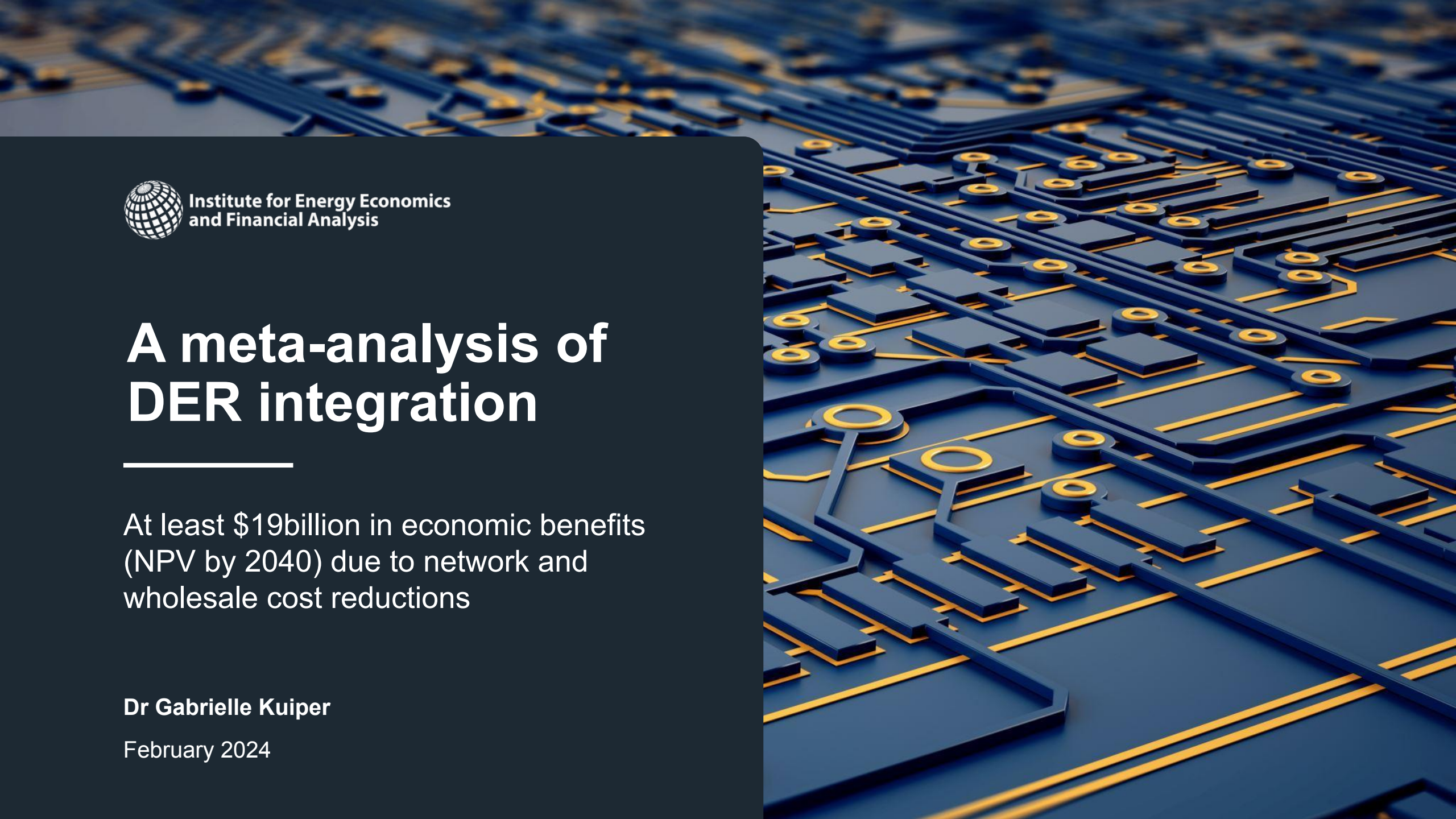


Institute for Energy Economics and Financial Analysis

A meta-analysis of DER integration

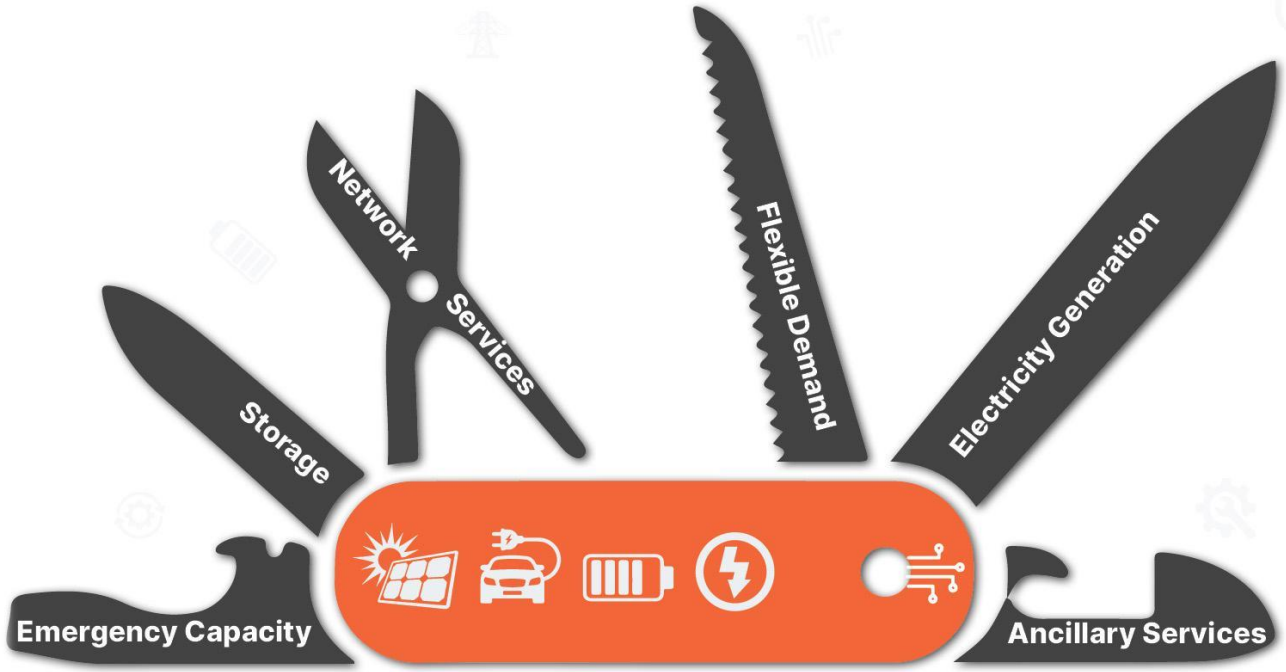
At least $19billion in economic benefits (NPV by 2040) due to network and wholesale cost reductions

Dr Gabrielle Kuiper

February 2024

DER: The Swiss Army knife of the electricity system

DER can deliver multiple energy services with large economic benefits



$11bn[1] in avoided networks costs

$8bn[2] in reduced generation and storage costs

$10bn[2] in reduced generator super profits

Net present value to 2040

1 Baringa Partners. *Potential network benefits from more efficient DER integration.* 18 June 2021.
2 NERA Economic Consulting. *Valuing Load Flexibility in the NEM.* 1 February 2022.

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Analysis reviewed

For individual types of DER:

- **Rooftop solar**: *'Rooftop Solar PV: In Whose Interests?'* 2021. Mountain, B, Percy, S & Burns, K.
- **Hot water**: UTS Institute for Sustainable Futures. *Domestic Hot Water and Flexibility*. June 2023. Roche, D., Dwyer, S., Rispler, J., Chatterjee, A., Fane, S. & White, S. Prepared for ARENA
- **Load flexibility**: RACE for 2030 CRC. *Flexible demand and demand control. Final report of opportunity assessment for research theme B4*. 2021. Brinsmead, TS., White, S., Bransden, C., Stanley, C. Hasan, K., Alexander, D., Sprague, M., Northey, J., Walgenwitz, G., Nagrath, K., Briggs, C., Leak, J., Harkins-Small, L., Murray-Leach, R. and Jennings, K.
- **Household electrification**: CSIRO. *Consumer impacts of the energy transition: modelling report*. 2023. Graham, Paul; Meher-Homji, Zubin; Havas, Lisa; Foster, James. Prepared for Energy Consumers Australia

Analysis reviewed

For multiple forms of DER:

1. CSIRO and Energy Networks Australia. **Electricity Network Transformation Roadmap: Final Report.** 2017.

2. Baringa Partners. **Potential network benefits from more efficient DER integration.** 18 June 2021. For the Energy Security Board.

3. NERA Economic Consulting. **Valuing Load Flexibility in the NEM.** 1 February 2022. Prepared for the Australian Renewable Energy Agency (ARENA).

4. Deloitte Access Economics. **Project EDGE Cost Benefit Analysis.** October 2023. Prepared for ARENA.

5. ITP Renewables. **Saturation DER modelling.** 2021. Confidential commission and not publicly available.

- All studies have shortcomings!

  Esp. underestimates of flexible demand, DER exports, GHG savings

- All partial estimates

Economic analyses of the benefits of aggregated DER

Name of study	Total benefit value	Wholesale/generation cost reductions, including at peak times	Avoided/ reduced transmission costs	Avoided/ reduced distribution costs	Other cost reductions e.g. carbon emissions
CSIRO and Energy Networks Australia 2017, Electricity Network Transformation Roadmap: Final Report.	**$101bn saving to 2050** in cumulative electricity system total expenditure	· $5billlion more in centralised generation · $22bn in reduced on-site generation · So net $17bn in reduced generation costs	· $7bn in reduced transmission costs	· $40 bn in reduced distribution costs · $16 bn in network infrastructure investment is avoided through DER providing network services	· $36bn in avoided off-grid systems (i.e. avoided death spiral)
Baringa Partners LLP 18 June 2021, Potential network benefits from more efficient DER integration,	**$11.3bn NPV by 2040** distribution and transmission network benefits under the step change scenario.	· None included	· $38m under the central scenario, and $1.4bn under the step change scenario	· $2.3bn in the central scenario, and $9.9bn in the step change scenario	· None
NERA Economic Consulting, 1 February 2022, Valuing Load Flexibility in the NEM,	State of the World 4 (high DER) **$8bn (new build generation and storage savings only)** or $18bn (consumer cost savings, including wholesale peak pricing reductions) NPV by 2040.	· $8bn (new build generation and storage savings only) or $18bn (consumer cost savings, including wholesale peak pricing reductions) NPV by 2040	Not included	Not included	· 3Mt for SoW 4 (not priced) GHG figure understates the emissions reductions from electrification

Economic analyses of the benefits of aggregated DER

Name of study	Total benefit value	Wholesale/generation cost reductions, including at peak times	Avoided/ reduced transmission costs	Avoided/ reduced distribution costs	Other cost reductions e.g. carbon emissions
Deloitte Access Economics, October 2023, Project EDGE Cost Benefit Analysis, For ARENA	**$6.04bn NPV over 20 years** for scenario 10 compared with the base case.	• $3.95bn over 20 years to DER Aggregators	$0.06bn in reduced transmission costs	• $1.3bn in reduced distribution costs	• $0.68bn in FCAS and visibility of DER • $0.07 in reduced system operator costs • The total emissions avoided can be up to 18,859,157 tCO2e ($1.54bn) under the AEMO ISP Step Change DER uptake assumptions and up to 32,871,522 tCO2e ($2.60bn) under the High DER uptake assumptions.
ITP, 2020, Saturation DER modelling, For anonymous client	Not available as modelling was only done for one NEM region	• **4pm-8pm wholesale market evening peak reduces by 67%-92%**	Not available as modelling was only done for one NEM region	• Rooftop solar alone reduces the average summer network peak in the region modelled by 28% and shifts it 2.5 hours later in the day. In scenarios where household batteries can trade easily, the average summer network peak is reduced by 64%.	

Changes to the wholesale market are likely to be significant

Sleeping duck or platypus?

- The end of evening peaks as we know them
- $10bn reduction in 'super profits' according to NERA
- Both flexible demand and storage will be needed to optimise the value of DER

DOEs are essential to realise the value of DER

- Roughly 80% of the $6bn benefit identified in the Deloitte analysis for Project Edge is related to DOEs.
- KPMG CBA for SA Power Networks for DOEs was NPV of $40m to 2035 – likely to be highly conservative.
- Suggests DOEs should be the default offer for consumers, with flat export rates as opt-in.

Flexibility is vital to unlock value in electrification

- Flexibility with electrification provides a virtuous circle, which unlocks greater variable renewable (VRE) energy to match the increased demand of electrification.
- It is not sufficient to deploy DER or VRE, we need to optimise flexible demand in the system to minimise the costs of the energy transition.

Reform the economic regulation of DNSPs

Baringa warns that changes are needed soon:

> *"because after certain expenditure on network upgrades are incurred, or after certain solar PV is curtailed in a particular year, these impacts cannot be reversed even if they were avoidable if reforms to more efficiently integrate DER had taken place earlier."*

DNSP Regulatory Resets

FY25-FY30 FY26-FY31 FY27-FY32

Well integrated DER will reduce costs for everyone

Fundamental logic :

- Consumers pay more of the capital cost of the generation and storage directly, and what they purchase is co-located with load, reducing network, wholesale and retail costs.
- The smart on-site use of DER reduces the use of the network and reduces network peaks (as the “sleeping duck” modelling shows) and so should reduce the cost of networks.
- There is large capacity available in distribution networks most of the time due to declining utilisation over the 15 years.
- The time efficiencies compared with large-scale generation and transmission construction are significant.
- The social licence issues are minimal compared with large-scale generation and transmission.

The resilience benefits also need to be considered

City of Newcastle: Solar farm powering City operations and revenue

City of Newcastle, 25 June 2020

City of Newcastle unveils debut electric truck

Australian Truck Radio, 27 January 2022

We need courageous action on DER integration

- DER must not come second in policy, planning and regulation to large-scale generation and transmission.
- It must be considered on equal terms with more thoughtful recognition of its multiple benefits

Thank you!

IEEFA Guest Contributor

Dr Gabrielle Kuiper

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Growing the sharing energy economy

DER could provide $19bn economic boost by 2040

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