Centre for Energy and Environmental Markets

UNSW SYDNEY

Tools for Community Sharing, Trading and Aggregation:

Community aggregation in Multi-Occupancy Residential Energy Networks

Mike Roberts

Anna Bruce, Iain MacGill

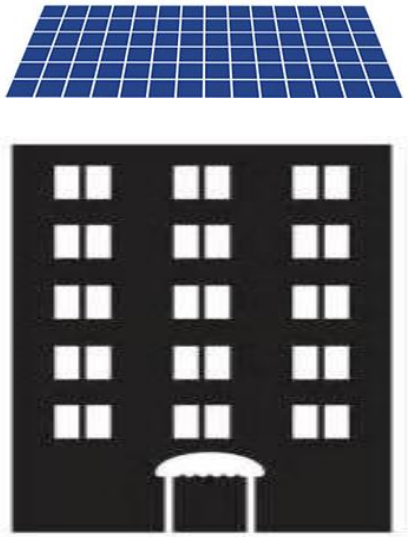
Open-source Python model developed for ECA 'Solar Apartments' Project

User-friendly Graphical User Interface under development for CRC-LCL Utilisation Project

ENERGY CONSUMERS AUSTRALIA

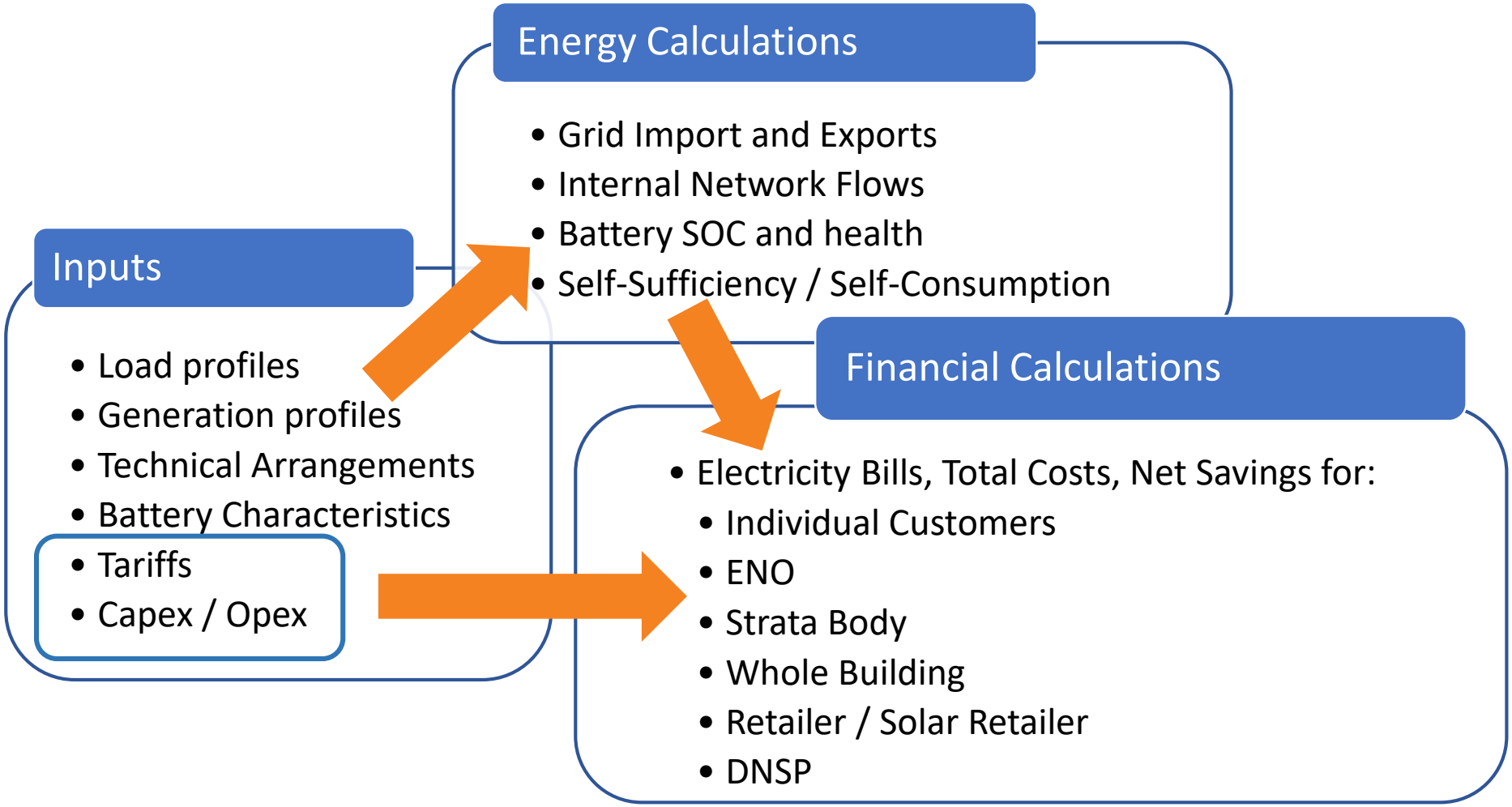
LOW CARBON LIVING CRC

Why model Solar Apartments?



- Big untapped PV opportunity
- Complexity of strata decision-making
- A need for clear, accurate information
- Multiple technical arrangements
- Multiple financial options
- High Variability and Building-Specificity:
  - Rooftop PV Capacity
  - Load profiles
  - Existing electrical infrastructure

Model Outline



Potential Users

Centre for Energy and Environmental Markets

UNSW SYDNEY

To inform customer decision making:

- Strata bodies – apartments / community title
- Advocacy / Advice agencies
- Local Councils
- Community Housing
- Energy Consultants

To assist planning:

- ENO's / ENM's
- Retailers

Model Inputs

Inputs (Load and Generation)

Centre for Energy and Environmental Markets

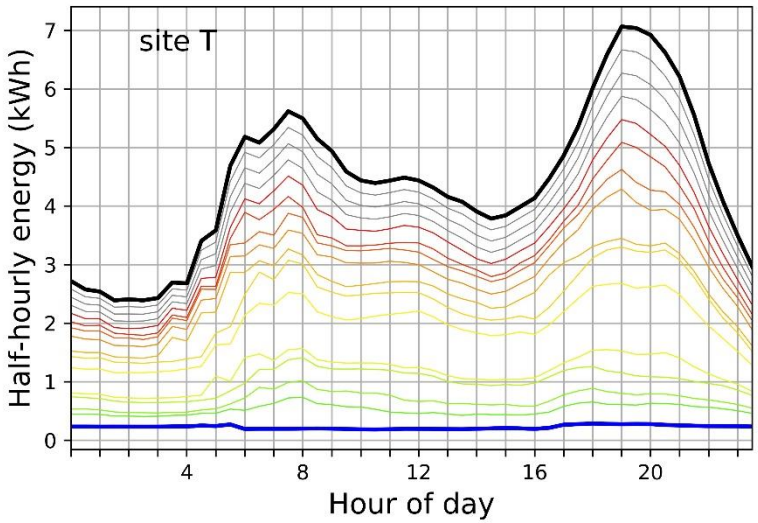
UNSW SYDNEY

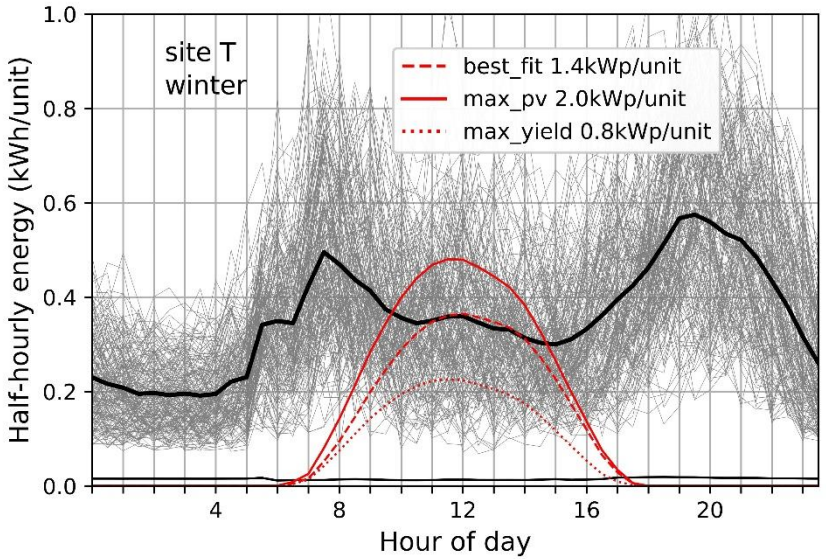
Annual **Load Profile** for the building:

- Half-hourly data
- Apartments and Common Property

Annual **PV Generation Profile**

- Half-hourly data
- Single Shared System
- Multiple Small Systems
- Scaleable profiles (x kWp)



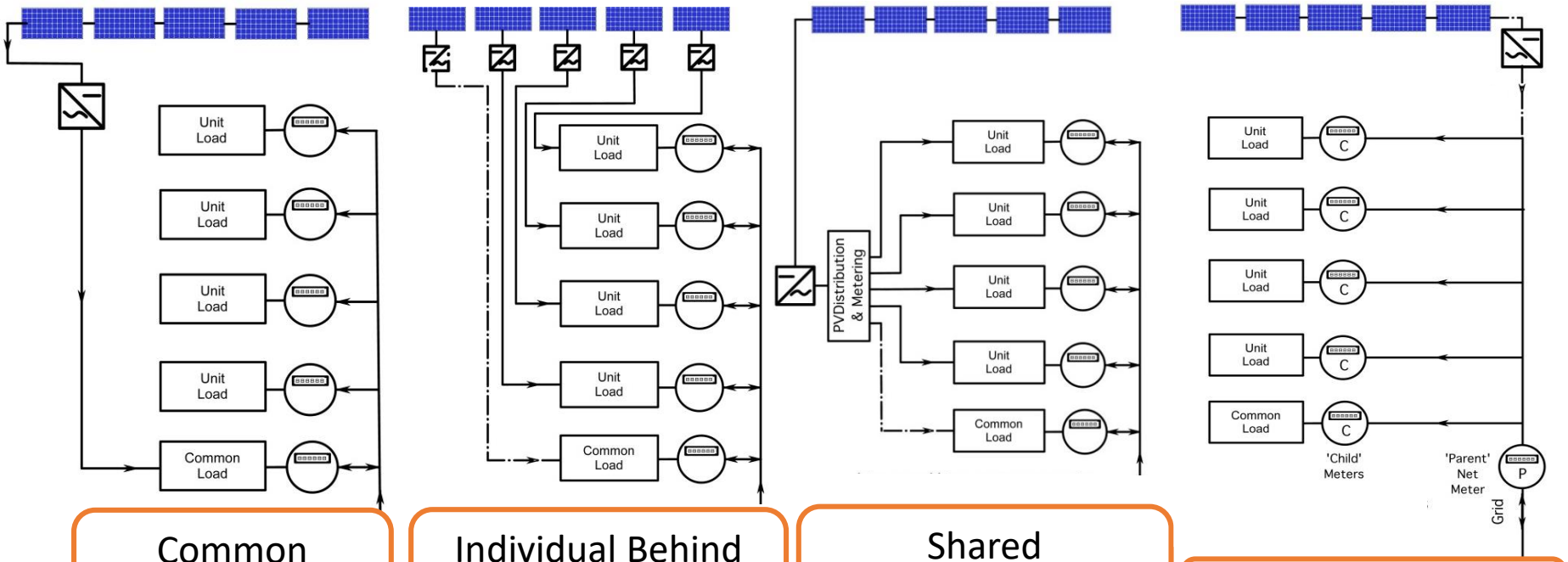


Single building profile or multiple buildings for stochastic analysis

PV Technical Arrangements

Centre for Energy and Environmental Markets

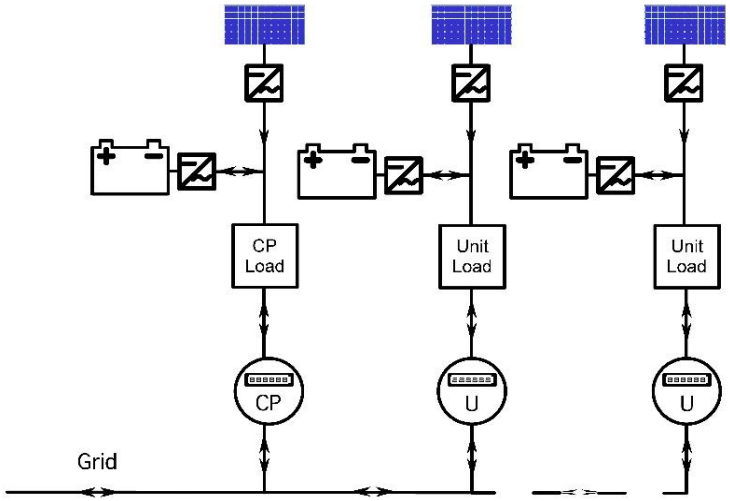
UNSW SYDNEY



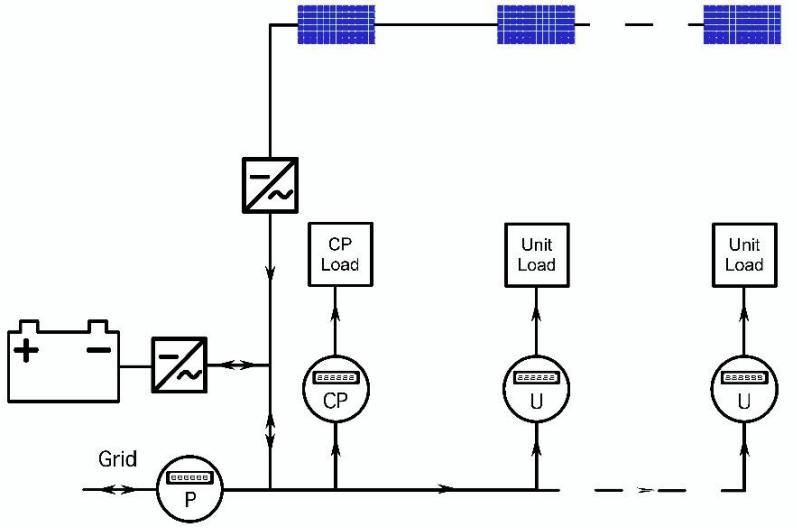
Common Property Only	Individual Behind the Meter	Shared Behind the Meter	Embedded Network
cp_only	btm_i	btm_s	en_pv

The model doesn't (currently) include peer to peer or off-site PV

Battery Technical Arrangements



Individual Batteries
(Behind the meter)



Central Battery
(in Embedded Network)

Inputs (Tariffs)

Centre for Energy and Environmental Markets

UNSW SYDNEY

Customer Residential Tariffs:
Single tariff for all customers
Individual tariff arrangements

Embedded network:
Commercial Parent Tariffs
(Network + Retail)

Internal EN Tariffs

Solar Tariffs (PPA)

Feed-In Tariffs:

Fixed Rate
Flat Rate
TOU
Block Rates
Demand Charge

Inputs (Capex / Opex / Finance)

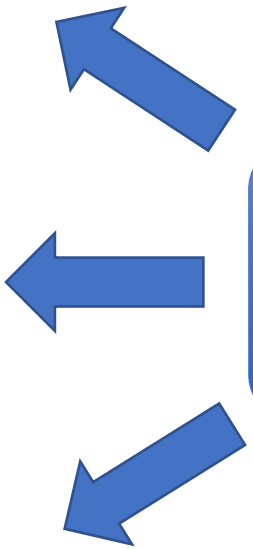
Centre for Energy and Environmental Markets

UNSW SYDNEY

PV CAPEX:
- System $
- Inverter $
- Inverter Lifetime

EN Capex / Opex:
- Capex $ / unit
- Capex $ / building
- Opex $ / unit

Battery Capex:
- Total System or $/kWh
- Inverter cost
- Battery Life (cycles / yrs)
- Inverter Life (years)



Financial Settings:
- Discount % Rate
- Amortization Term

Inputs (Batteries)

Centre for Energy and Environmental Markets

UNSW SYDNEY

Battery Characteristics:

- Capacity (kWh)
- Max Charge / Discharge Rate (kW)
- Max SOC
- Max DOD
- Lifetime

Control Strategies:

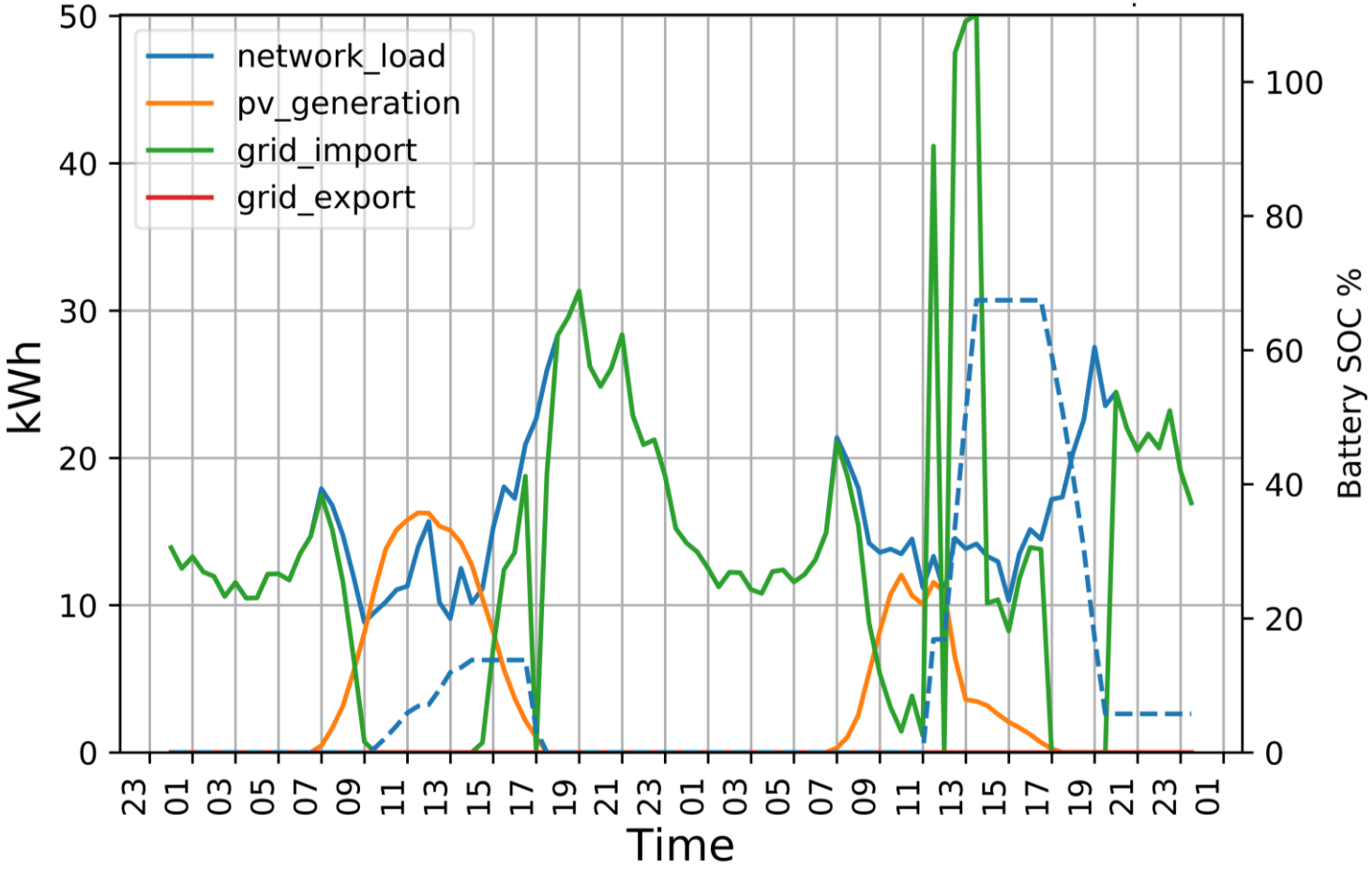
- PV charge / evening discharge
- Charge priority / evening discharge
- Single Cycle
- Double Cycle
- Peak Demand threshold

Model Outputs

Energy Outputs: Timeseries

Centre for Energy and Environmental Markets

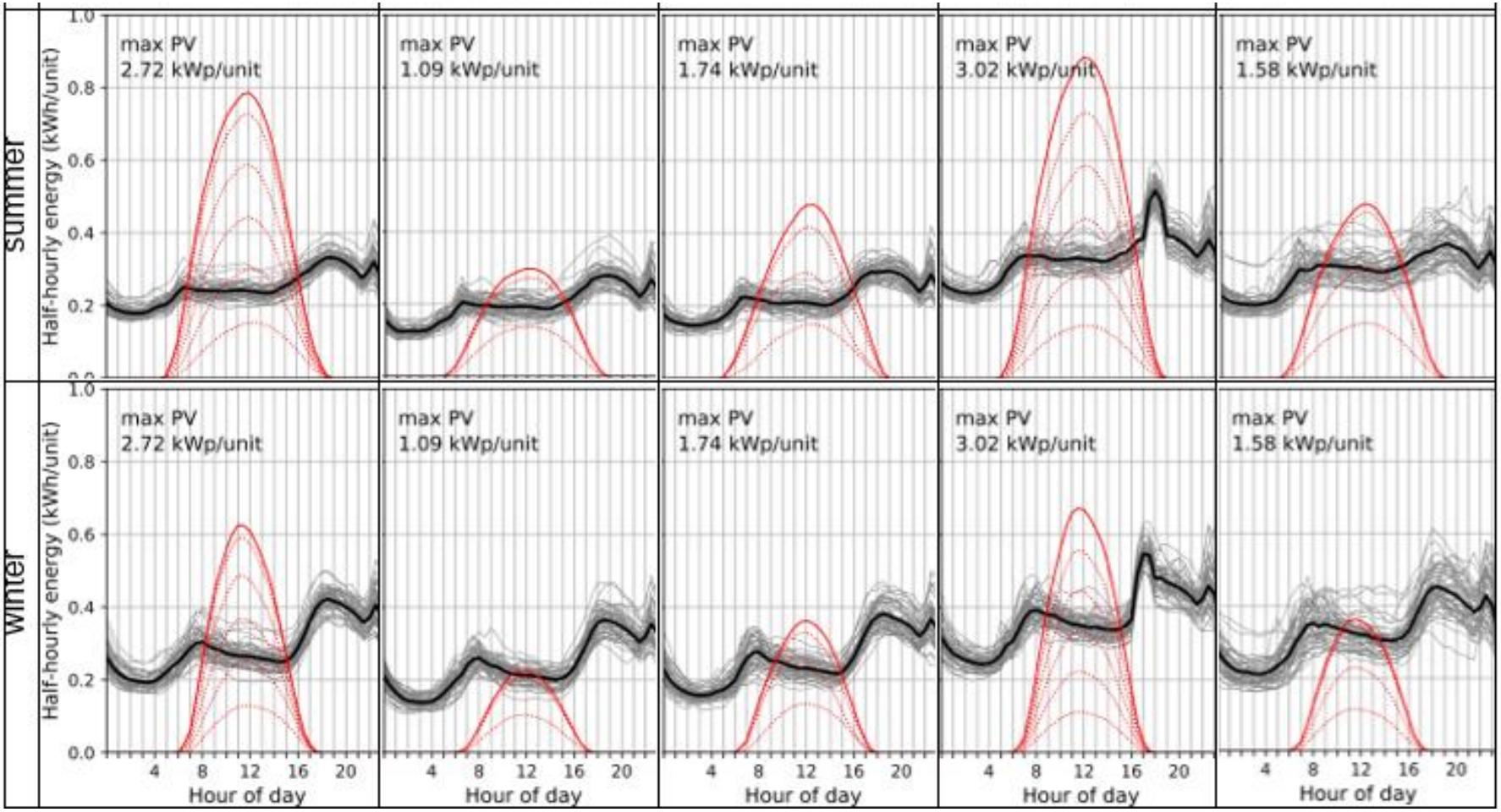
UNSW SYDNEY



Energy Outputs: Average Profiles

Centre for Energy and Environmental Markets

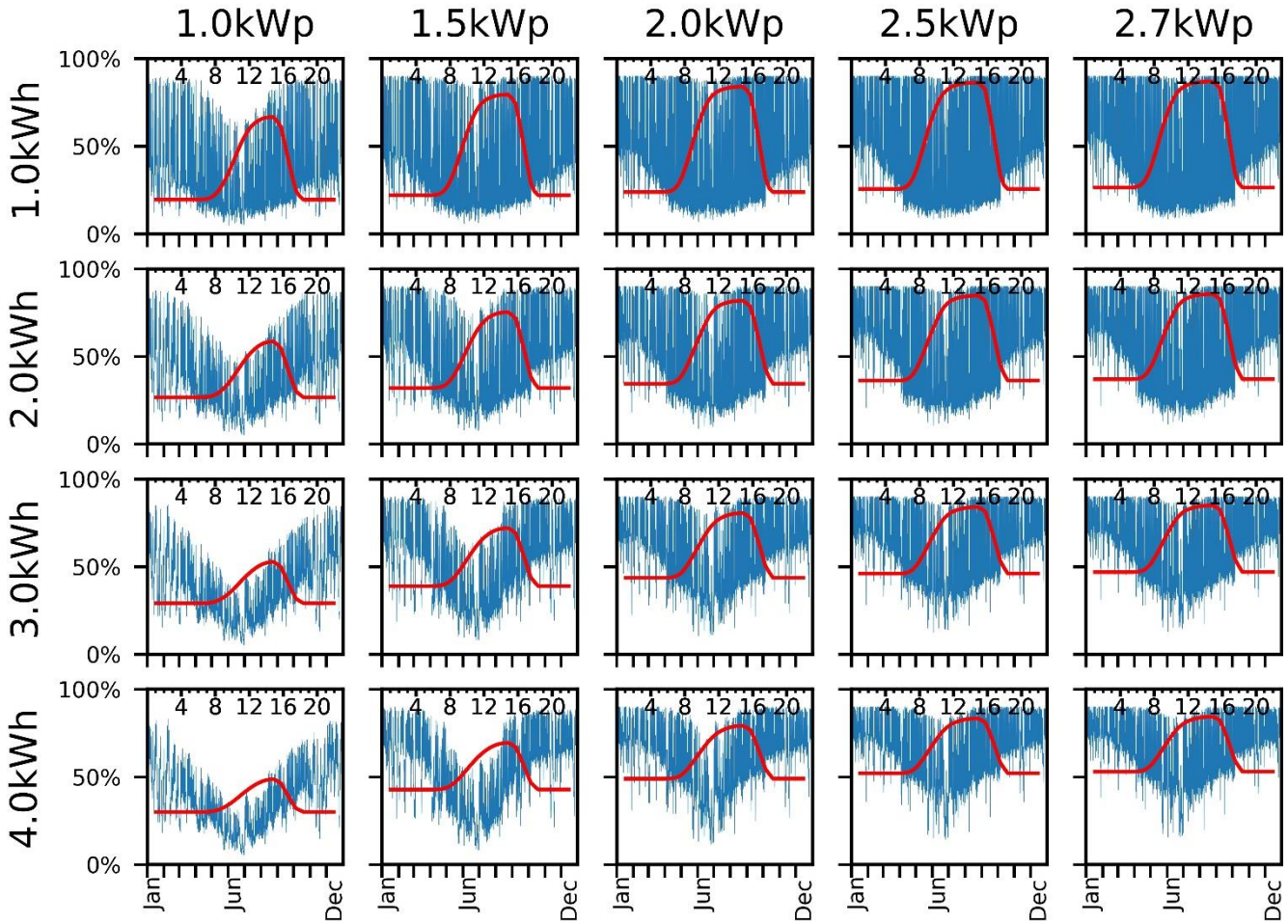
UNSW SYDNEY



Energy Outputs: Battery SOC

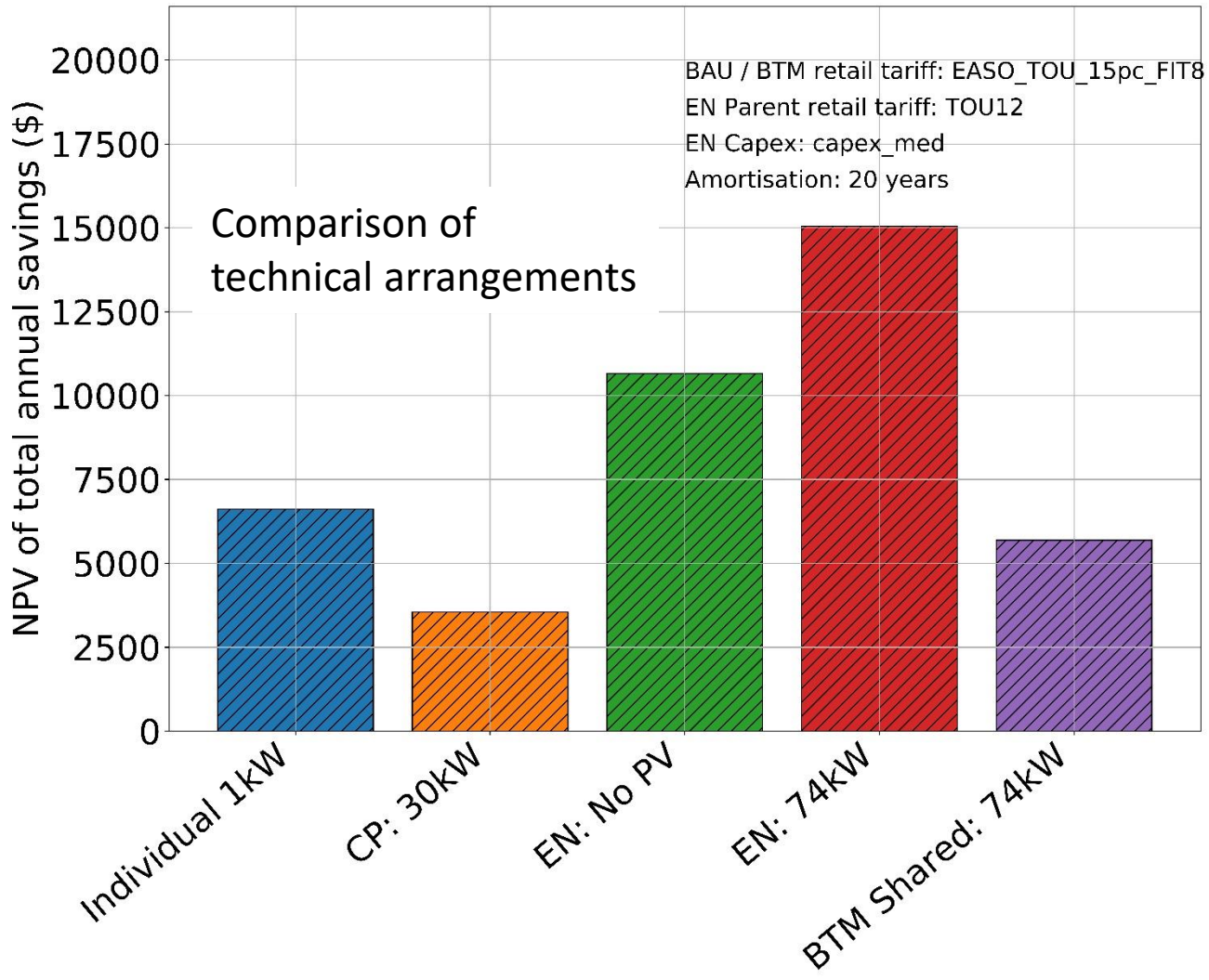
Centre for Energy and Environmental Markets

UNSW SYDNEY



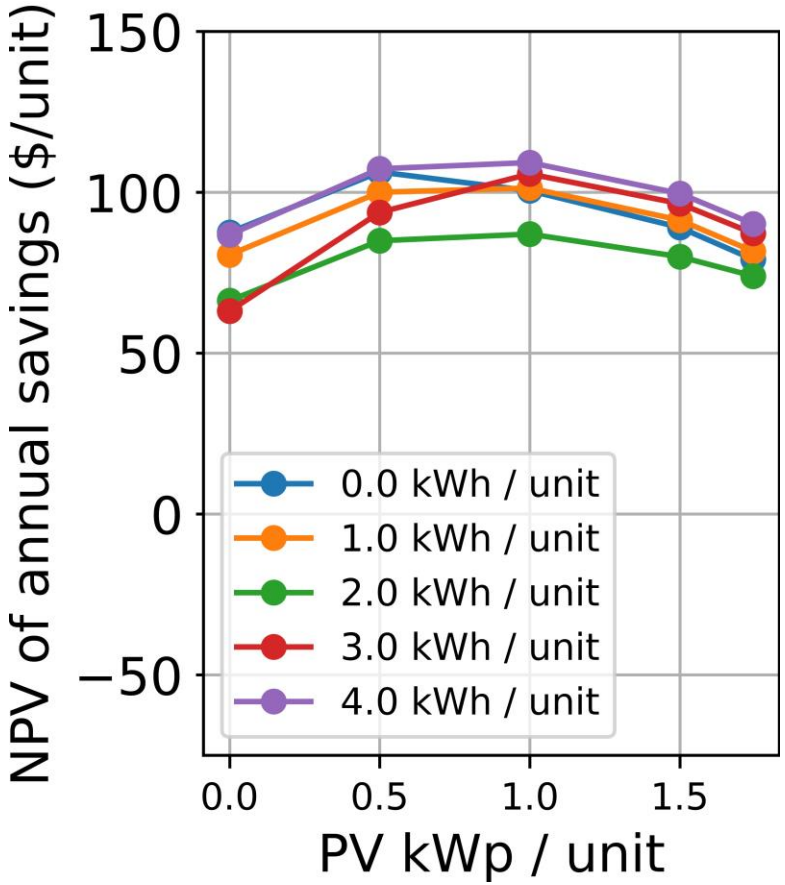
Average daily SOC (red) and annual SOC (blue) for central battery in EN

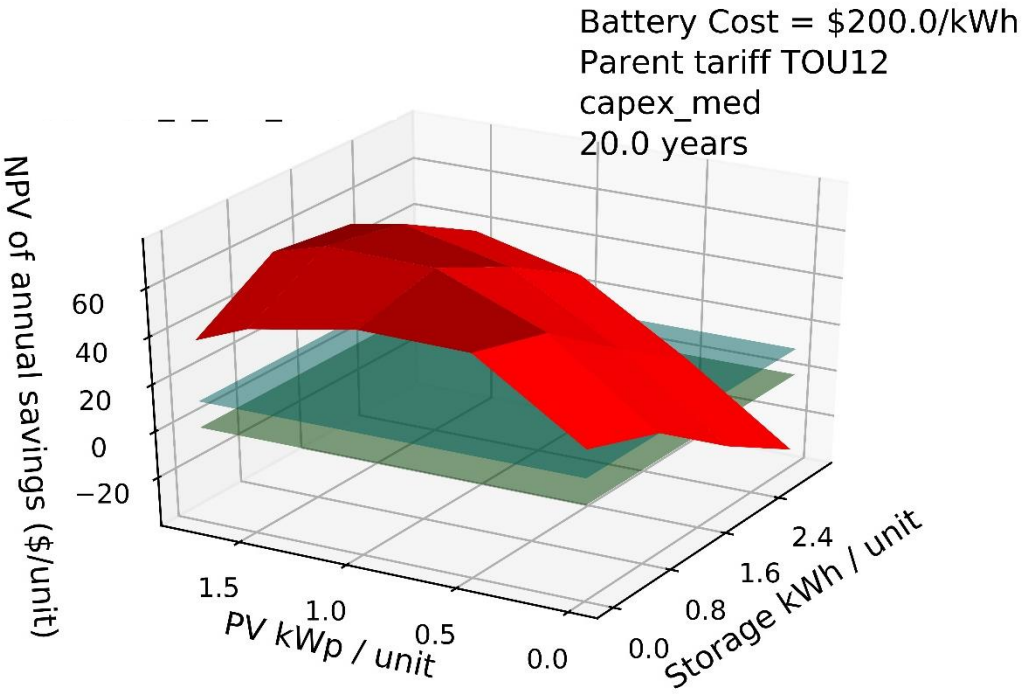
Financial Outputs: Outcomes for Whole Building



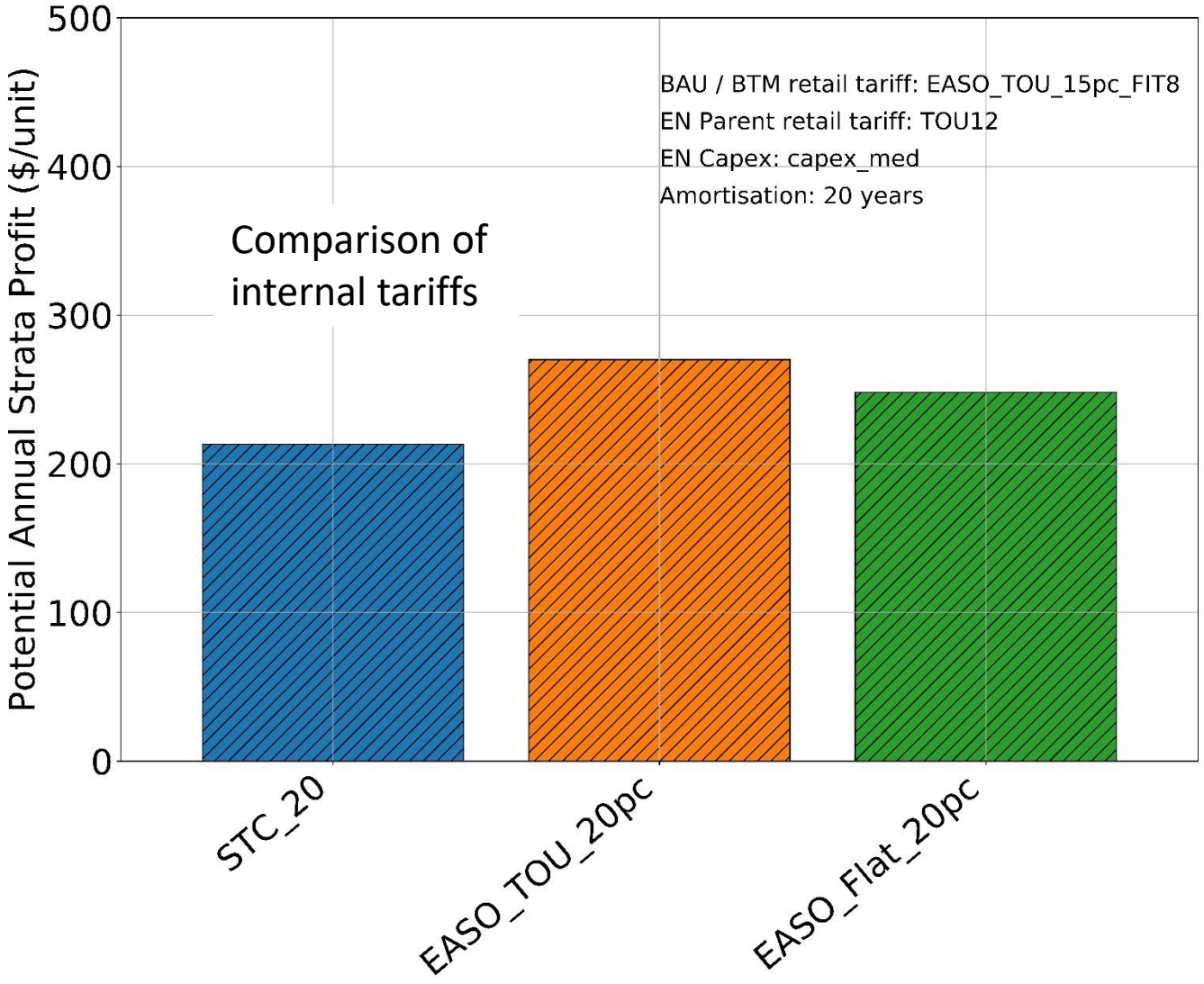
Financial Outputs: Outcomes for Whole Building

Technoeconomic Optimisation

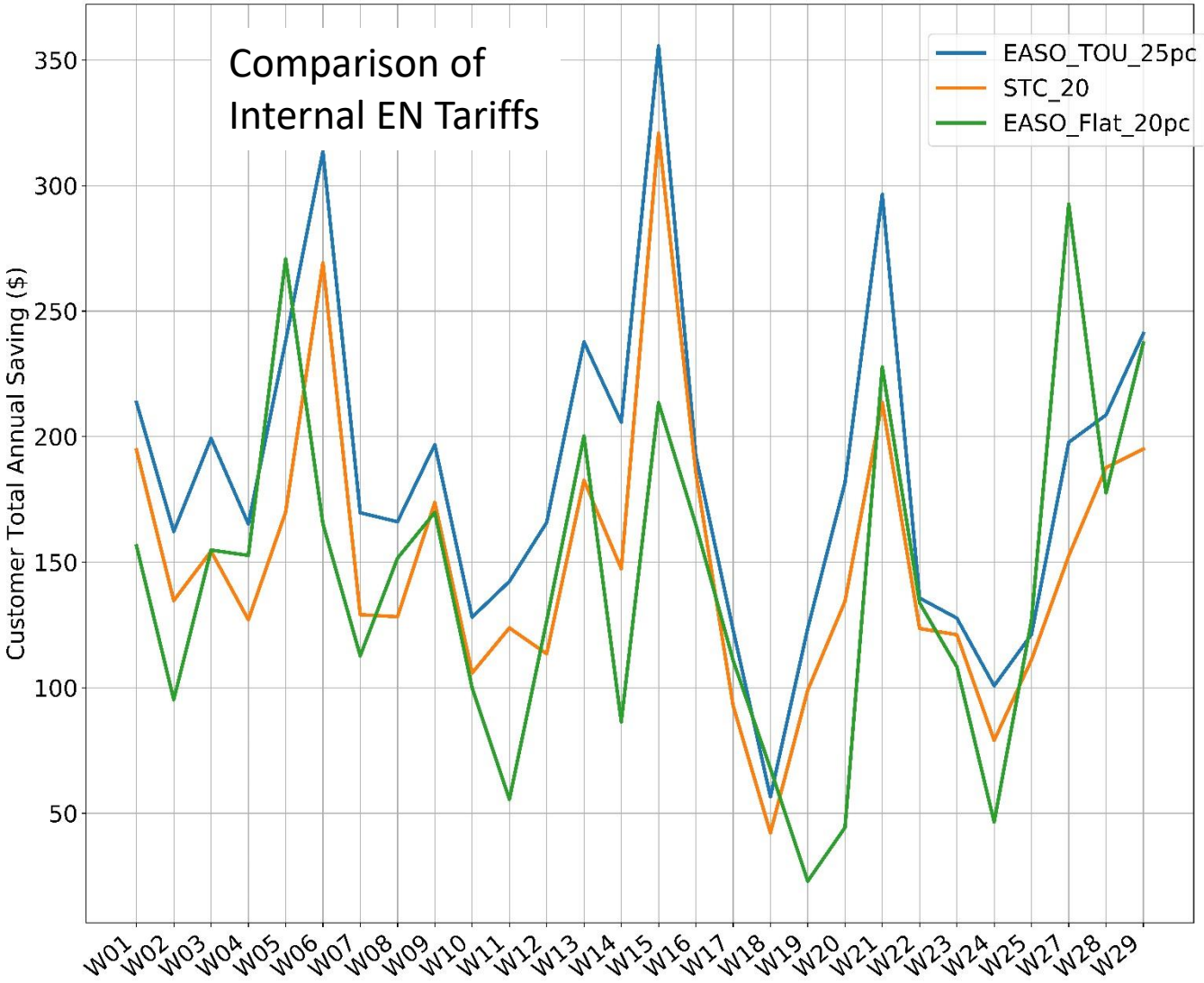




Financial Outputs: Outcomes for Strata / ENO



Financial Outputs: Outcomes for Customers

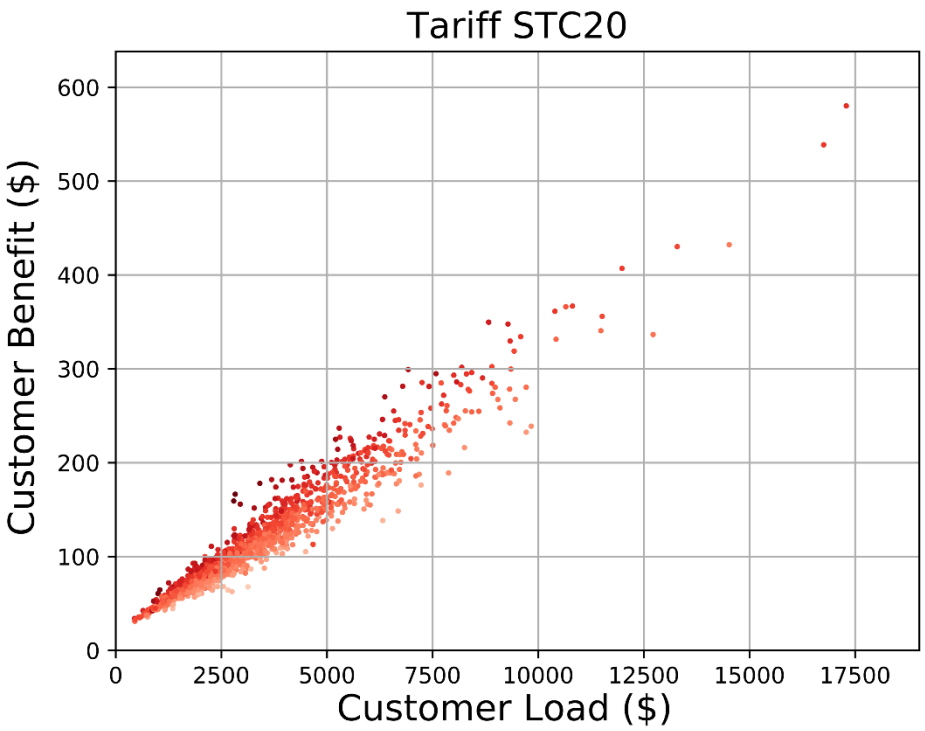


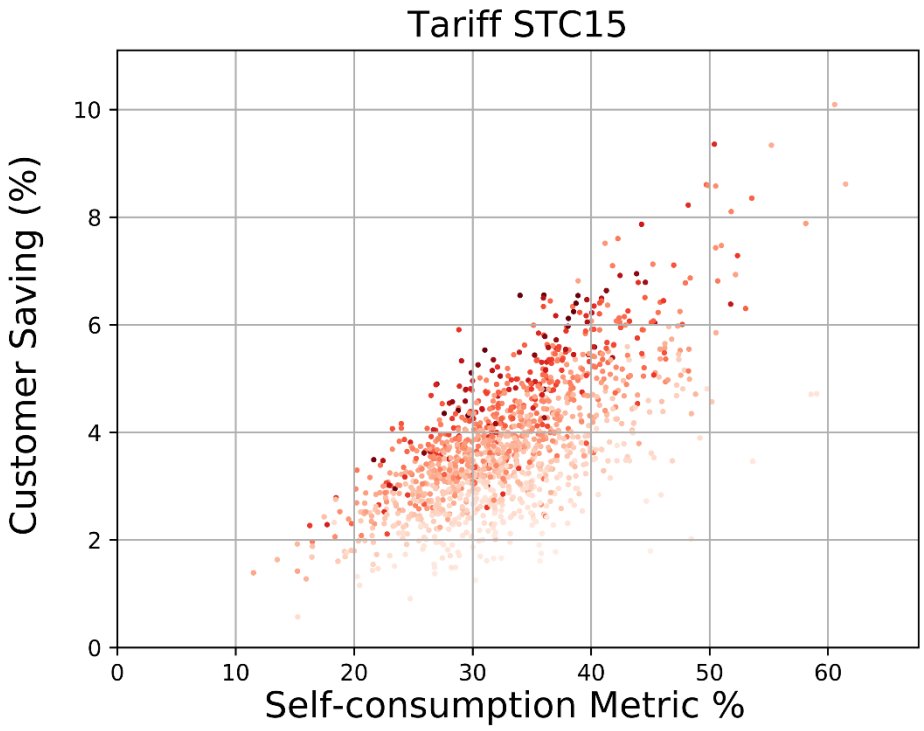
Output Charts: Customer Metrics

Centre for Energy and Environmental Markets

UNSW SYDNEY

Customer Analysis: Savings vs Self-Consumption or Energy Demand





Possible Extensions

Centre for Energy and Environmental Markets

UNSW SYDNEY

Improved Tariff Functionality:

- TOU FiTs
- Tariff-Tool Compatibility

Extend beyond apartment buildings:

- ‘Horizontal’ strata
- Microgrids

Combine shared and individual

- Central PV and BTM PV
- Central and BM Batteries

Combine on- and off-market customers

Questions & Suggestions ?