17 July 2018

Economic efficiency benefits from equal access

(Teleconference)

INNOVATION AND PARTICIPATION ADVISORY GROUP

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Reasons for this slide pack

- Provide more detail on the economic assumptions underpinning the benefit range calculations that IPAG requested for the last meeting

- Support members discussion (via teleconference) of the validity of the assumptions driving differences in benefits between the scenarios that IPAG is considering

Structure of this slide pack

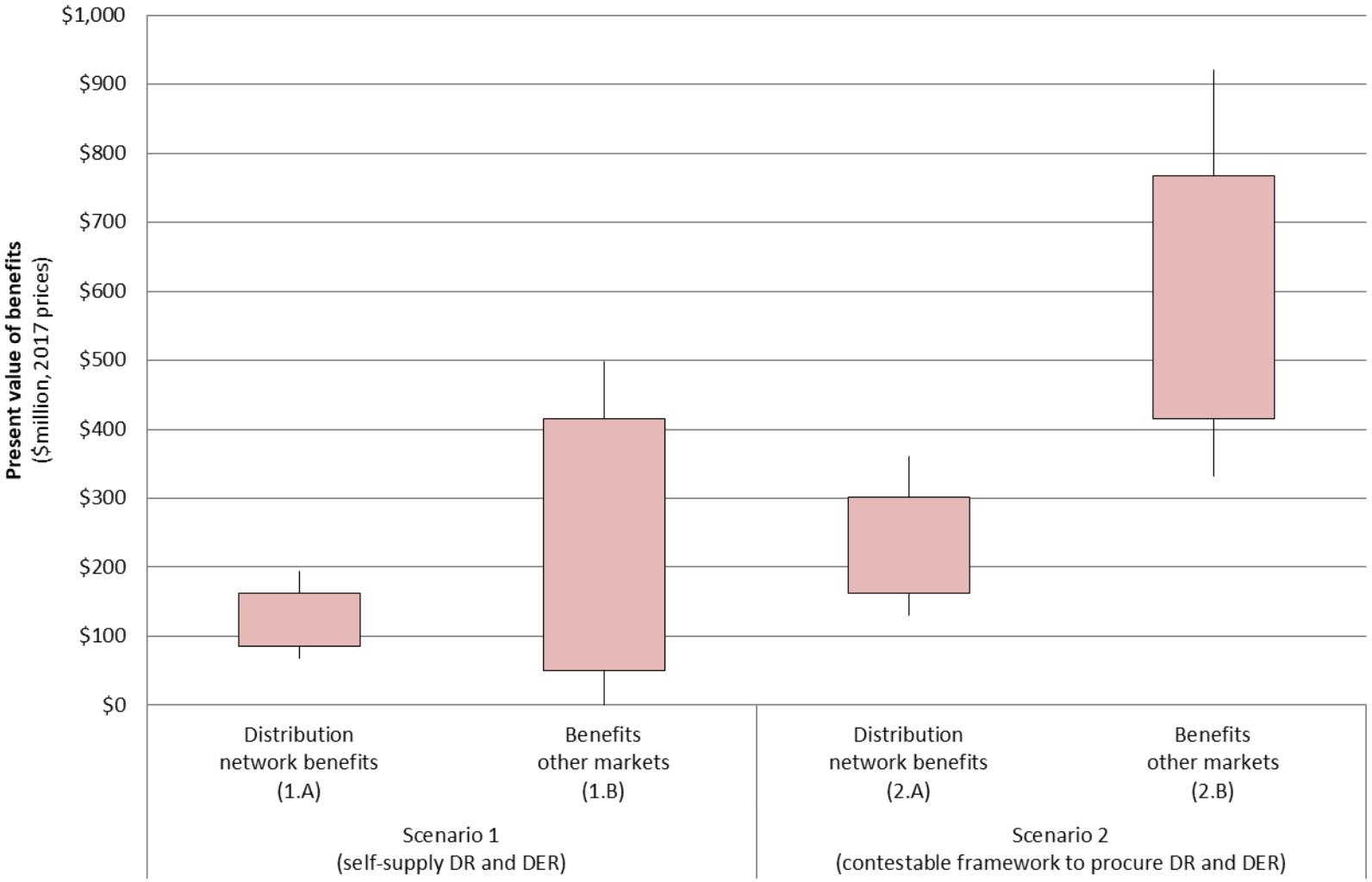
1. Brief recap of the scenarios considered and results
2. Dive into the **4 key assumptions** driving greater benefits under a contestable framework scenario (divided into 2 different sections)
3. Annex provides more technical detail of how the assumptions have been used to calculate the benefit ranges (for the analytical minded)

Two scenarios considered and four benefit ranges calculated (recap)

Recap from last IPAG meeting on scenarios considered and benefit range calculations

	Distribution network benefits	Benefits realised in other markets
Self-supply (Scenario 1)	***Range 1.A*** a *rough order of magnitude* of the benefits of networks using DER and DR rather than relying on traditional network solutions (poles, wires and transformers)	***Range 1.B*** a *rough order of magnitude* of the benefits available from network owned DERs and DR participating in other markets
Contestable framework (Scenario 2)	***Range 2.A*** a *rough order of magnitude* of the benefits of networks using DER and DR rather than relying on traditional network solutions	***Range 2.B*** a *rough order of magnitude* of the benefits from DERs and DR participating in other markets where these resources are not necessarily owned by the network

Economic benefit ranges associated with scenarios 1 and 2 (recap)



Key assumptions driving greater distribution network benefits under a contestable framework (scenario 2)

Comparing the set-up for each scenario (distribution benefits)

Self-supply (scenario 1)	Contestable framework (scenario 2)
• Distributors are efficiently encouraged to seek for DER and DR alternatives via regulation • Only distributors invest, own and operate DER and DR through self-supply • Distributors invest in DER and DR as part of their *regulated* business activity	• Distributors are efficiently encouraged to seek for DER and DR alternatives via regulation • There is an **efficient contestable framework based on equal access** to procure DER and DR own and operated by other parties • A contestable framework does not rule out that a distributor's DER and DR self-supply investments could be the efficient option • As part of a contestable framework, distributors' self-supply investments in DER and DR are part of their *unregulated* business activities*

*****Some assumptions about what a contestable framework might look like are required to understand the full scale of the benefits available. The scenario set-up assumes that under a contestable framework the self-supply of DER and DR investments happen under the umbrella of the distributor's unregulated business activities. We then compare the benefits against scenario 1 that reflects the current 'status quo' where DER and DR investments happen under the umbrella of the distributor's regulated business activity.

Two key assumptions drive the extra distribution benefits under a contestable framework scenario

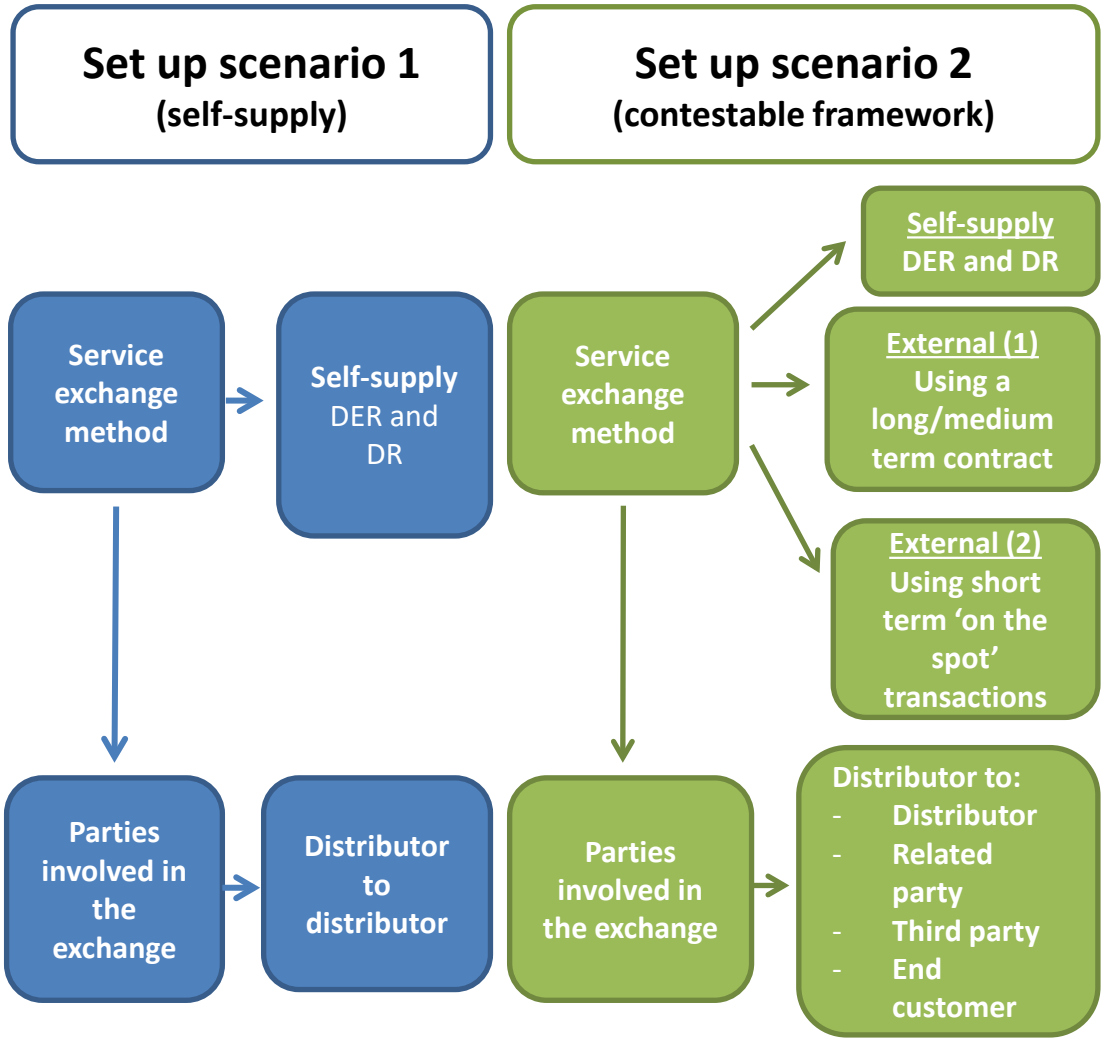
- **Assumption 1:** Using new ways to exchange services and more and more diverse parties competing to provide a service delivers greater innovation and lower costs*****

- **Assumption 2:** As part of a contestable framework, deregulated distribution DER and DR self-supply investments promotes more efficient investment choices and supports greater 'liquidity' of DER and DR participants

Explained in the next slides

*https://www.economist.com/open-future/2018/06/18/why-collaborative-thinking-beats-individual-smarts

(1) Using new ways to exchange services and more and more diverse parties competing to provide a service delivers greater innovation and lower costs



Extra benefits in scenario 2

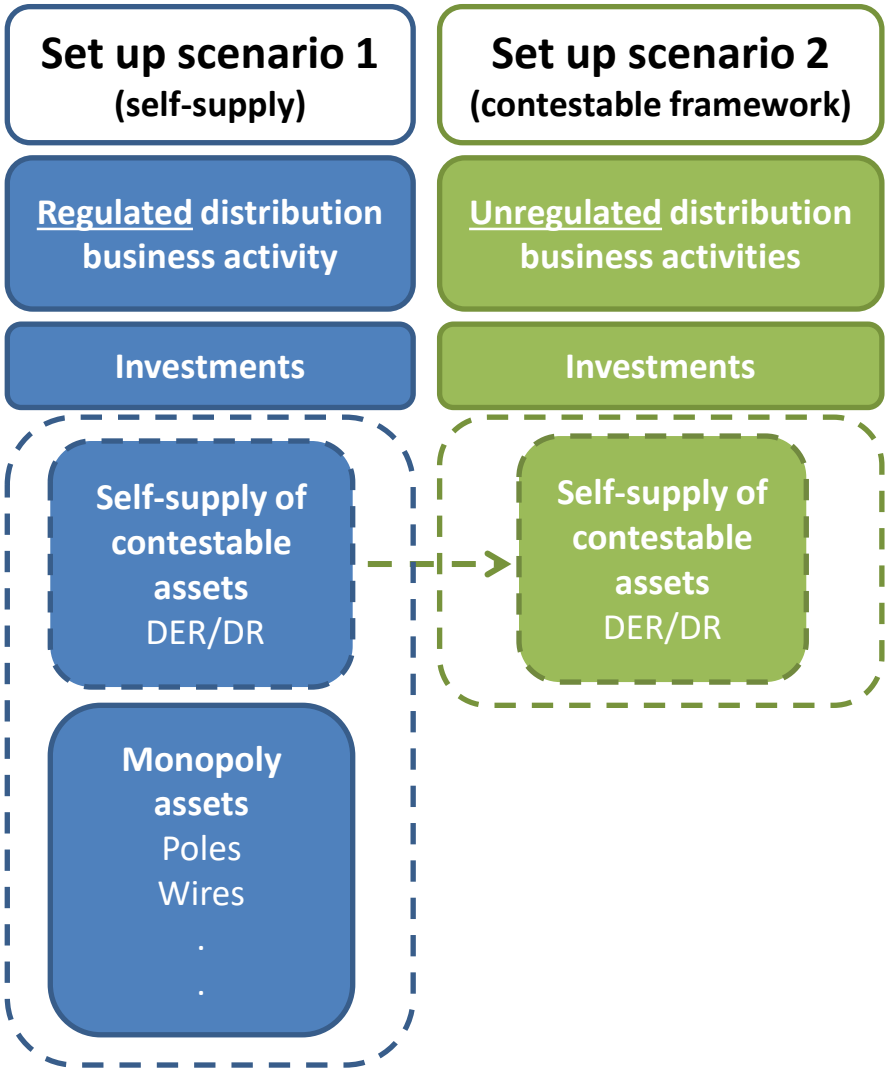
Greater innovation and lower costs from

- More diversity of service exchange methods
- More diversity and more parties competing to deliver innovative and efficient services

Equal access is key to deliver 'contestable framework' benefits

- No unfair bias towards a specific exchange method
- No unfair bias towards a specific party
- No unfair bias towards a specific DER/DR technology

(2) Deregulated DER and DR self-supply investments promotes more efficient investment choices and supports greater 'liquidity' of DER and DR participants



Extra innovation, timing and cost benefits in scenario 2

More efficient DER and DR self-supply investment decisions when a distribution business self-supplies DER and DR as part of the unregulated business activity compared to self-supplying DER and DR as part of the regulated business activity

All DER and DR investments are treated equally supporting greater 'liquidity' of DER and DR participants External parties are confident that all parties investing in DER and DR are subject to the same and more efficient competitive market-based investment risks when DER and DR self-supply investments are part of the distributor's unregulated business activities

Next slide for an analysis

(2) Deregulated self-supply investments promote better investment choices and supports greater 'liquidity' of DER and DR participants, AN ANALYSIS

Simple case – The treatment of technology obsolescence

Treatment of DER and DR technology obsolescence	Scenario 1 Self-supply as part of the regulated business activity	Scenario 2 Self-supply as part of the unregulated business activity
How is DER/DR asset value determined?	Determined via a regulatory decision	Determined under competitive market rules
Impact of technology obsolescence on DER/DR asset value?	No asset value write-off	Asset value write-off
Who makes the decision to invest in DER/DR?	Regulated business	Unregulated business
Who is best placed to bear the risk the of DER/DR technology obsolescence?	Regulated business on behalf of shareholders	Unregulated business on behalf of shareholders
Who bears the risk of technology obsolescence?	Consumers	Unregulated business on behalf of shareholders

Analysis underlying extra benefits in scenario 2

More efficient DER and DR self-supply investment decisions from

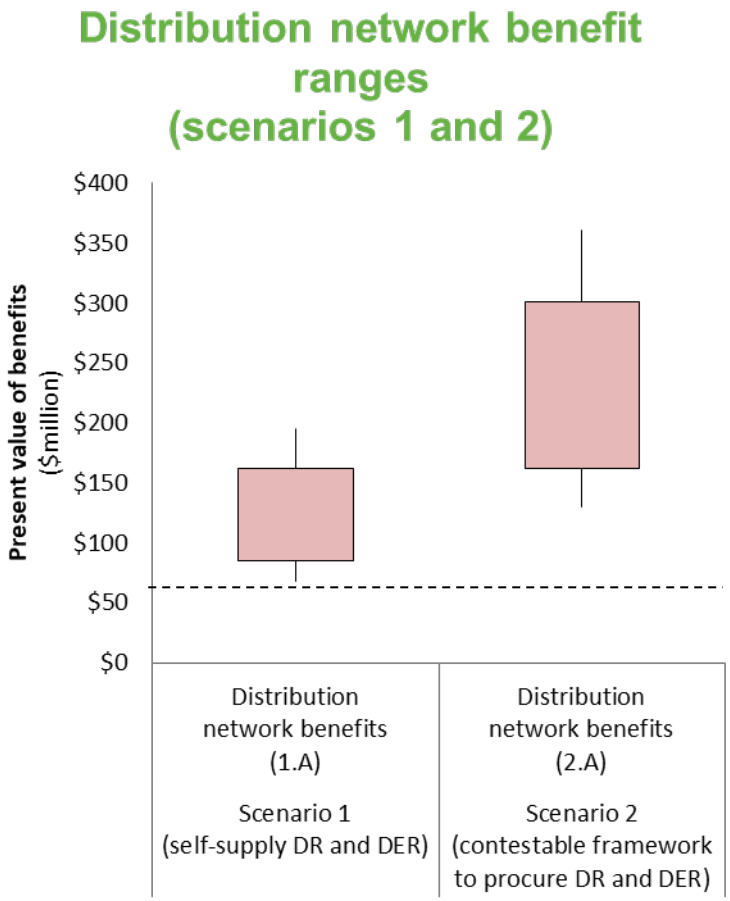
More balanced incentives placed on the distributor to consider and manage the impact of upside as well as the downside risks of self-supply investment decisions as part of an unregulated business activity

Confidence that all DER and DR investments are treated equally supports a 'liquid' market

External parties greater willingness to invest in DER and DR to provide network support services because there is confidence that:

- All market participants manage the same competitive market investment risks
- Distributors decisions towards DER and DR self-supply are more balanced because they are better encouraged to consider the investment risks of owning DER and DR assets

Applying contestable framework assumptions resulted in more distribution network benefits



- ***Scale of innovation benefits***: These benefits emerge because contestability helps the distributor discover more innovative and efficient DER and DR options to defer traditional network investment which the distributor might be unaware off or not necessarily have the skills or expertise to develop. *This results in a greater adoption of DER and DR in scenario 2*

- ***Timing of innovation benefits***: These benefits emerge because contestability helps the distributor discover opportunities to deliver scale benefits promptly which avoids missing out on opportunities to make more efficient DER and DR investments. *This results in a faster adoption of DER and DR in scenario 2*

- ***Cost benefits***: These benefits emerge because contestability helps the distributor to deliver scale and timing innovation benefits at the *lowest possible cost* in scenario 2*

*Time constraints implied that DER and DR costs and costs reductions were not modelled. However, the embedded assumption would have been that contestability contributes to reduce DER and DR costs through: (1) economies of scale driven by the greater and faster DER and DR adoption; and (2) competition pressures to keep costs down and seek for cost reductions. Transpower has shared some data for its DR programme. That data shows how their DR procurement costs have reduced over time as a result of increased participation and contestability.

Key assumptions driving greater benefits in other markets across the supply chain under a contestable framework scenario?

Comparing the set-up for each scenario (benefits realised in other markets)

Self-supply (scenario 1)	Contestable framework (scenario 2)
• Markets across the supply chain to exchange DER and DR services are efficiently set-up* • Only DER and DR own by the distributor participates in these other markets	• Markets across the supply chain to exchange DER and DR services are efficiently set-up • DER and DR own by the distributor and other third parties participates in these other markets across the supply chain

*Please, refer to the Annex for a recap of the services considered across the supply chain informed by the 'wheel' of services

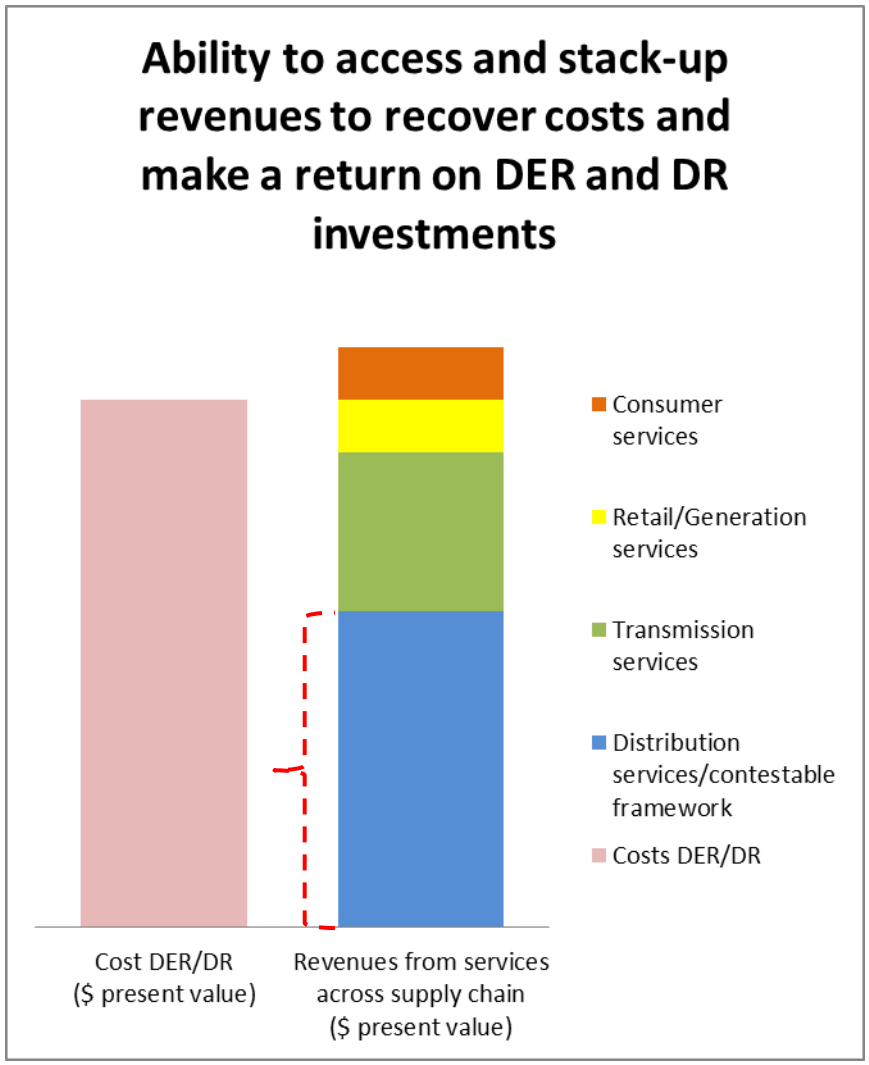
Two key assumptions support the realisation of extra benefits

- **Assumption 3:** Parties ability to access and stack-up a revenue stream from providing distribution network support services is critical to support greater 'liquidity' of DER and DR participants in other markets across the supply chain

- **Assumption 4:** A contestable framework provides better incentives for distribution businesses to operate DER and DR to maximise total benefits across the supply chain rather than just focusing the operation of DER and DR to maximise distribution benefits

Explained in the next slides

(3) Ability to access and stack-up a revenue stream from providing distribution network support services is critical to support greater 'liquidity' across the supply chain



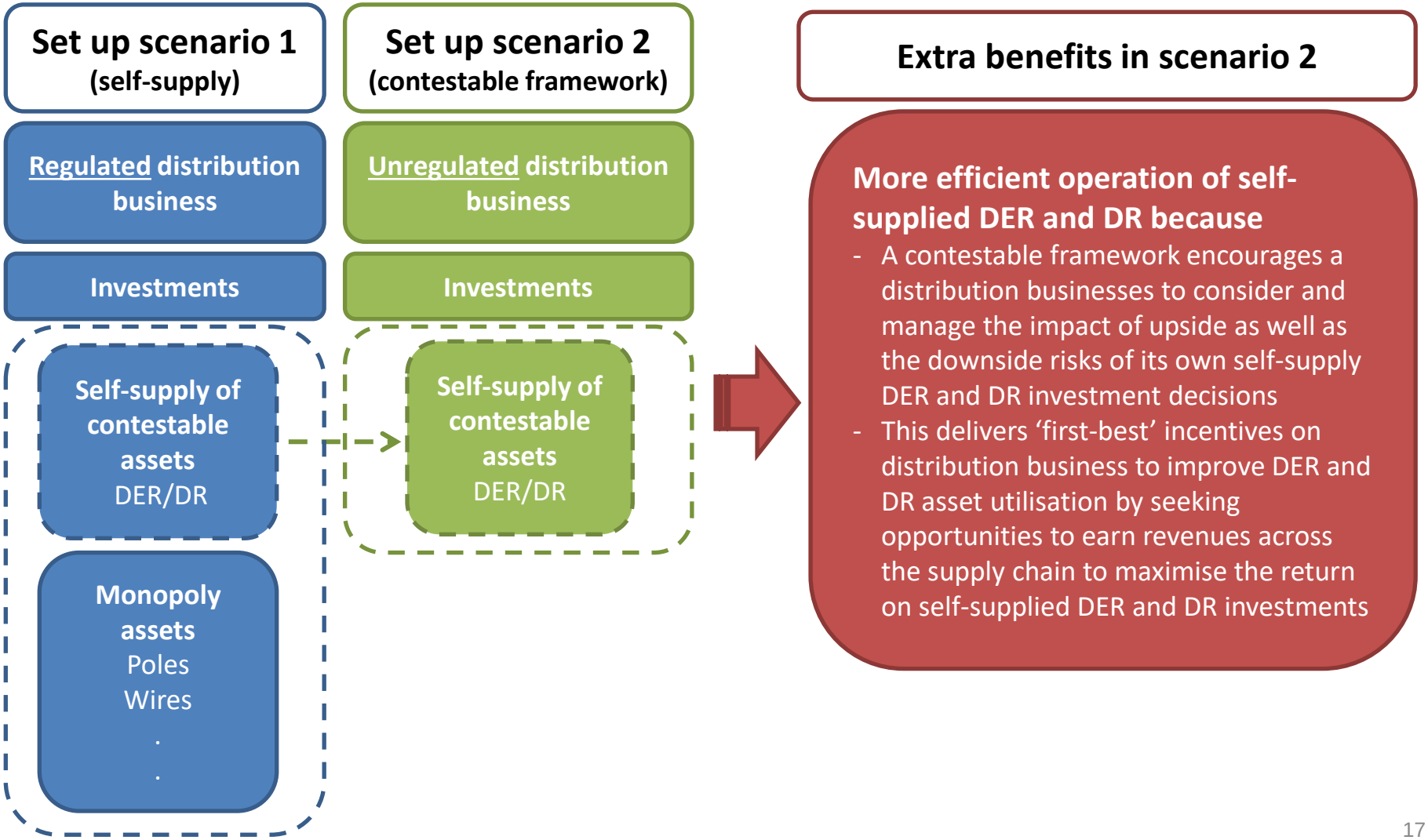
Extra benefits in scenario 2

Ability to access and stack-up revenue from distribution services supports investment in DER and DR which

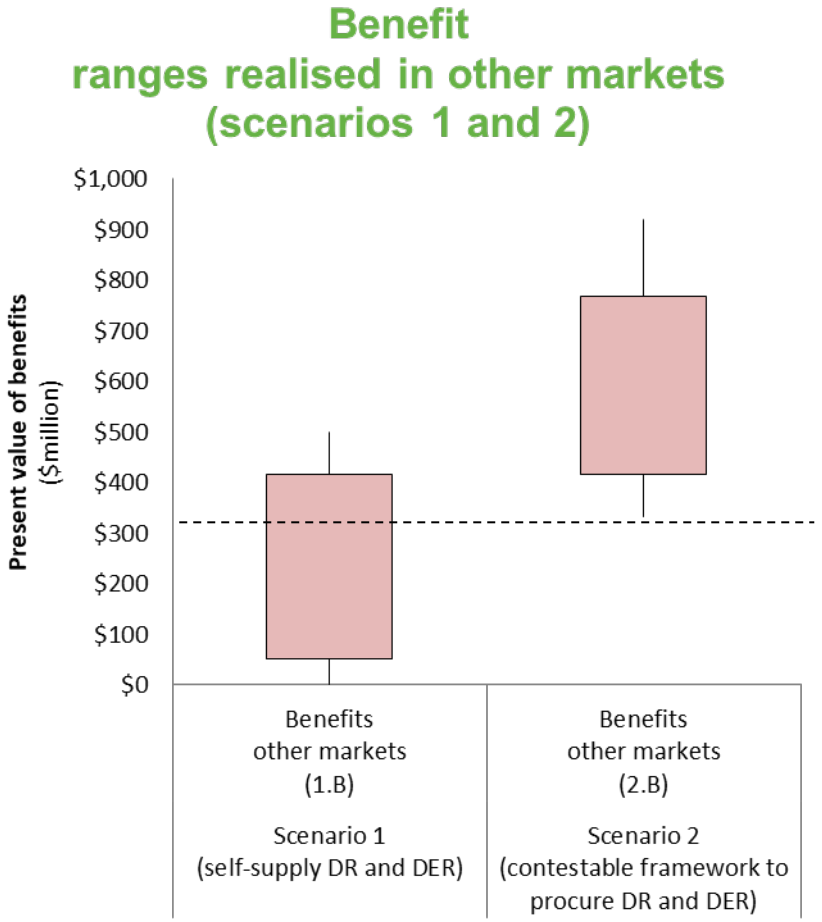
- Delivers greater 'liquidity' of DER and DR participants across the supply chain
- 'Liquidity' provides more diversity and more parties competing to deliver innovative and lower cost services across the supply chain

'Contestable framework' supports confidence in the ability to access revenues from providing distribution network support services supporting investment in DER and DR resulting in greater 'liquidity' of DER and DR participants across the supply chain

(4) A contestable framework provides better incentives to distribution businesses to focus the operation of DER and DR assets to maximise total benefits across the supply chain



Applying contestable framework assumptions also results in more benefits realised in other markets



- **'Flow-on' benefits from a contestable framework to procure DER and DR:** The greater and faster adoption of DER and DR fostered through a contestable framework create 'flow-on' innovation and cost benefits in other markets across the supply chain*

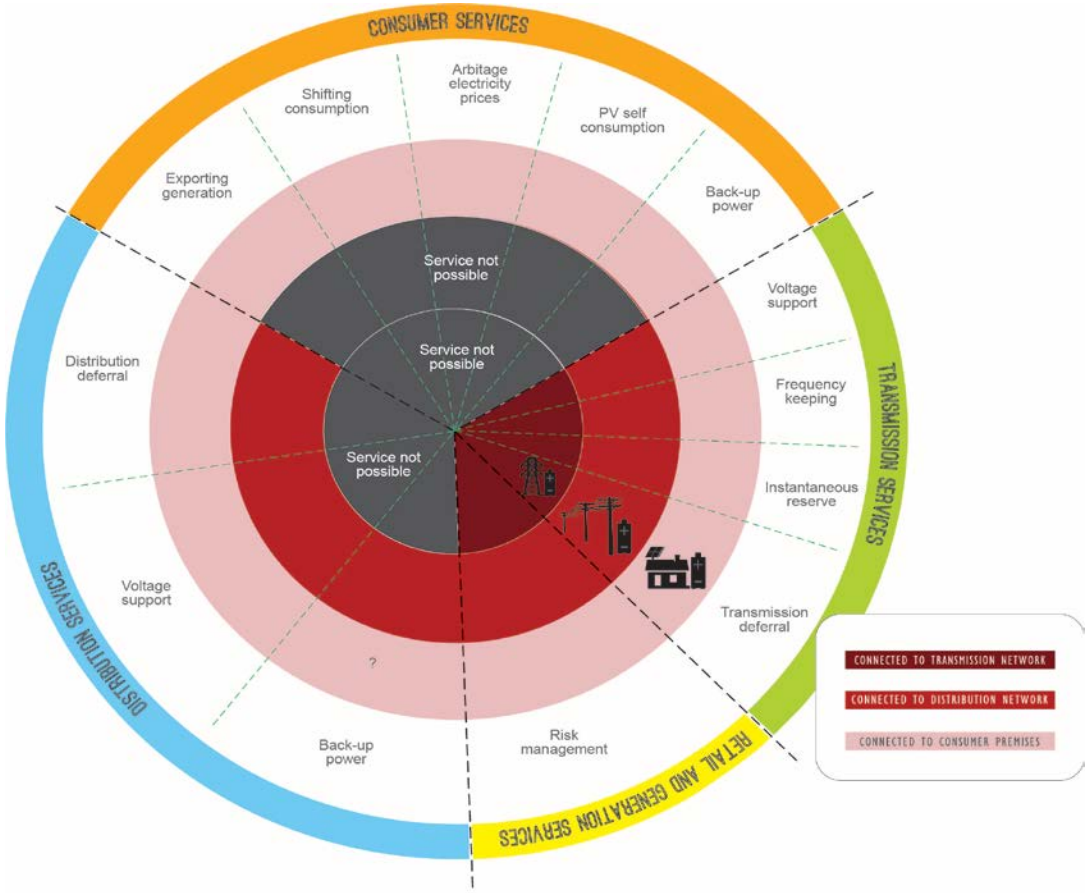
*We used the 'wheel' of services to inform the likely markets where DER and DR could participate to provide services resulting in economic benefits. See the Annex for a reminder of the 'wheel' of services and an example of how benefits have been modelled.

Annex
Methodology, assumptions and calculations

We have used the model underpinning Transpower's battery storage report

- Transpower's battery storage report provides an 'informed guess' of the benefits available from investing in DER solutions such as batteries
- We have used the underlying modelling (provided by Geoghegan Consulting) to inform our own calculations for distribution network benefits, as well as benefits across other markets/services
- Data limitations, complexity of the task and time constraints means that calculations are underpinned by numerous assumptions which are only informed in some circumstances

Using the battery storage report model allows us to consider distribution network benefits as well as other benefits across the 'wheel' of services

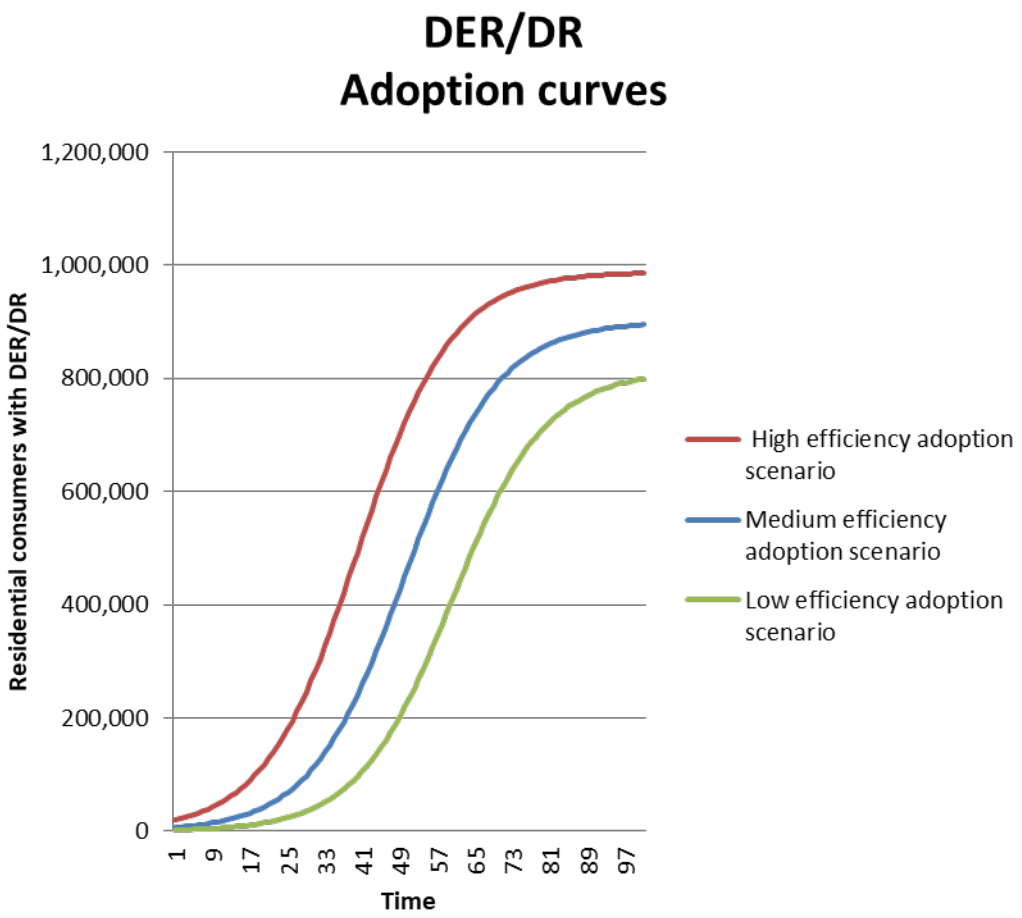


*Voltage support as part of transmission level services has been added with respect to figure presented in other occasions

How are benefits measured?

Service on the "wheel" of services	Sub-service in the 'wheel' of services	Measure of economic benefit	Source
Distribution services	Deferring network investment (by 5 years)	Network long run marginal cost $150/KW/pa (mid-end)	Battery storage modelling
Transmission services	Deferring network investment (by 5 years)	Network long run marginal cost $30/KW/pa (low -end)	
	Frequency keeping	National average: $12/MWh	
	Instantaneous reserve	National average: $5.5/MWh	
	Voltage support	Equivalent Statcom carry costs $40/KVA/pa	
Consumer services	PV self-consumption	Avoided cost from average feed-in-tariff 8c/KWh	
	Shifting consumption	Based on existing TOU tariff values	
	Back-up power	Value of lost load (residential) $11,000/MWh	
Retail and wholesale market services	Risk management	Peaking plant capacity payment $150/KW/pa	

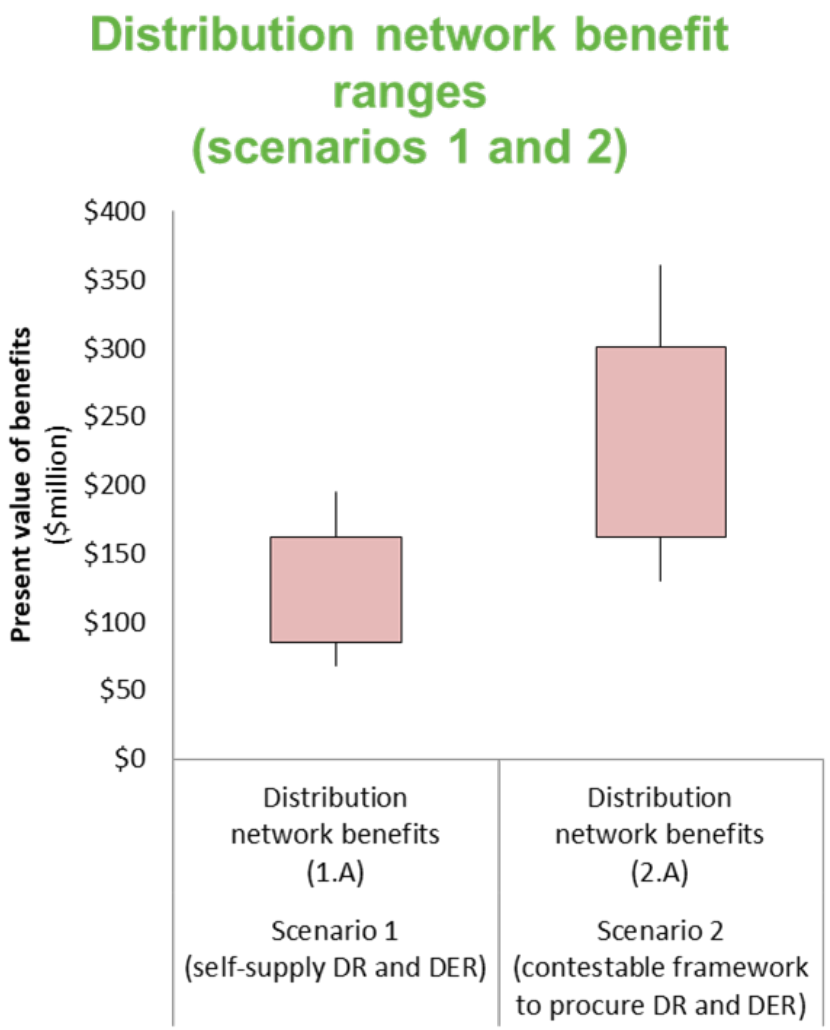
We assumed a DER/DR adoption curve for residential consumers only



- We used an 'S-technology' adoption curve specification to model residential DER/DR adoption
- Final number of residential consumers modelled to adopt DER/DR is assumed to fluctuate around half of the existing 1.8million residential consumers
- Each new consumer delivers, on average, 3kW of DER/DR capacity at the time of adoption
- **A key assumption underpinning the analysis is that adoption of DER/DR can differ depending on whether scenarios 1 or 2 are considered**. We used the Low, Medium, High efficiency scenarios to account for this. Details about the reasoning behind these efficiency scenarios is provided in the next slides

Distribution network benefits modelling

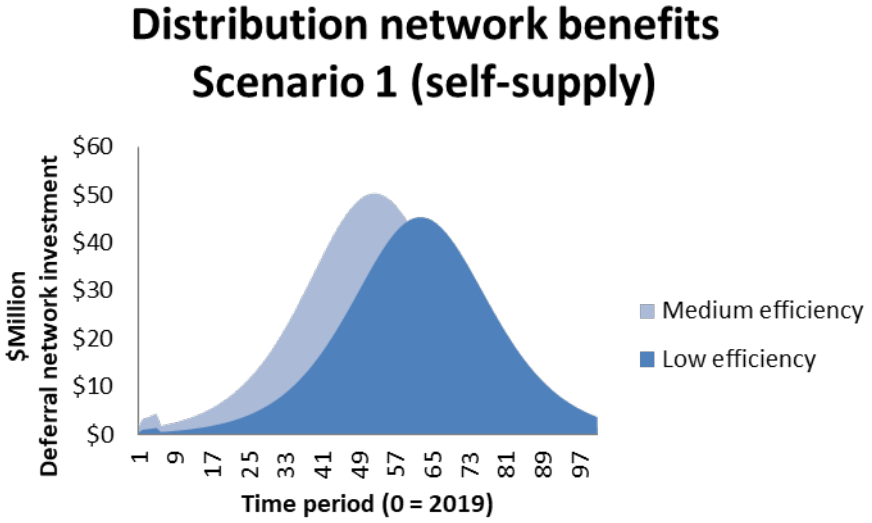
Distribution network benefit calculations



Drivers of benefit differences between scenarios

- ***Scale of innovation benefits***: These benefits emerge because contestability helps the distributor discover more innovative and efficient DER and DR options to defer traditional network investment which the distributor might be unaware off or not necessarily have the skills or expertise to develop. *This results in a greater adoption of DER and DR in scenario 2*
- ***Timing of innovation benefits***: These benefits emerge because contestability helps the distributor discover opportunities to deliver scale benefits promptly which avoids missing out on opportunities to make more efficient DER and DR investments. *This results in a faster adoption of DER and DR in scenario 2*
- ***Cost benefits***: These benefits emerge because contestability helps the distributor to deliver scale and timing innovation benefits at the *lowest possible cost* in scenario 2*

Modelling of distribution network benefits in the self-supply scenario



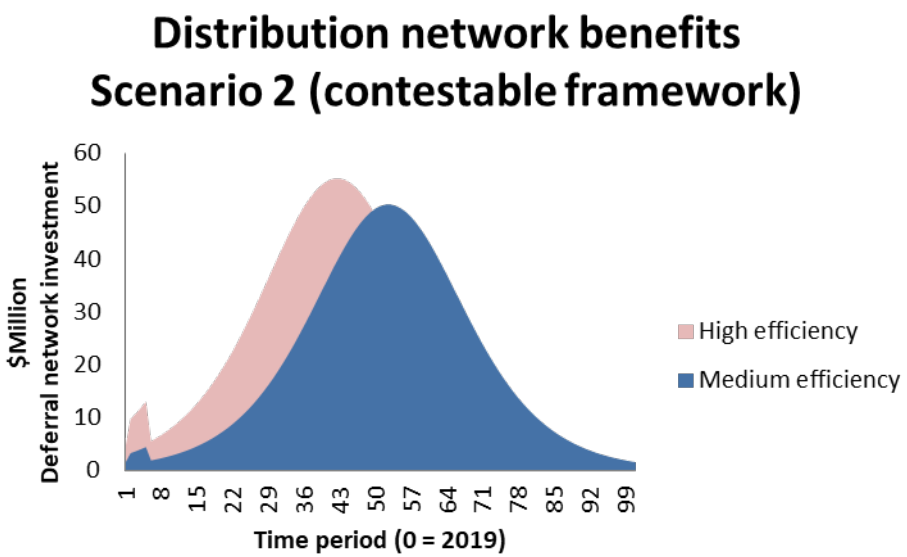
Rationale for using low and medium efficiency assumptions to calculate a benefit range under a self-supply supply scenario

Using low and medium efficiency scenarios to calculate a benefit range attempts to capture the potential variation in distributors' efficiency in terms of their ability to deliver innovation, timing and cost benefits

	Lower bound* (based on Low efficiency scenario)	Higher bound* (based on Medium efficiency scenario)
PV $Million (6% discount rate, 100 year period)	$85	$162
± 20% $Million (because of uncertainty)	**$68**	**$194**
Average $Million (based on a 50/50 weighting)	**$131**	

*Numbers have been rounded

Modelling of distribution network benefits under a contestable framework scenario



Rationale for using medium and high efficiency assumptions to calculate a benefit range under a contestable framework scenario

Using high and medium efficiency scenarios to calculate a benefit range attempts to capture the potential variation in the ability of a contestable framework to deliver greater innovation, timing and cost benefits

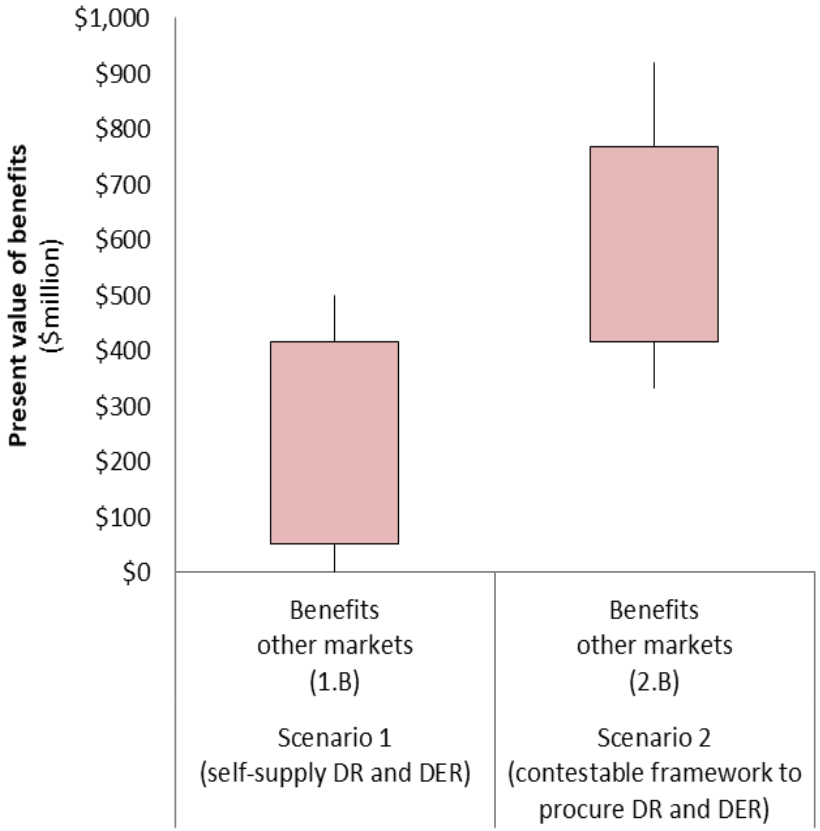
	Lower bound* (based on Medium efficiency scenario)	Higher bound* (based on High efficiency scenario)
PV $Million (6% discount rate, 100 year period)	$130	$360
± 20% $Million (because of uncertainty)	**$104**	**$432**
Average $Million (based on a 50/50 weighting)	**$268**	

*Numbers have been rounded

Benefits in other markets modelling

Benefits realised in other markets calculations

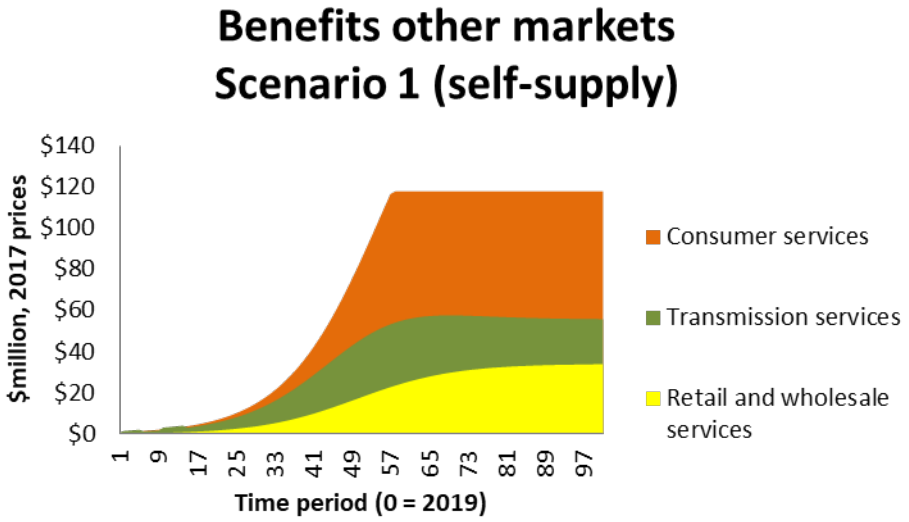
Benefit ranges realised in other markets (scenarios 1 and 2)



Drivers of benefit differences between scenarios

- **'Flow-on' benefits from a contestable framework to procure DER and DR:** The greater and faster adoption of DER and DR fostered through a contestable framework create 'flow-on' innovation and cost benefits in other markets across the supply chain*****

Modelling of benefits in other markets under self-supply scenario



Rationale for using low and medium efficiency assumptions to calculate a benefit range under a self-supply scenario

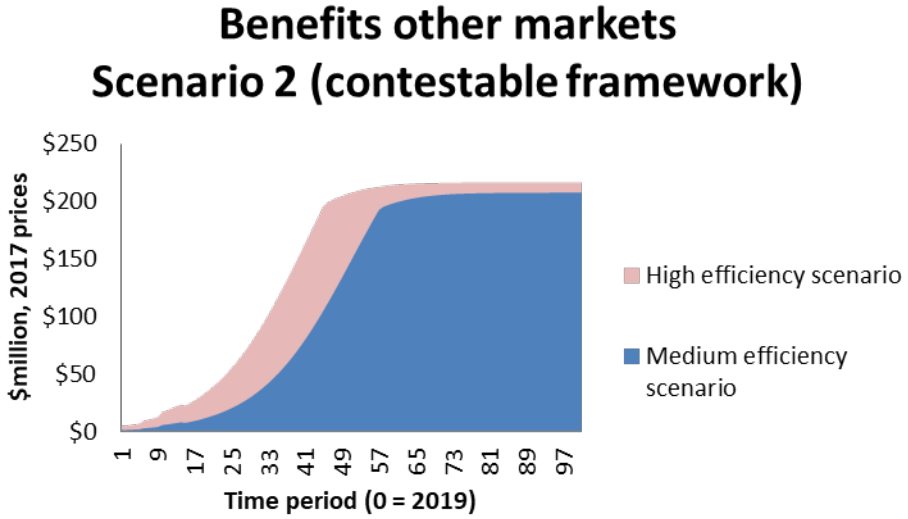
Using low and medium efficiency scenarios to calculate a benefit range attempts to capture the potential variation in:

- 'flow on' benefits from DER and DR adoption fostered by the take-up to deliver distribution network services
- distributors' incentives to seek to maximise DER and DR asset utilisation by maximising participation of these assets in other markets to generate revenues. The low efficiency scenario assumes the extreme case where no DER or DR is offered into these market (= $0 benefits)

	Lower bound* (based on Low efficiency scenario)	Higher bound* (based on Medium efficiency scenario)
PV $Million (6% discount rate, 100 year period)	$0	$415
± 20% $Million (because of uncertainty)	**$0**	**$500**
Average $Million (based on a 50/50 weighting)	**$250**	

*Numbers have been rounded

Modelling of benefits in other markets under contestable framework scenario



Rationale for using high and medium efficiency assumptions to calculate a benefit range under a the contestable framework scenario

Using high and medium efficiency scenarios to calculate a benefit range attempts to capture the potential variation in:

- 'flow on' benefits from DER and DR adoption take-up to deliver distribution network services using a contestable framework
- opportunities to maximise DER and DR asset utilisation by maximising participation of these assets in other markets to generate revenues

	Lower bound* (based on Medium efficiency scenario)	Higher bound* (based on High efficiency scenario)
PV $Million (6% discount rate, 100 year period)	$415	$770
± 20% $Million (because of uncertainty)	**$330**	**$925**
Average $Million (based on a 50/50 weighting)	**$630**	

*Numbers have been rounded