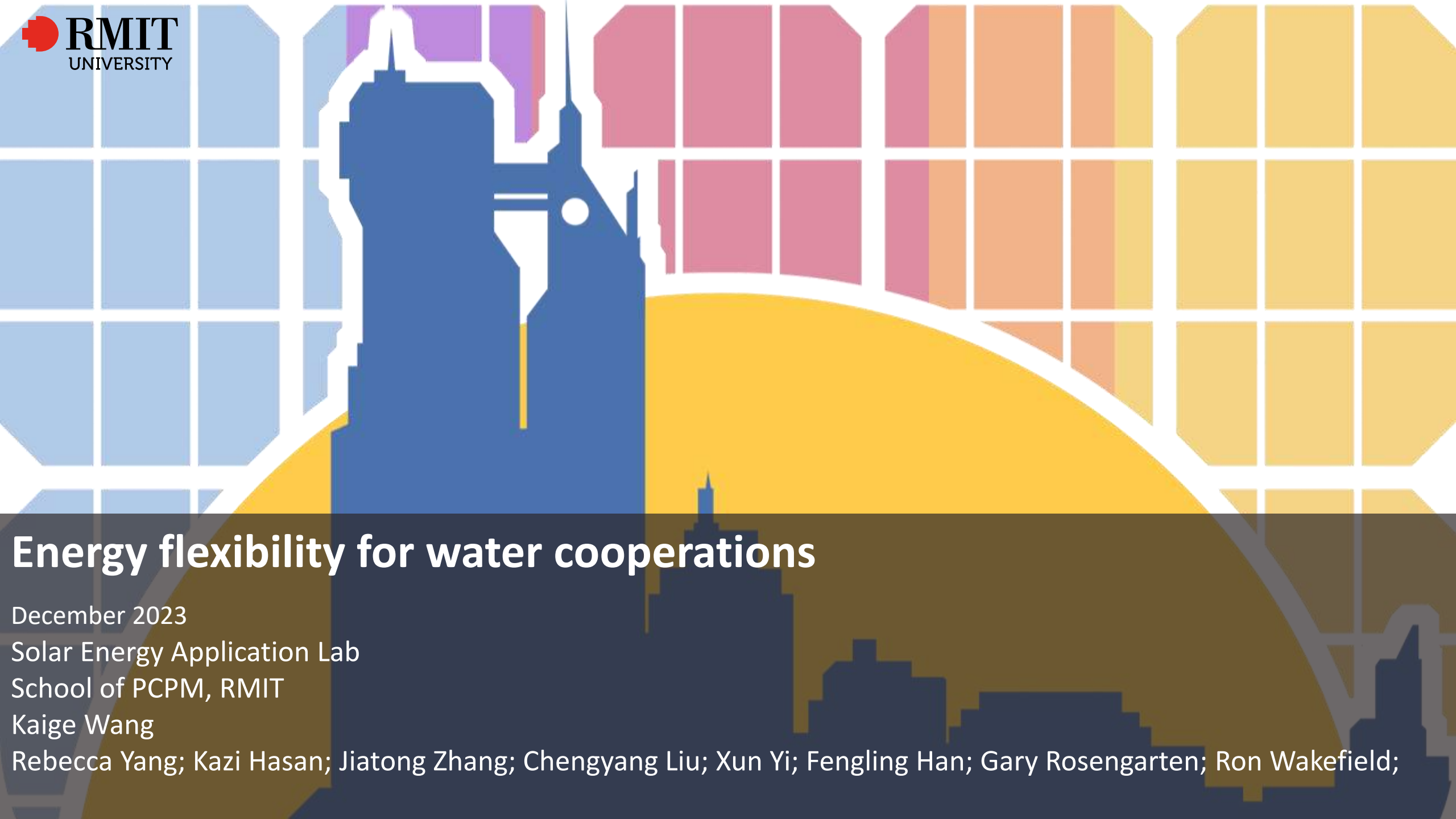

Energy flexibility for water cooperations

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Solar Energy Application Lab
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Project partners

RACE for 2030

C4NET
Centre for New Energy Technologies

Coliban WATER

Sydney WATER

RMIT UNIVERSITY

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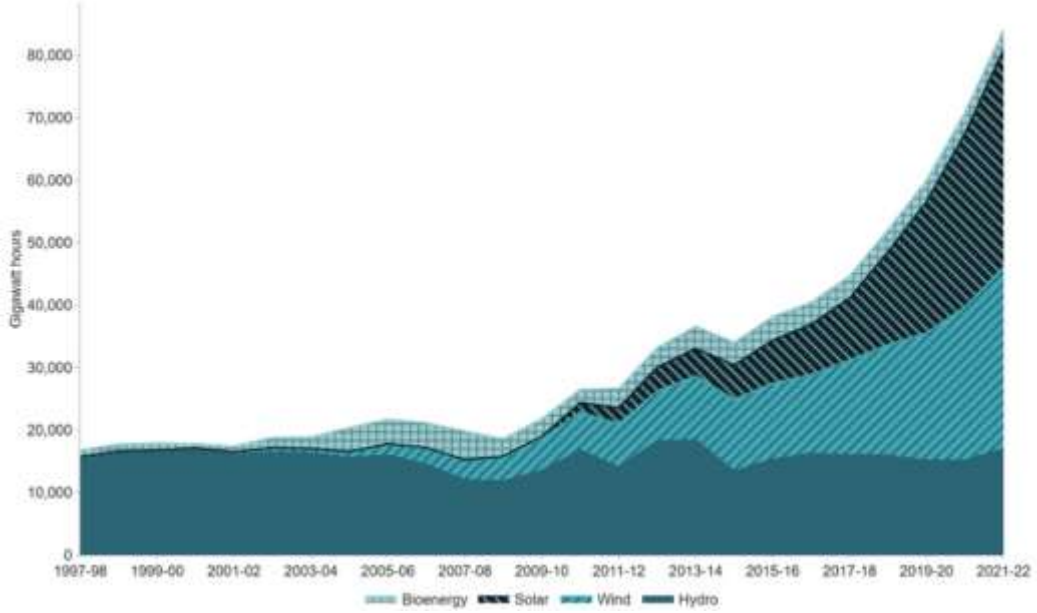
Background – RE transition in power systems

Australian electricity generation renewable sources

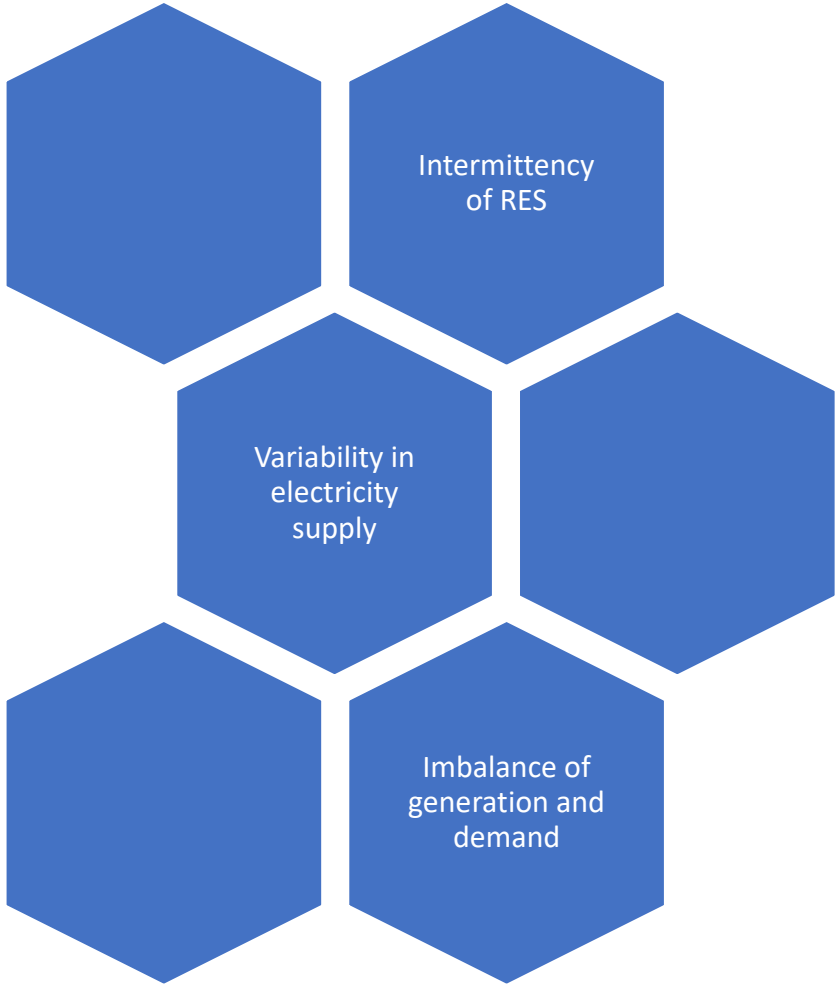


Source: DCCEEW (2023) Australian Energy Statistics

- RES are essential and inevitable for future power systems.
- Wind and solar penetration has increased considerably worldwide in last decades.
- Australian renewables generation has increased 215% from 2012 to 2022 (fig 1).

High RE penetration challenges

Source: AEMO (2020) Energy Explained: Frequency



To mitigate the imbalance…

Demand response is an effective method to balance electricity supply and demand.

Changes in electric use from demand side in response to the variation of electricity price or power system reliability.

Large flexible demand users, such as water utilities, have higher potential to provide demand response.

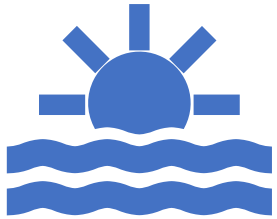
Why water utilities?

- Large energy demand and carbon emissions
- Ambitious net zero carbon targets
- Abundant on-site renewable generation
- Surrounded by DERs communities
- Vast load flexibility

Research aim and main tasks

This project aims to support the water corporation in achieving their net-zero targets through exploring the potential of community-based distributed generators and load management & renewable energy strategies.

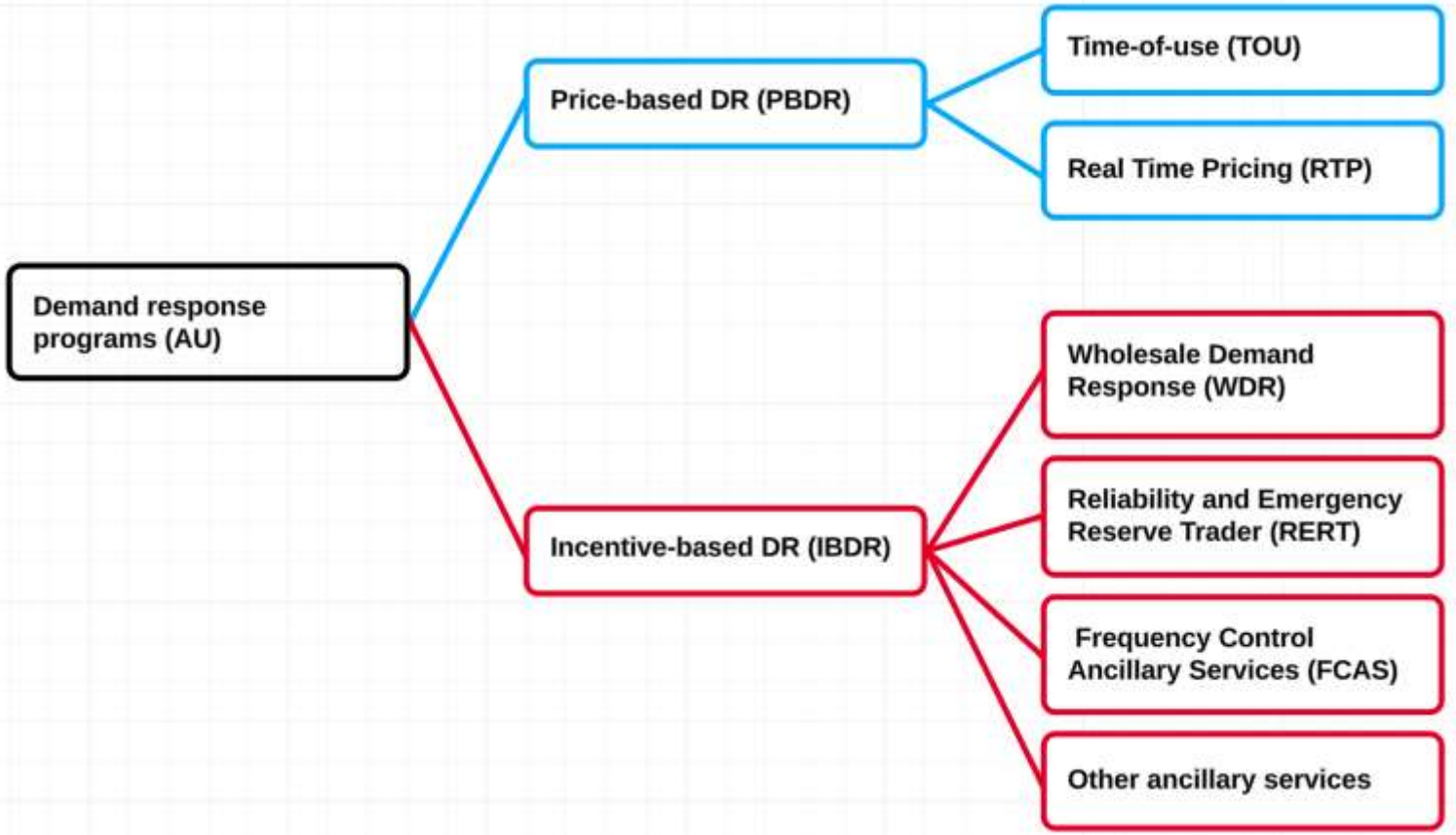
Energy and cost efficiency benefits of adopting load management strategies for water utility



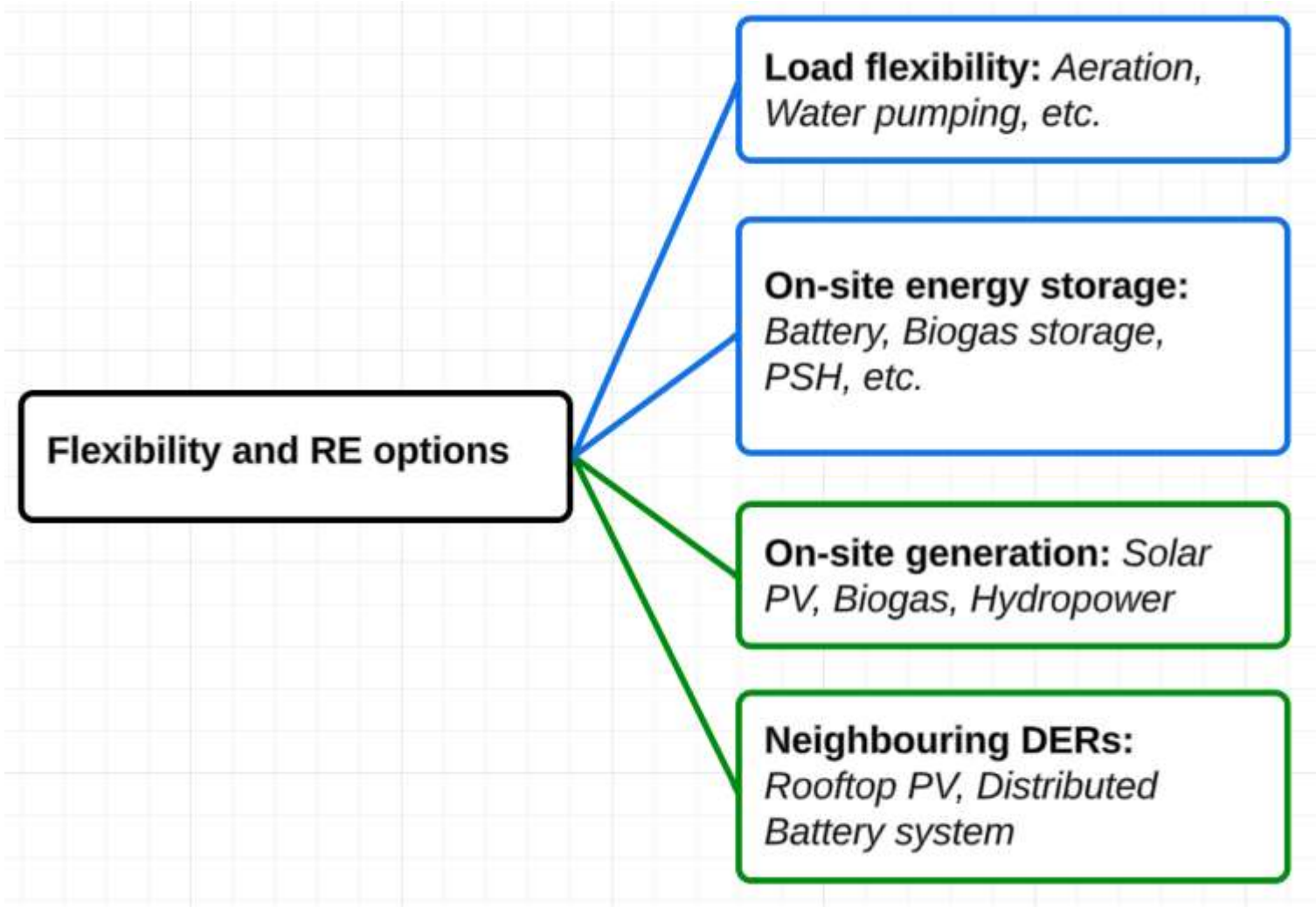
The potential of integrating renewable generation, storage and trading options

Decision-making of optimal energy strategies from both technical and economic perspectives

Demand response programs in Australia



Flexibility in water utilities



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RE and Load Management analyses matrix

Demand resposne options \ Flexibility and RE options		R0: Load flexibility On-site generation	R1: Load flexibility On-site generation On-site energy storage	R2: Load flexibility On-site generation Neighbouring DERs	R3: Load flexibility On-site generation Neighbouring DERs On-site energy storage
Price-based DR	Retailer contract (TOU)	TOU-R0	TOU-R1	TOU-R2	TOU-R3
	Spot market (RTP)	RTP-R0	RTP-R1	RTP-R2	RTP-R3
Incentive-based DR	NEM-FCAS demand response (FCAS)	FCAS-R0	FCAS-R1	FCAS-R2	FCAS-R3
	NEM-Wholesale demand response (NEM-W)	NEM-W-R0	NEM-W-R1	NEM-W-R2	NEM-W-R3
	Emergency demand response (RERT)	RERT-R0	RERT-R1	RERT-R2	RERT-R3

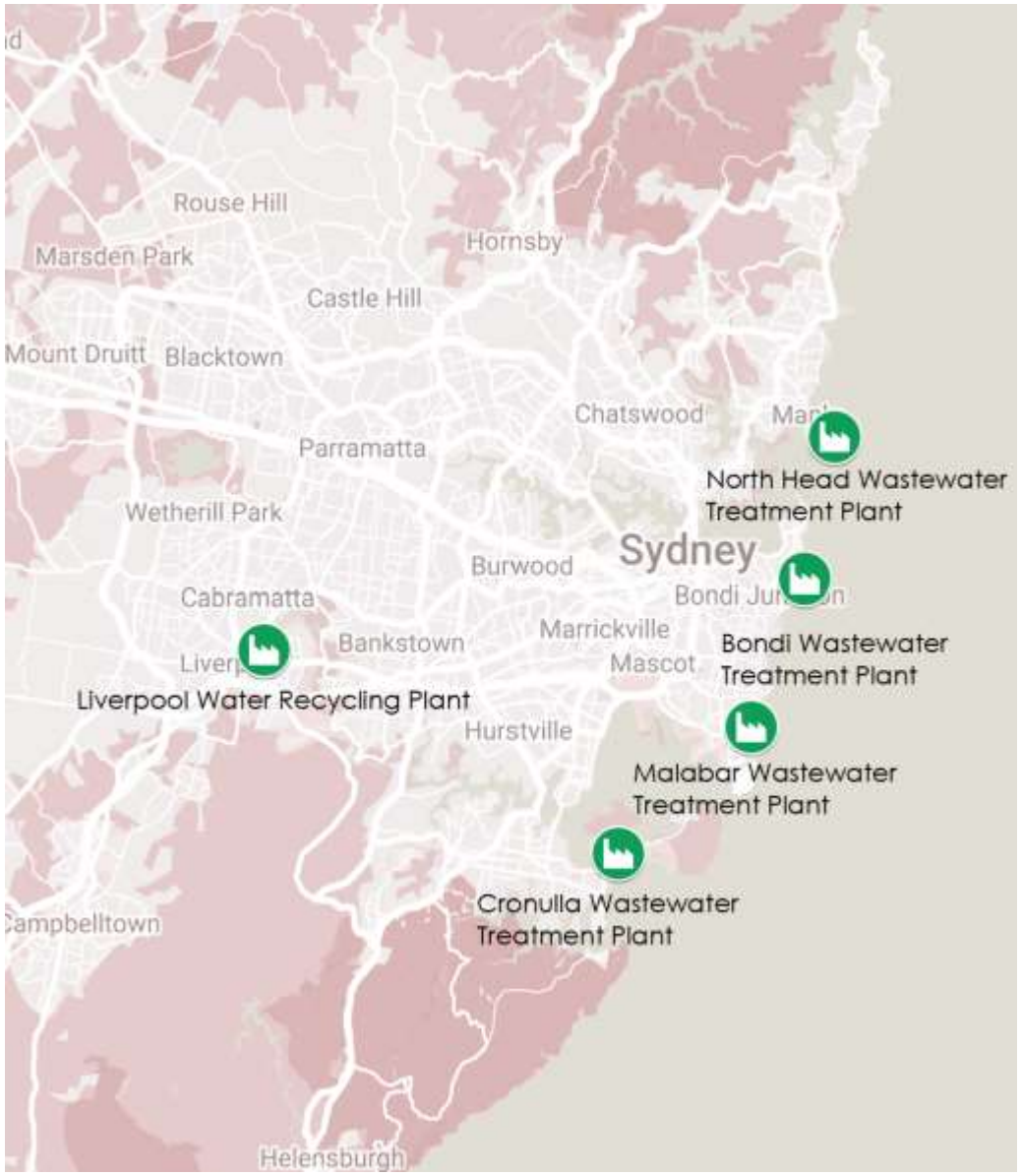
Modelling and optimization methods

Coliban Water Sites selection

Epsom WWTP	• 2 Bluefish Dr, Manly NSW 2095
Echuca WWTP	• Hugh Bamford Reserve, North Bondi NSW 2026
Kyneton WWTP	• 1 Fishermans Rd, Malabar NSW 2036
Rochester WWTP	• 380-420 Captain Cook Dr, Greenhills Beach NSW 2230

Sydney Water Sites selection

North Head WWTP	• 2 Bluefish Dr, Manly NSW 2095
Bondi WWTP	• Hugh Bamford Reserve, North Bondi NSW 2026
Malabar WWTP	• 1 Fishermans Rd, Malabar NSW 2036
Cronulla WWTP	• 380-420 Captain Cook Dr, Greenhills Beach NSW 2230
Liverpool WWTP	• 32-40 Scrivener St, Warwick Farm NSW 2170



Case study: Bendigo (Epsom) Water Reclamation Plant
DR + RE + P2P + BESS – Scenario R3

Renewable energy option:

- PV and battery proposed
- On-site PV: 250 KW
- Battery:
  - Capacity: 250 kWh
  - Max output: 125 KW

Existing load management plan:

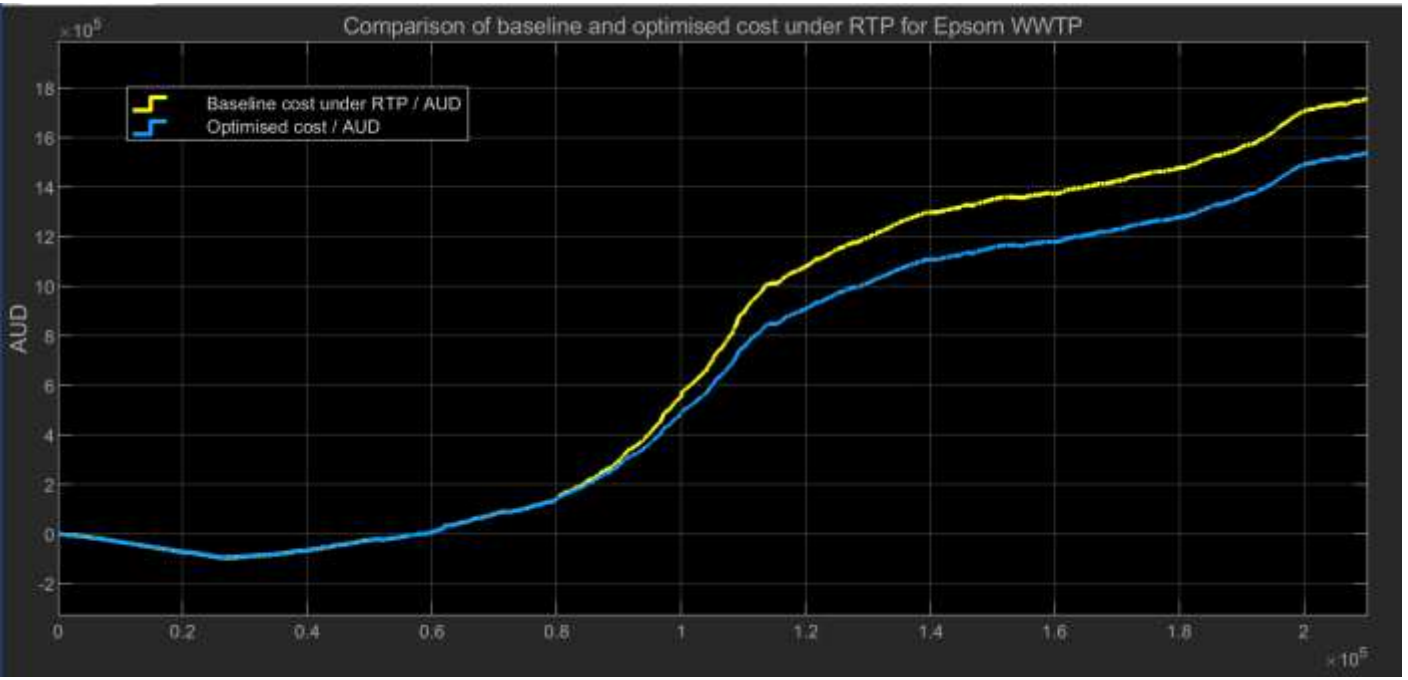
FCAS agreement in place for 700 KVA (switching off the aerators)

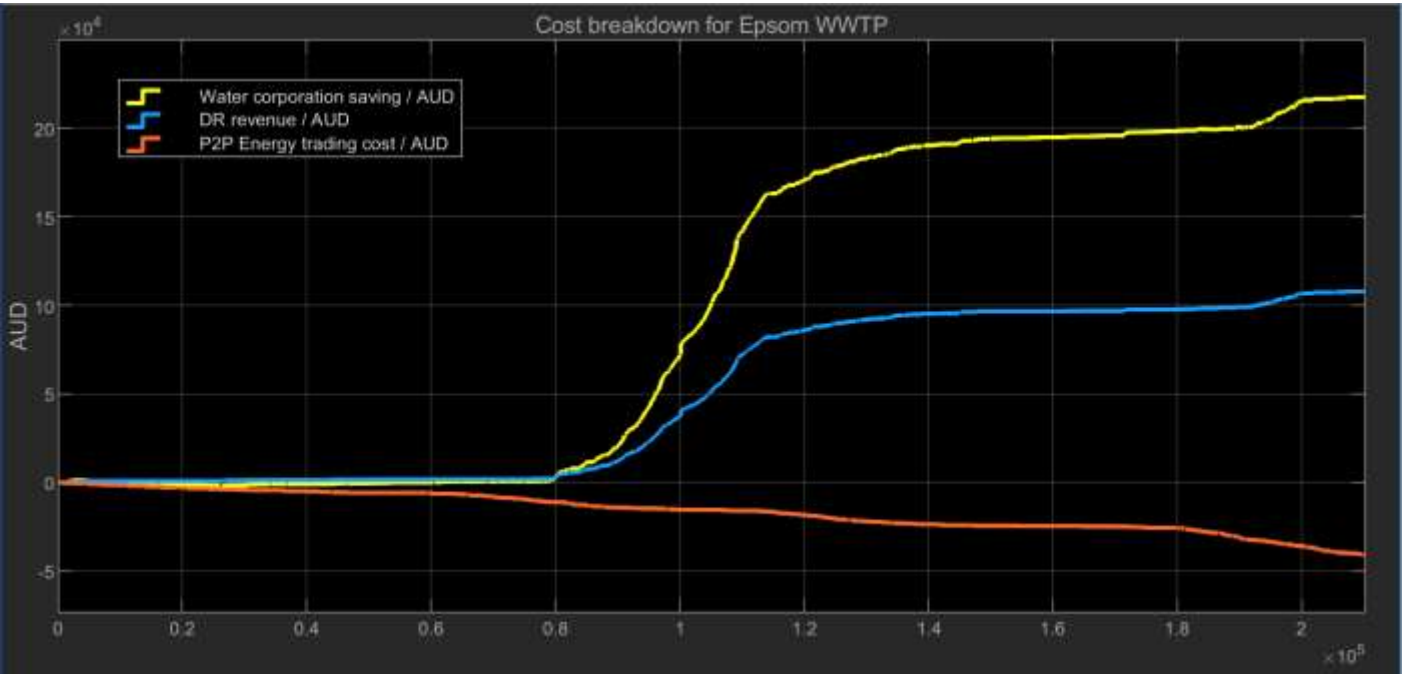
Consumption:

~ 1.2 MWh per hour

Proposed load management options:

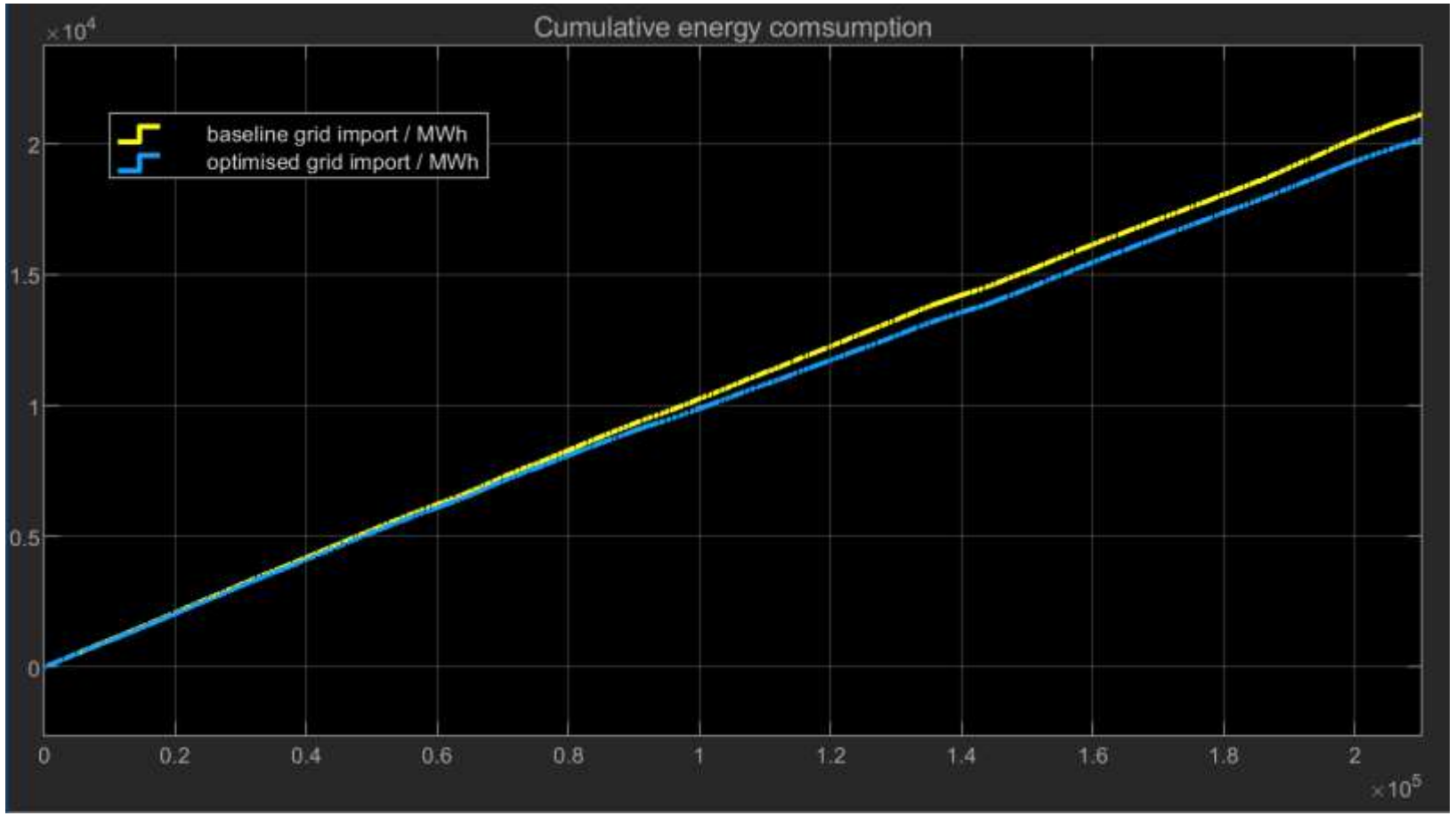
- Demand response
  - NEM: FCAS, WDR
  - Price-based DR: RTP (NEM spot market)
- P2P energy trading: 500 households with rooftop PV





Economic analysis

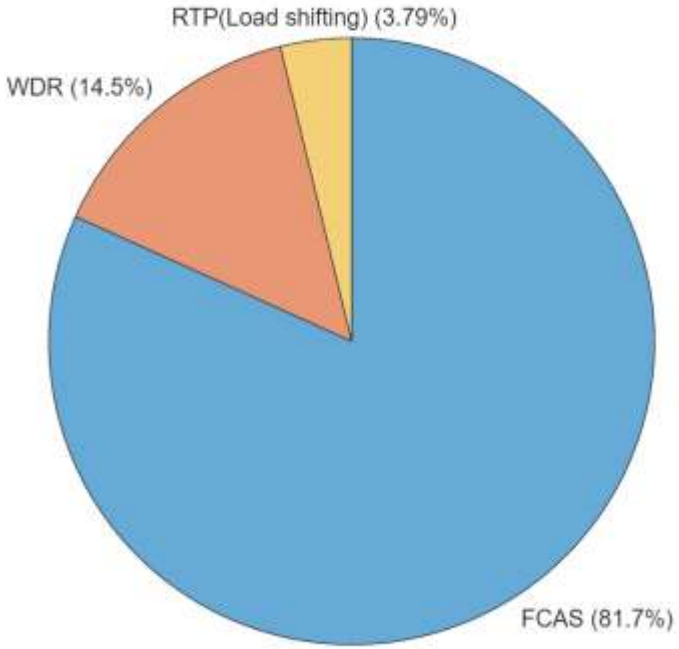
- **Base case**: On-site PV
- **Optimised case**: On-site PV + DR + P2P + BESS
- **Cumulative cost reduction**: AUD 115,000 / year
- The total energy expenses were reduced by **13 %**
- **IBDR revenue**: AUD 54,000 / year
- **P2P energy trading expenses**: AUD 20,000 / year
- **Community Savings**: 16,500 / year

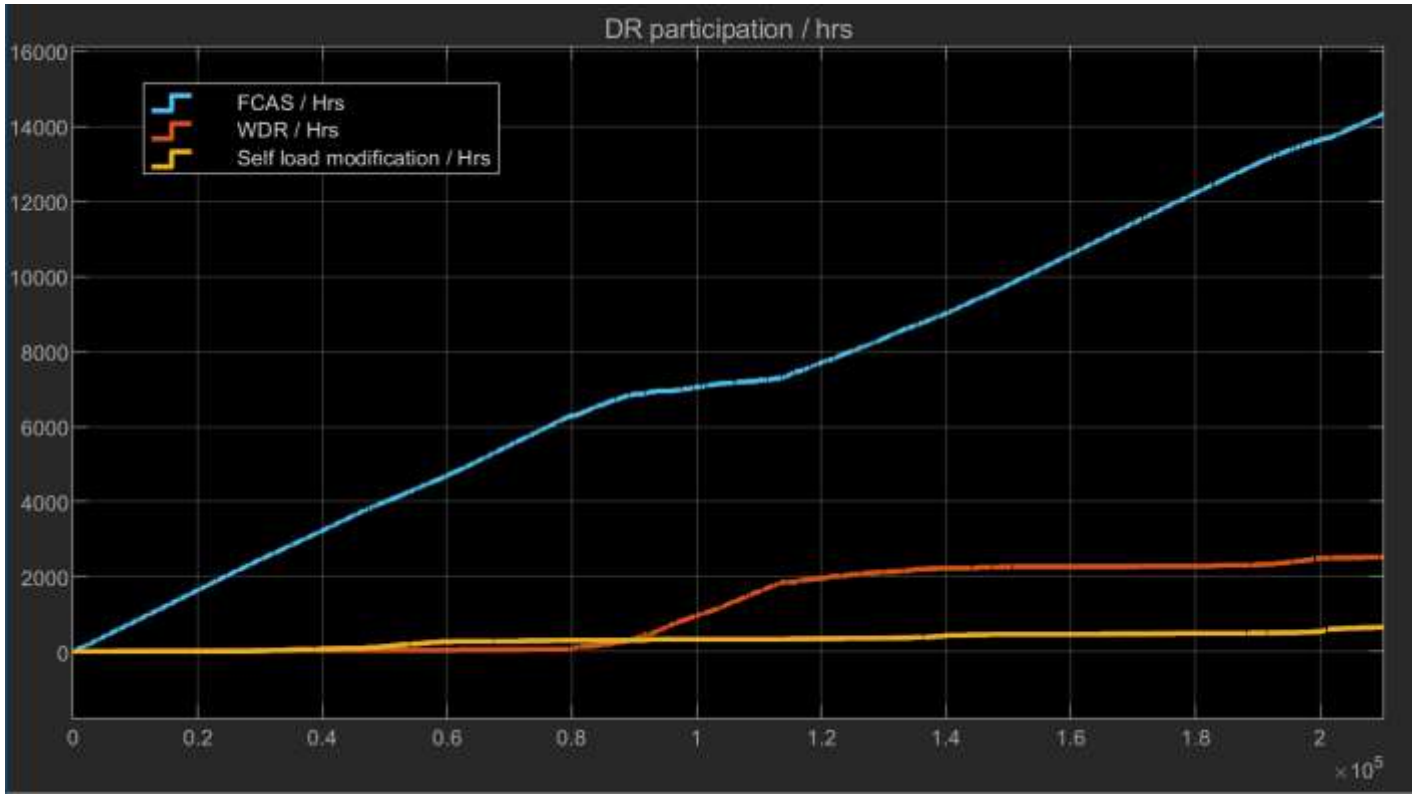


Grid Import

- **Reduction on grid import** : 500 MWh / year
- The total grid import was reduced by **5 %**

DR participation





Future work

Deploy training process with AWS Cloud Computing platform

Completing simulation and analysis for more case studies

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