

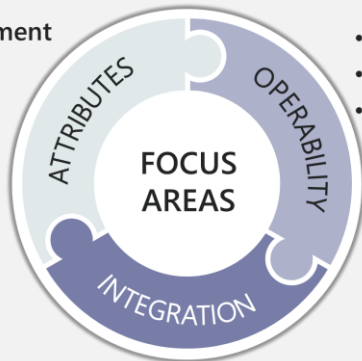
A structured approach towards 100% renewables



The Engineering Framework

Current knowledge and work (March 2021)

- Frequency Management
- System Restoration
- System Strength
- Voltage Control
- Resource Adequacy



- System Analysis
- Control Room and Support
- Resilience

- Distributed Energy Resources
- Performance Standards



Potential gaps and actions (December 2021)



Operational Conditions Summary (July 2021)

1	Fewer synchronous generators online
2	Ubiquitous rooftop solar
3	Extensive grid-scale VRE
4	Structural demand shifts
5	Responsive demand
6	Widespread energy storage

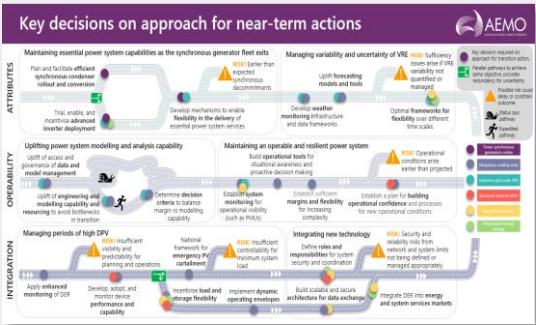
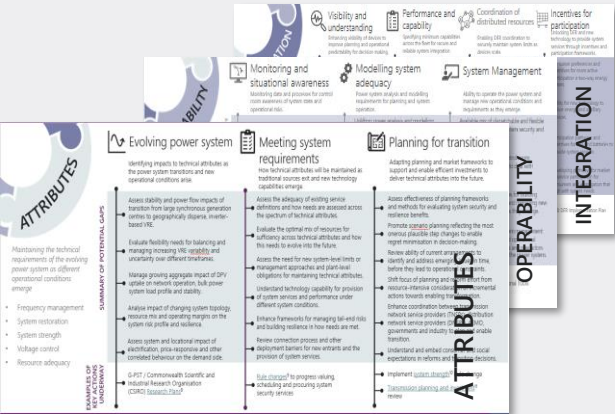
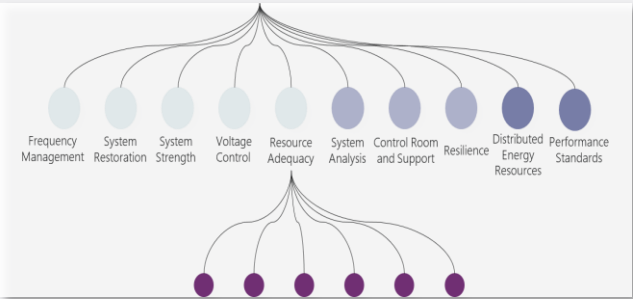


Elements of the Initial Roadmap

300+ individual potential gaps

Summaries of potential gaps

Key decisions on approach



Key decisions – attributes

ATTRIBUTES

Maintaining the technical requirements of the evolving power system as different operational conditions emerge

Maintaining essential power system capabilities as the synchronous generator fleet exits

Plan and facilitate efficient synchronous condenser rollout and conversion

Trial, enable, and incentivise advanced inverter deployment

Develop mechanisms to enable flexibility in the delivery of essential power system services

RISK! Earlier than expected synchronous decommitments

Managing variability and uncertainty of VRE

Uplift forecasting models and tools

Develop weather monitoring infrastructure and data frameworks

Optimal frameworks for flexibility over different time scales

RISK! Insufficient flexibility to balance VRE variability

Operational Conditions

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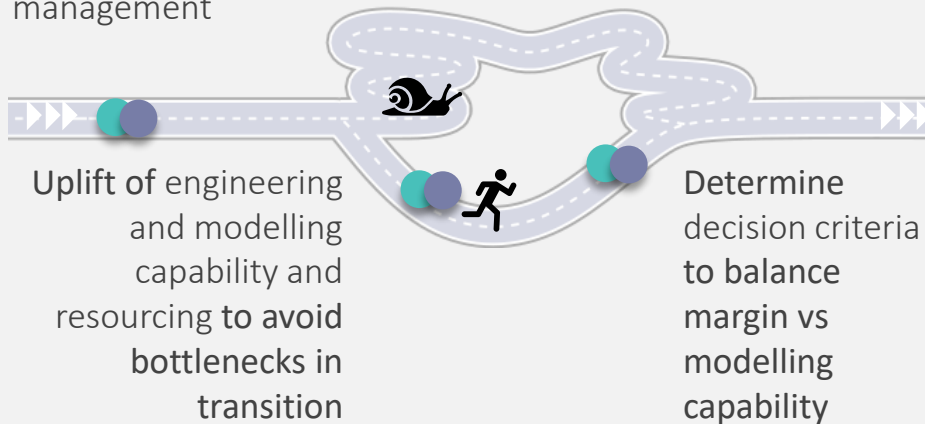
Key decisions – operability



System analysis, operational tools and practices to support and enable increasingly complex power system operation

Uplifting power system modelling and analysis capability

Uplift of access and governance of data and model management



Maintaining an operable and resilient power system

Build operational tools for situational awareness and proactive decision making

Establish system monitoring for operational visibility (such as PMUs)

Establish sufficient margins and flexibility for increasing complexity

Establish a plan for building operational confidence and processes for new operational conditions

RISK!
Operational conditions arise earlier than projected

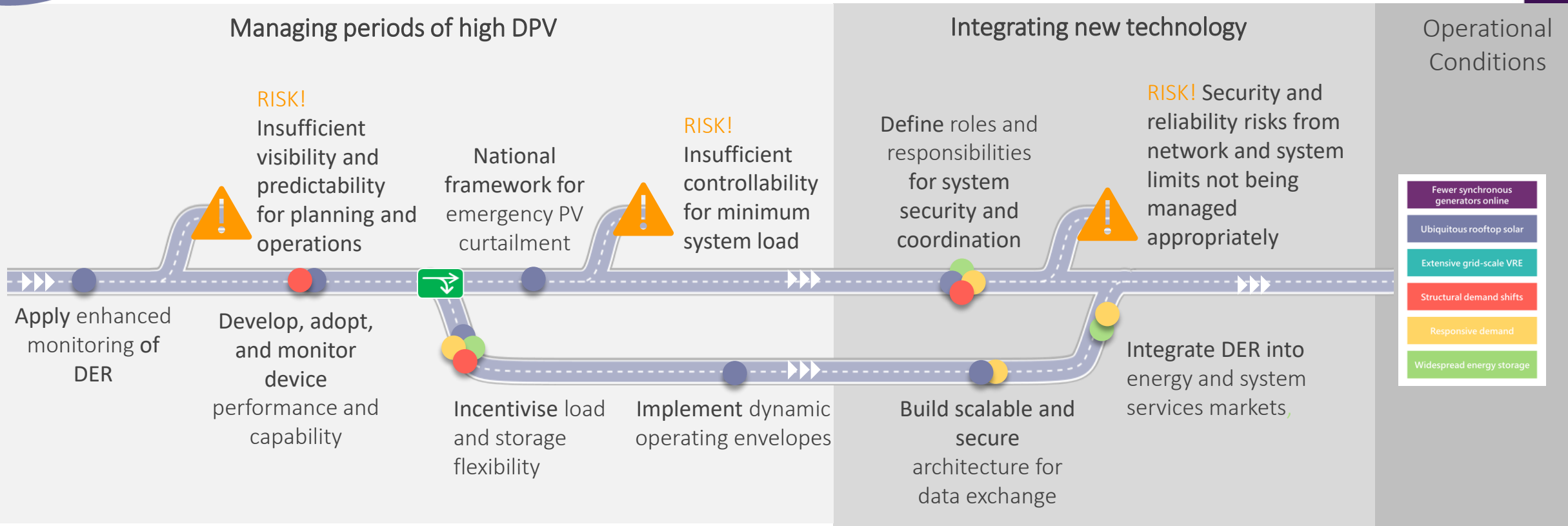
Operational Conditions

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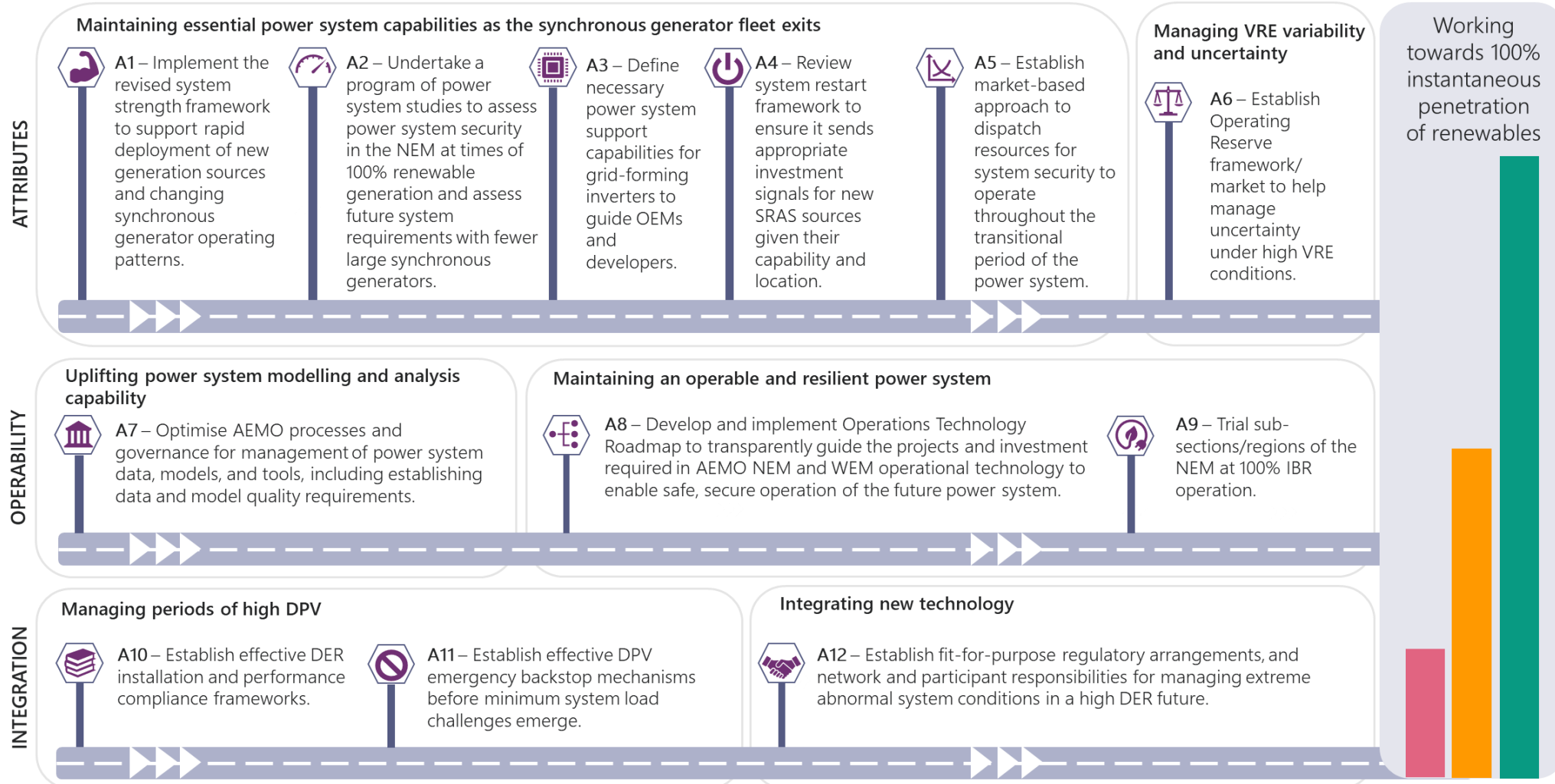
Key decisions – integration



Optimally deploying and incentivising new and existing technologies, both grid-scale and distributed, within the power system and market



Priorities to support 100% instantaneous penetrations of renewables





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