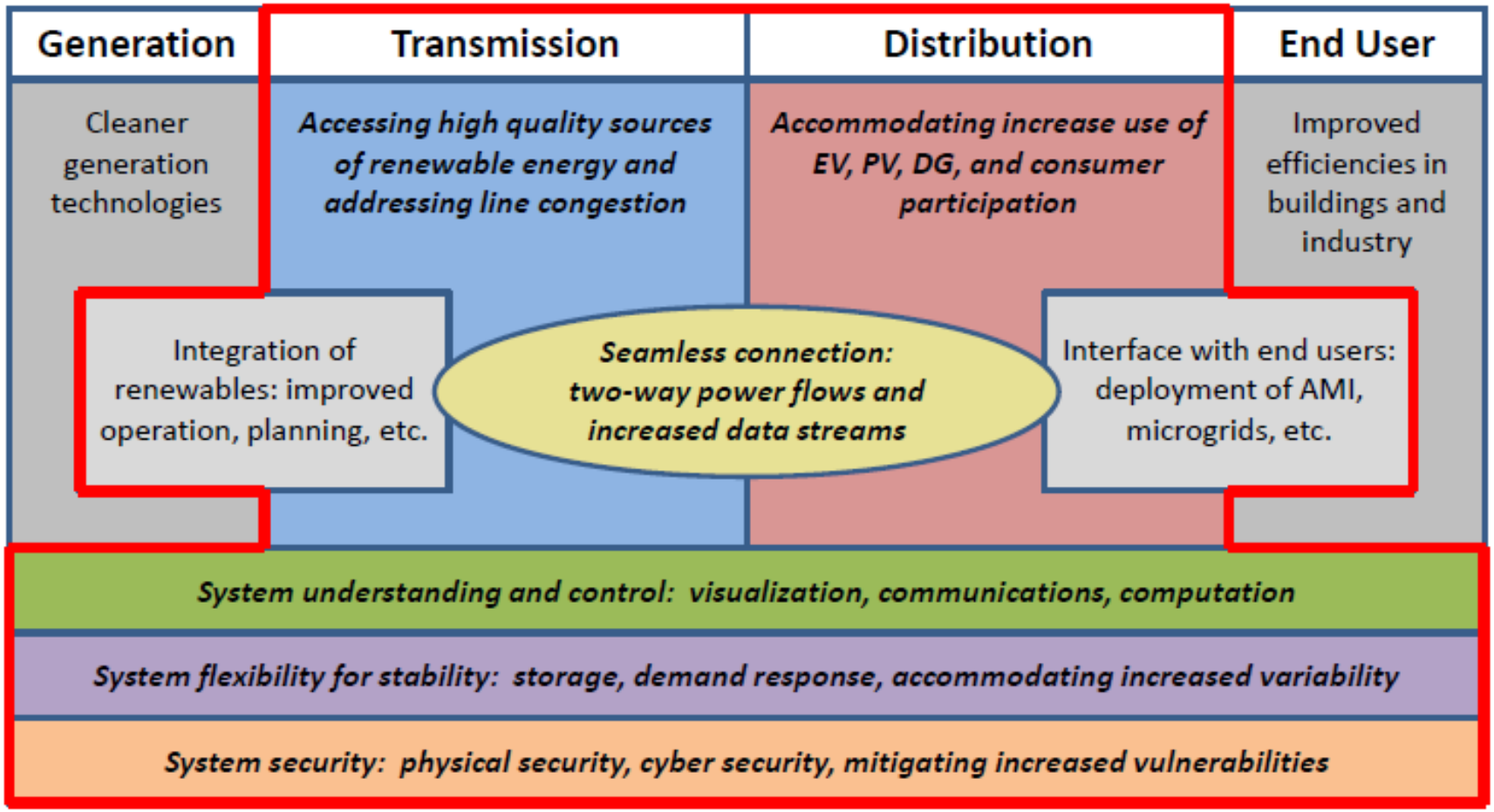


Integration of Distributed Energy Resources requires a careful operational response to challenges such as voltage management, frequency regulation and network stability.

However, well-integrated DERs can also provide solutions for addressing these network challenges and improving network efficiency. This is likely to require:

- New regulatory frameworks
- Commercial responses which unlock the potential of energy storage, demand response services and power electronics solutions.
- Critical gaps in current standards and there are requirements for enhanced standards.
    - For example Standards for: Storage, Electric Vehicles, Inverters, Protection Relay, Smart Meters, intelligent control architecture
- Smart Control and Storage
    - The addition of smarter control, and/or better storage to DER enhances their benefits and improves voltage control, power quality and increases their reliability.
- Adaptive Systems – Demand Response and Prediction:
    - Critical to predicting and controlling network loads in the integrated grid.

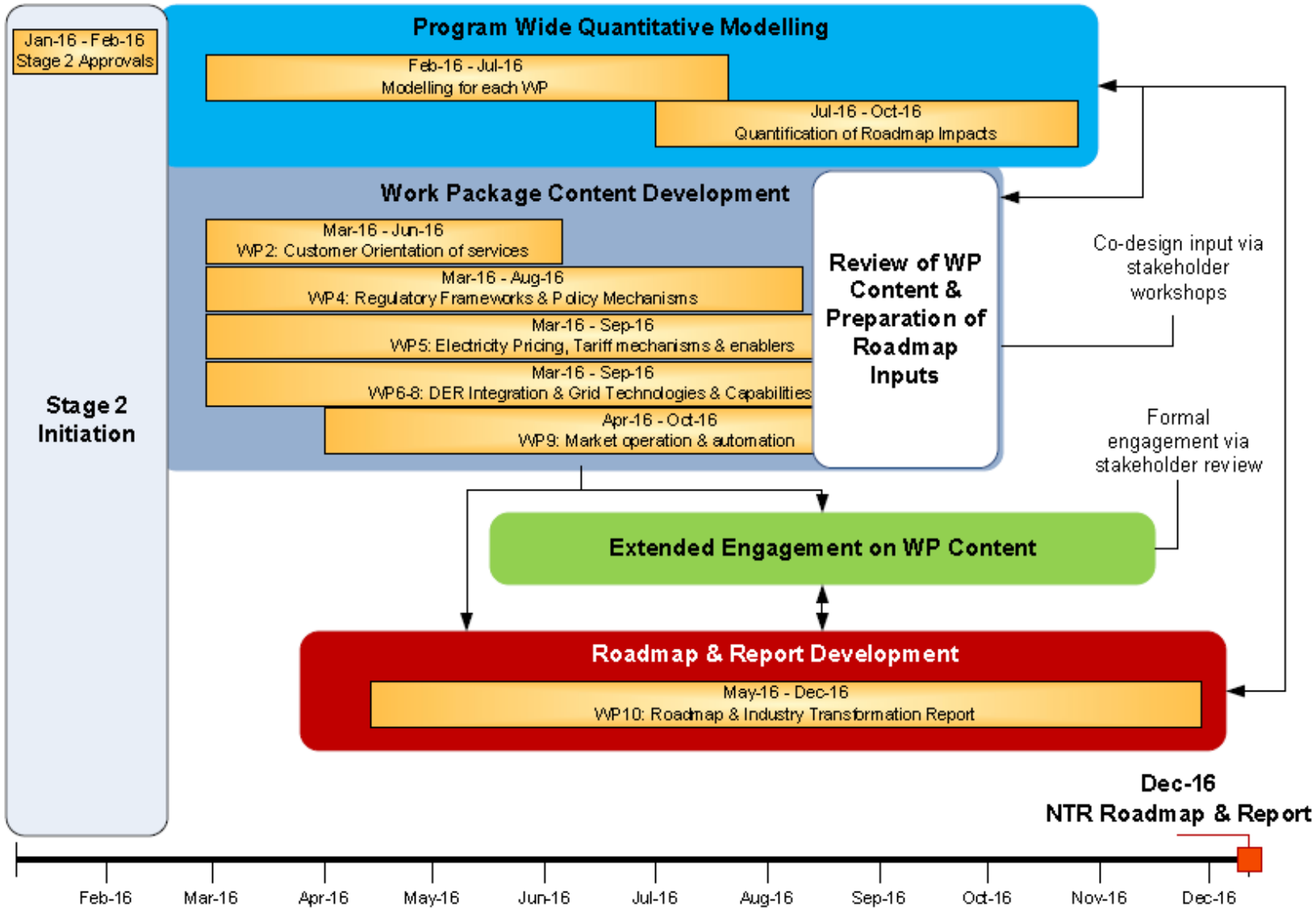
Conceptual Future System Operability



Technical Focus of Stage 2

1. **Grid Design & Operation**
   - Develop a functional description/specification of DSO functionality that are likely to be inherent in future network services
2. **Develop the most effective operating platform that allows full optimisation and coordination of the diverse range of connected Demand Side services**
3. **Technical enablers**
   - Roadmap to deal with gaps in industry standards and guidelines
   - Establish what communication requirements are required
4. **Innovation**
   - Identify the key gaps in research and development
5. **Future Industry Workforce Requirements**
   - Establish a strategy to identify and facilitate the changes required to service the future skills and training requirements

Stage 2 Integrated Schedule



Vision for the Transition to the Energy Supply Industry of the Future

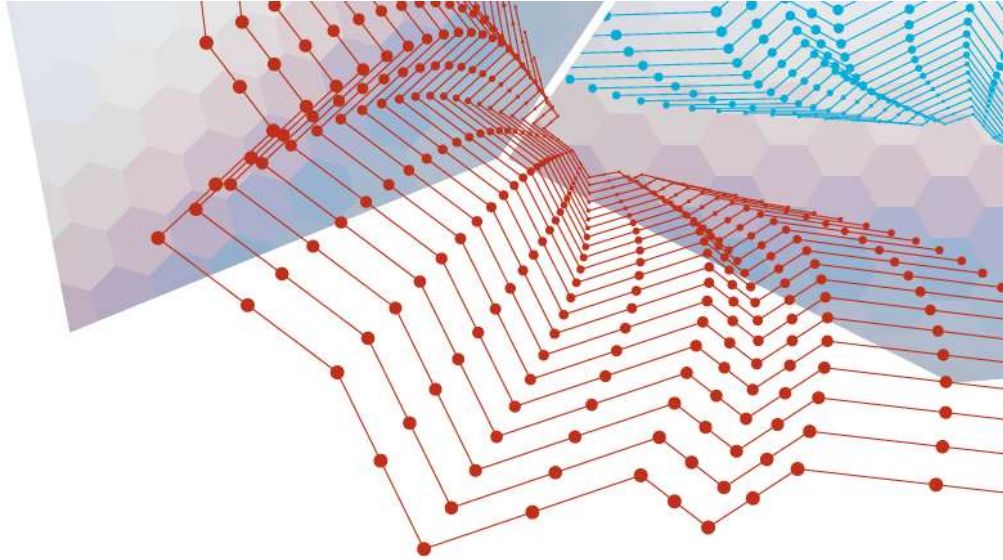
Leadership is needed in creating a shared vision of the future and to build strong and effective partnerships with all key stakeholders

The Way Forward

Enabling an Electricity Services Economy

- "Electricity as a Service"
- Access to clean energy generation and options
- Delivery of desired power quality when it is wanted
- Customer participation into electricity markets (demand response)
- Customer flexibility to use new technologies (electric vehicles, distributed generation, energy management system, etc.)
- Dynamic protection, privacy, and cyber security

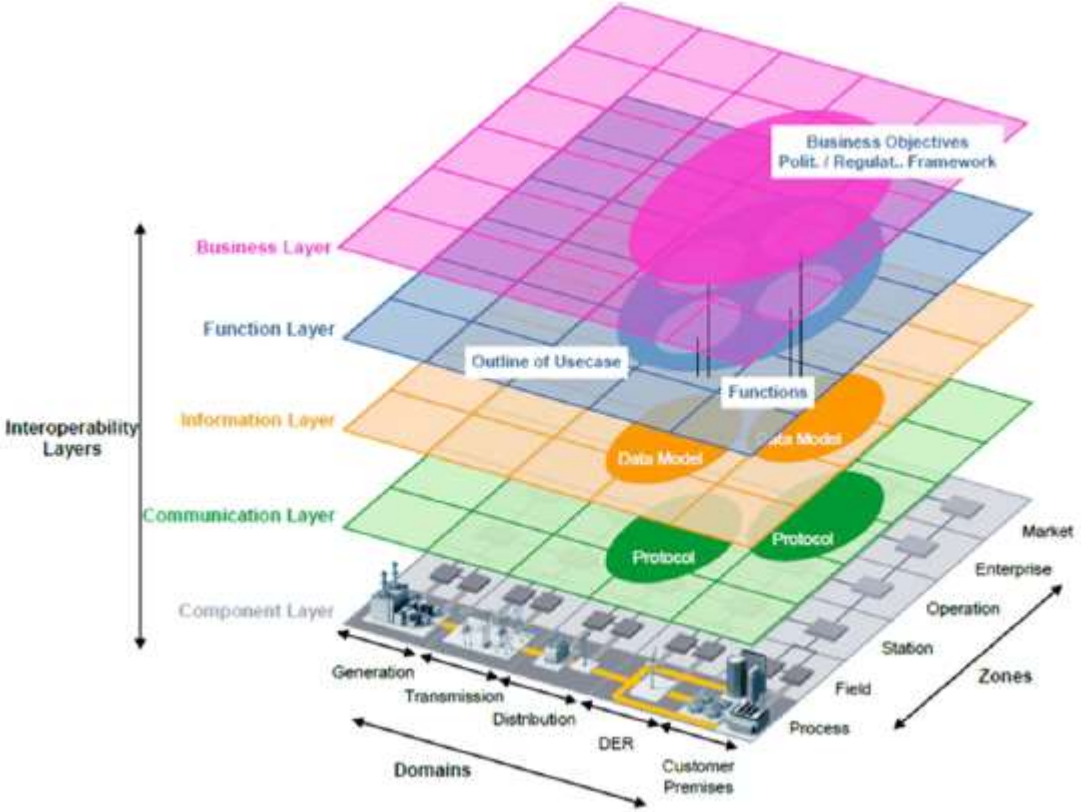
Deliverable 1 & 2 - Design, Operation and Control



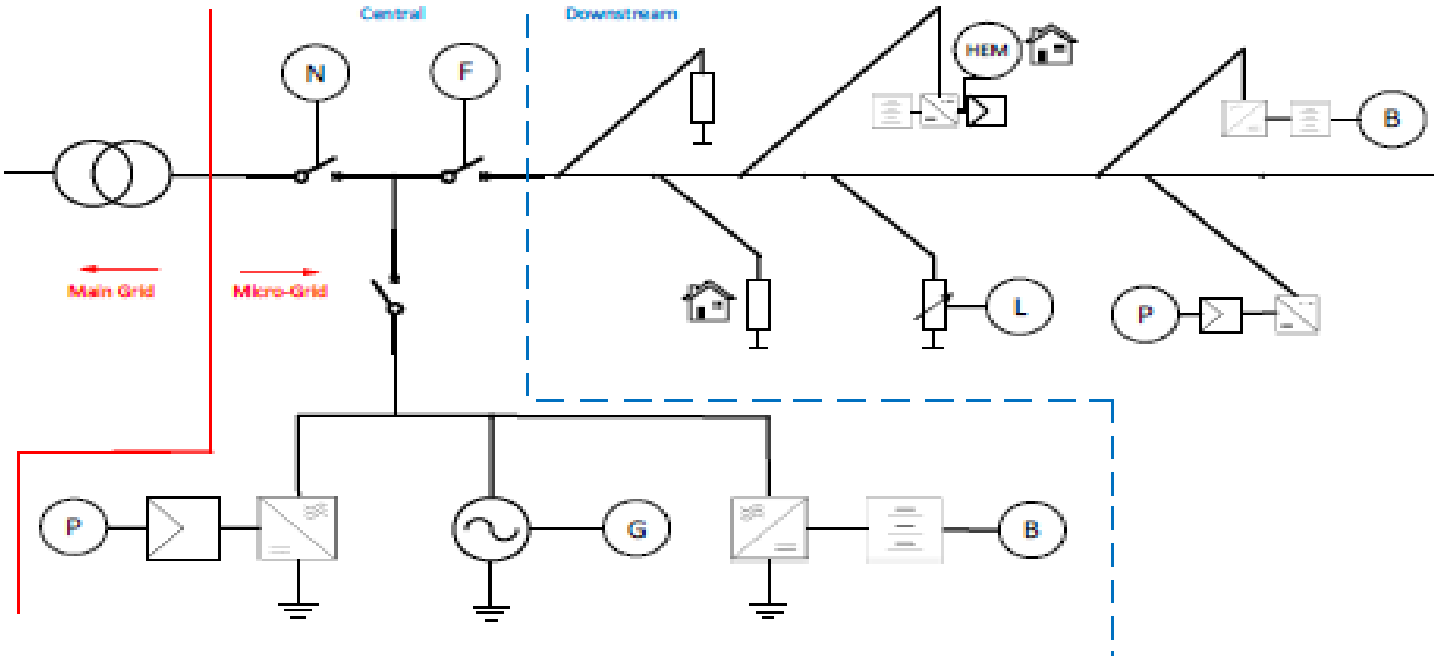
- Develop a functional description/specification of DSO functionality that are likely to be inherent in future network services
- Establish what is the optimum design and operating parameters of an inverter dominated power system of the future to allow for the likely reduction in the level of synchronous generation and the increase in non-synchronous generation.
- Identify the solutions to efficiently design, control, and operate grid connected and islanded/non-connected microgrids/minigrids.
- Balancing demand side response.
- network operation and control that alleviates the technical impacts and maximise the benefits of new demand side technologies
- Establish the optimal controls required to maximise overall system performance and maintain system stability and global optimisation.

DSO Design and Function

View of what the future DSO model architecture could look like, and the ways on which the different layers of the distribution network interact and can be utilised.



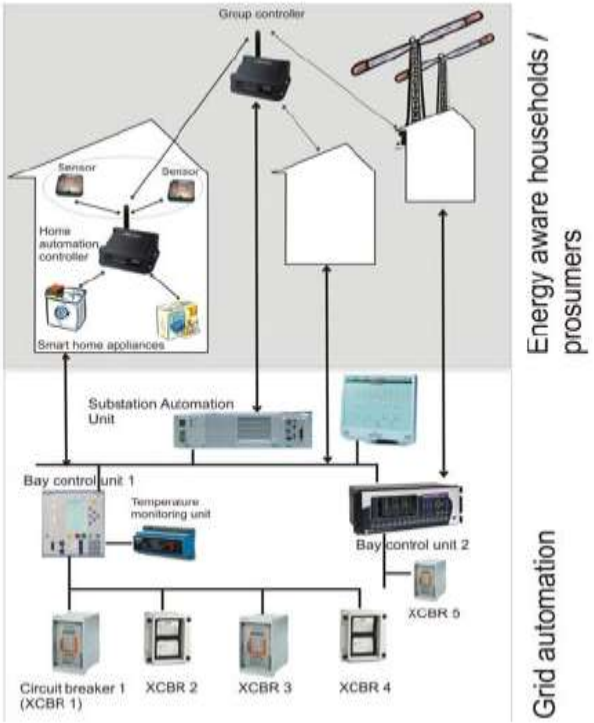
Micro-grid Design and Function

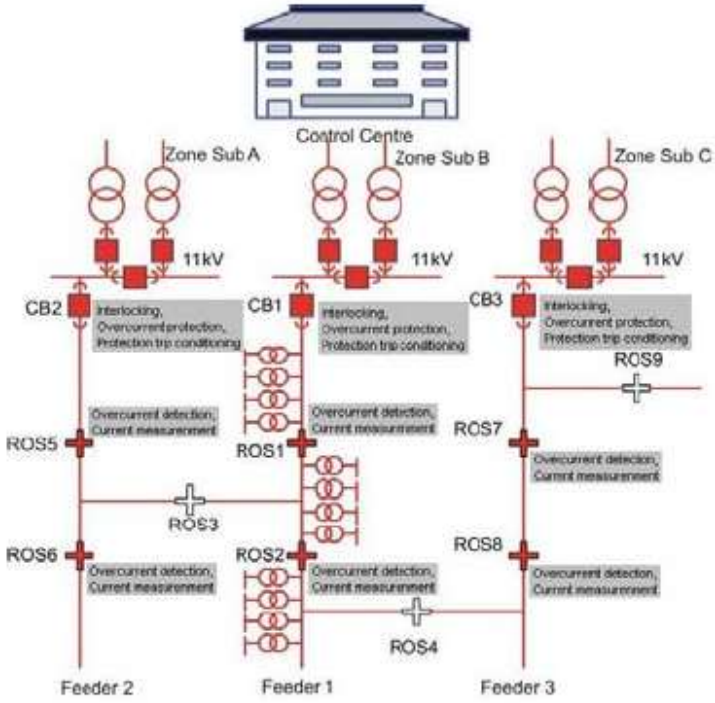


The generic model of a Microgrid/minigrid could contain any or all of the following components or power assets that can be deployed, started up, shut down, connected or disconnected multiple times a day and/or have continuously controlled power generation or consumption

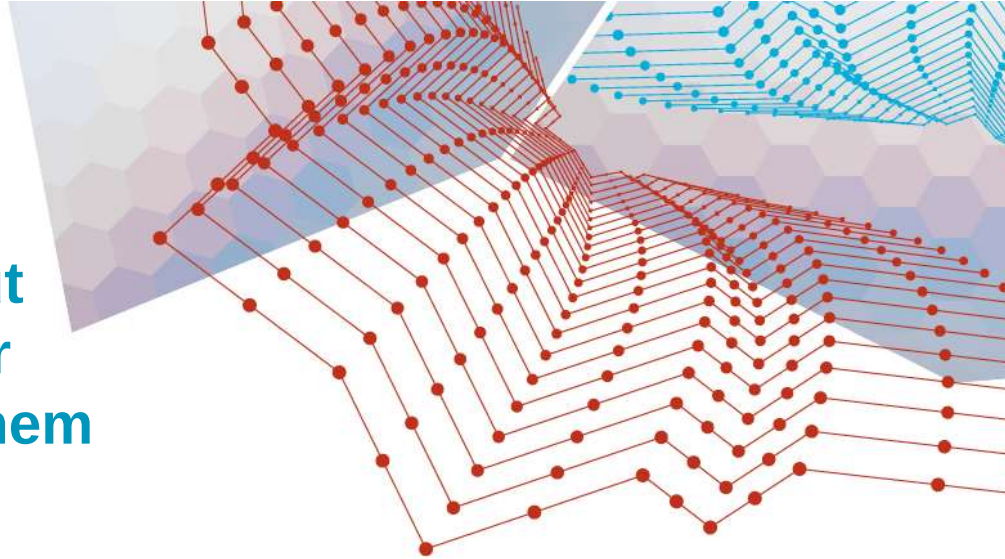
Deliverable 3 – Standards Roadmap

If we want to build interoperability and intelligent control systems as part of the future Energy System we need to ensure we have appropriate standards to facilitate this transition.





The roadmap process is about assessing the requirement for standards – not developing them



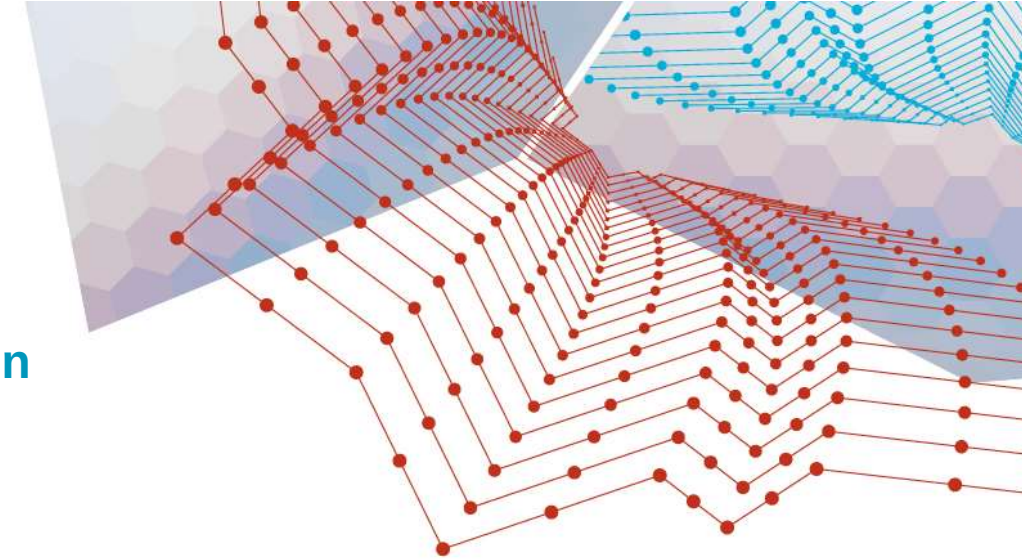
1. Identify all stakeholders
2. Issue & stakeholder analysis
3. Scoping study (strategic framework)
4. Validate strategic framework
5. Develop work plan

Initiate discussion

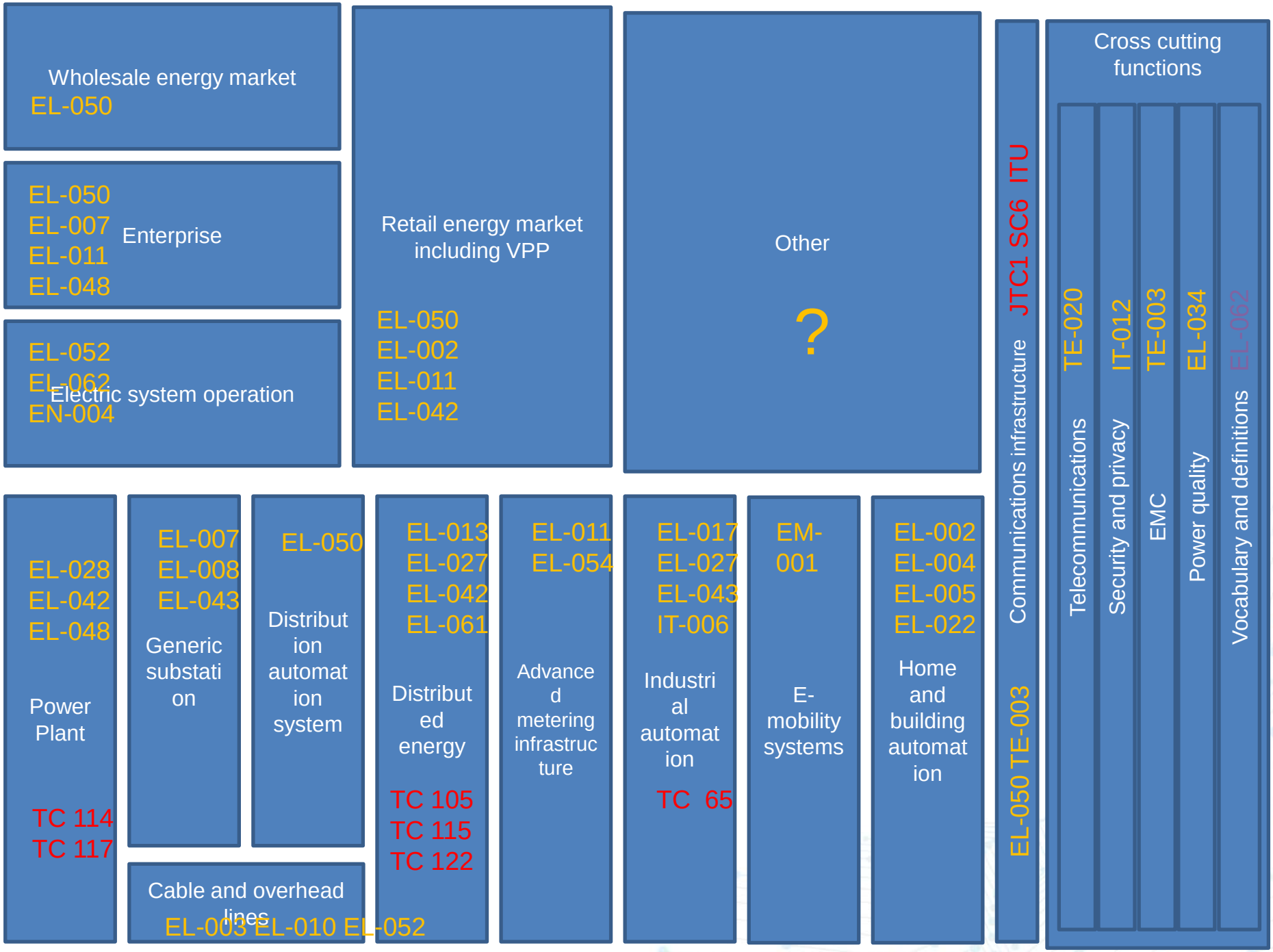
Strategic leadership

Facilitate outcomes

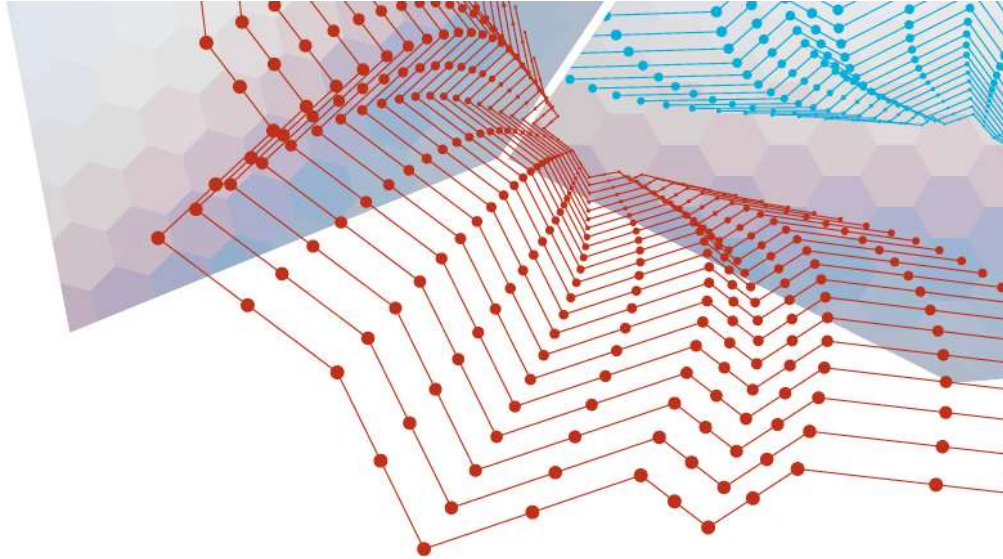
Framework of the approach that is being pursued by the NTR for development of a prioritised plan on Standards



Why Standards?	What priorities and why?	What specific Standards and when?
Objective	Priorities for Standards	Standard Topics
Prioritised plan to deal with gaps in industry standards and guidelines	Priority Area 1	Action 1.1
		Action 1.2
	Priority Area 2	Action 2.1
		Action 2.2
	Priority Area 3	Action 3.1
		Action 3.2


Wholesale energy market
EL-050
EL-050
EL-007
EL-011
EL-048
Enterprise
EL-052
EL-062
EN-004
Electric system operation
Retail energy market including VPP
EL-050
EL-002
EL-011
EL-042
Other
?
Communications infrastructure
JTC1 SC6 ITU
EL-050 TE-003
Cross cutting functions
Telecommunications
TE-020
Security and privacy
IT-012
EMC
TE-003
Power quality
EL-034
Vocabulary and definitions
EL-062
EL-028
EL-042
EL-048
Power Plant
TC 114
TC 117
EL-007
EL-008
EL-043
Generic substation
EL-050
Distribution automation system
Cable and overhead lines
EL-003 EL-010 EL-052
EL-013
EL-027
EL-042
EL-061
Distributed energy
TC 105
TC 115
TC 122
EL-011
EL-054
Advanced metering infrastructure
EL-017
EL-027
EL-043
IT-006
Industrial automation
TC 65
EM-001
E-mobility systems
EL-002
EL-004
EL-005
EL-022
Home and building automation

Deliverable 5 – Future Workforce Requirements



Drivers of change

- What changes are expected to asset design, technical support equipment and organizational processes in the next 15 years?
- How will these developments affect the role of maintainers and their day-to-day tasks?

Training of maintainers

- How maintainers are currently trained in Australia?
- What are the enablers and barriers to ensure an appropriate maintenance workforce for the future?

Technicians/ trades in Australia

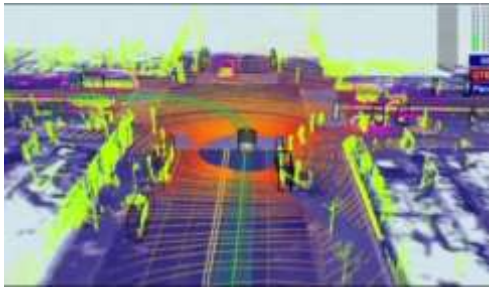
1.4m people considered as technician or trades worker in Australia

252,626 electrical/ electronic/ ICT/ telecommunications technicians (electrical trades) in Australia

16,908 electrical trades in the Electricity, Gas, Water and Waste Services sector

Data from ABS 2011 Census and NCVER

Changes in our lifetime



How do we expect asset design, technical support equipment and organizational processes to change?

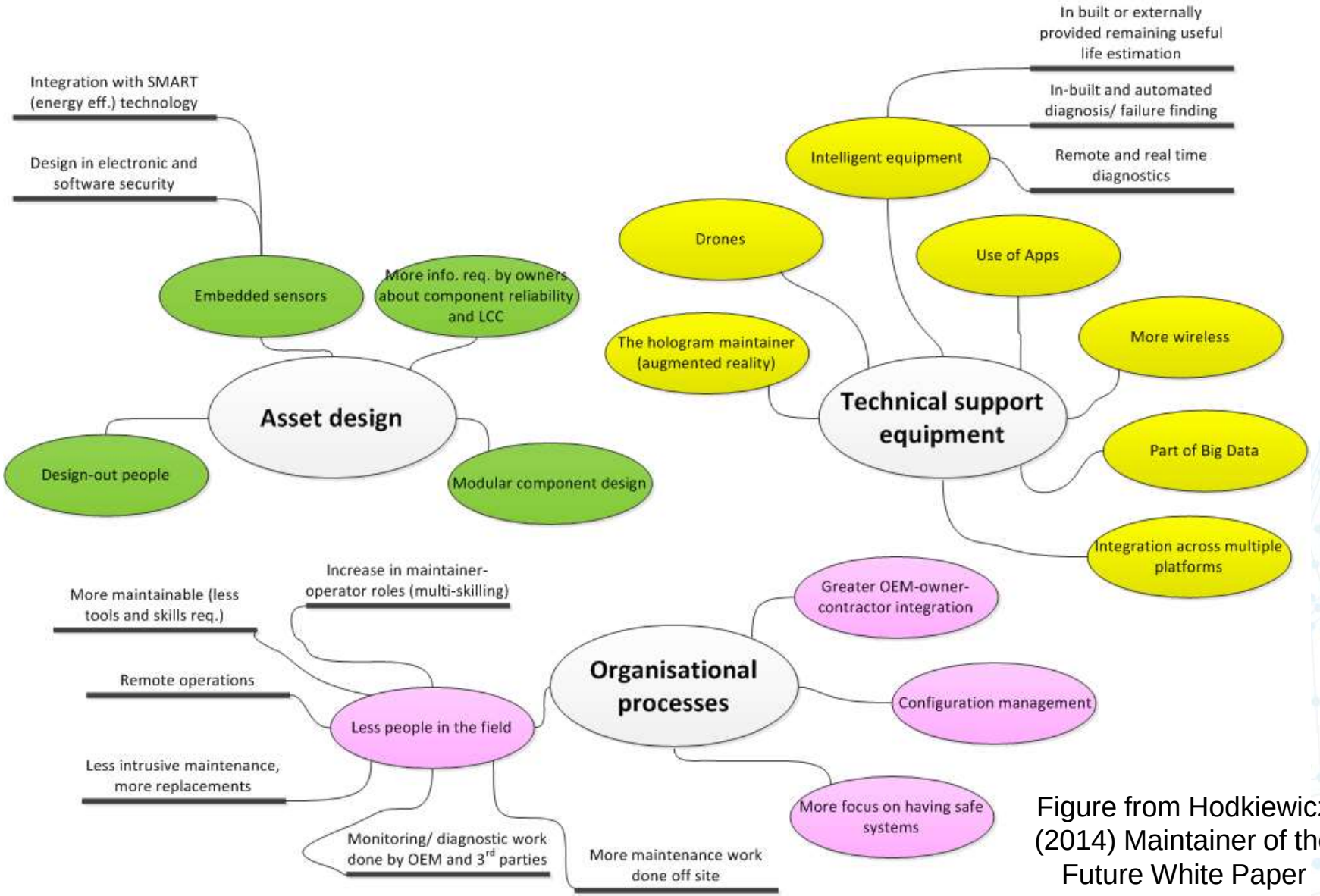
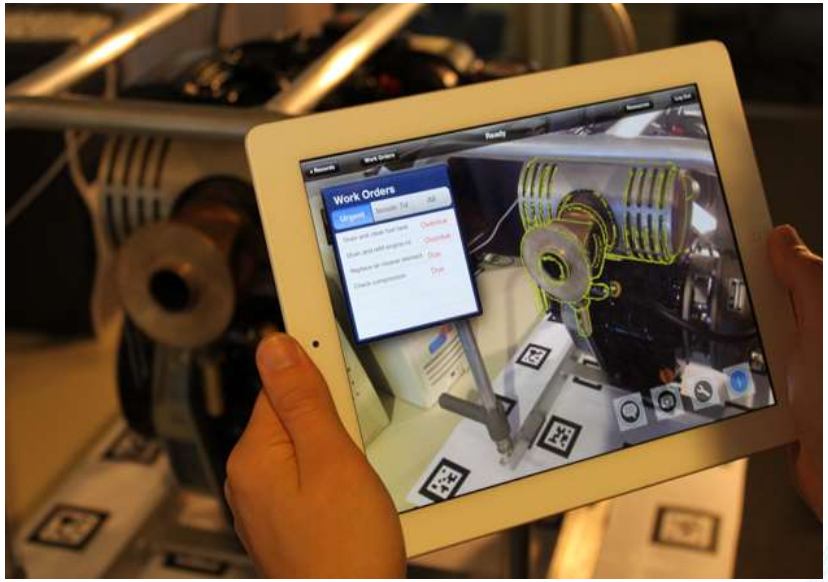
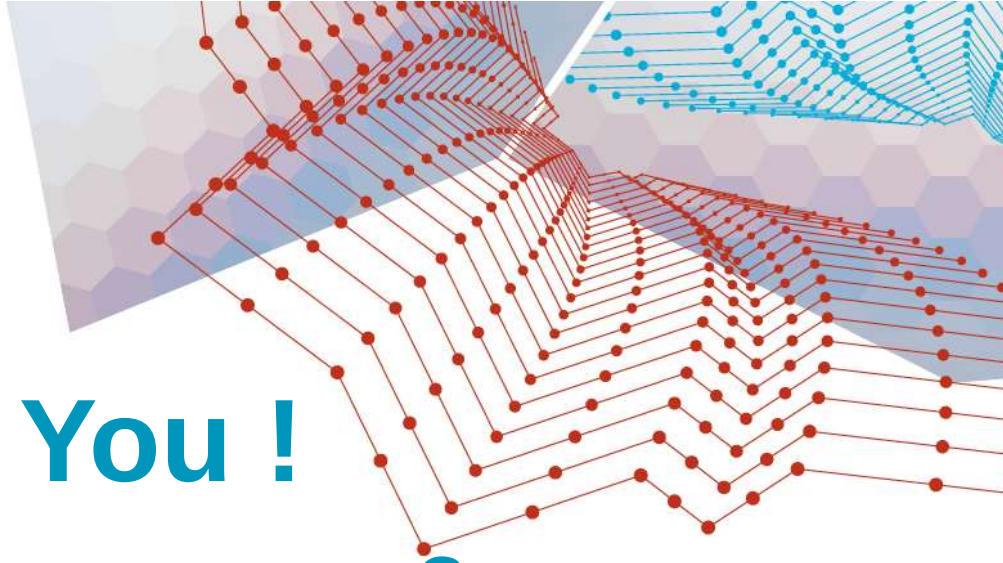


Figure from Hodkiewicz (2014) Maintainer of the Future White Paper

Training maintainers





Thank You !

Want to know more?

For more information on the Electricity Network Transformation Roadmap

http://www.ena.asn.au/electricity-network-transformation-roadmap

or contact

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