



Centre for Energy and
Environmental Markets



UNSW
SYDNEY

Tariff Design and Assessment Tool Workshop

3 Dec 2018, UNSW Sydney, Asia-Pacific Solar Research Conference (APSRC 2018)

Welcome from the SPREE/CEEM Distributed Energy Modelling and Analysis Team

Anna Bruce (a.bruce@unsw.edu.au)

Jose Bilbao (j.bilbao@unsw.edu.au)

Jessie Copper (j.copper@unsw.edu.au)

Nicholas Gorman (n.Gorman@unsw.edu.au)

Emi Gui (emi.gui@unsw.edu.au)

Navid Haghadi n.haghadi@unsw.edu.au

Iain MacGill (i.macgill@unsw.edu.au)

Luke Marshall (luke_marshall@unsw.edu.au)

Rob Passey (r.passey@unsw.edu.au)

Mike Roberts (m.roberts@unsw.edu.au)

Alistair Sproul (a.sproul@unsw.edu.au)

Naomi Stringer (n.stringer@unsw.edu.au)

Sharon Young (Sharon.young@unsw.edu.au)

Katelyn Purnell (k.purnell@unsw.edu.au)



www.ceem.unsw.edu.au

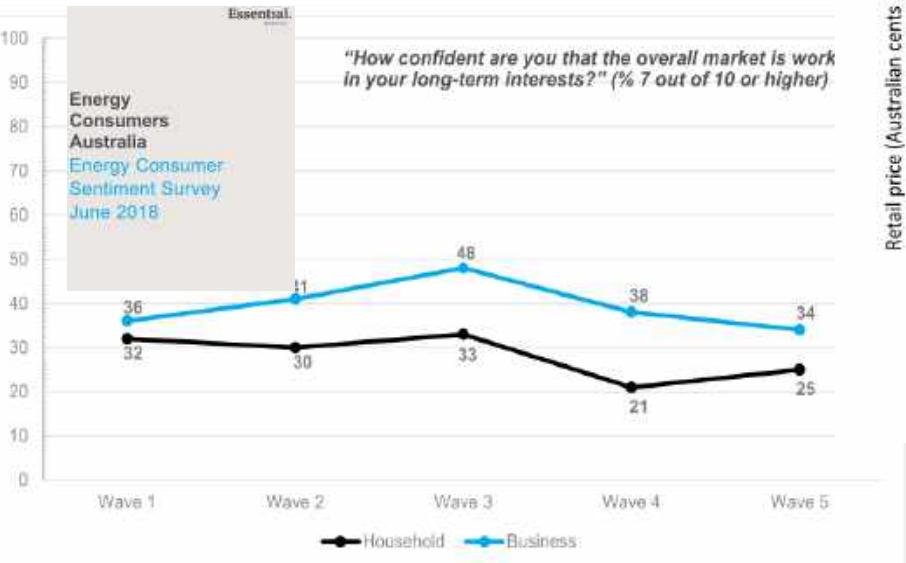
facebook.com/ceem.unsw/

twitter.com/ceem_unsw

linkedin.com/company/ceem.unsw/

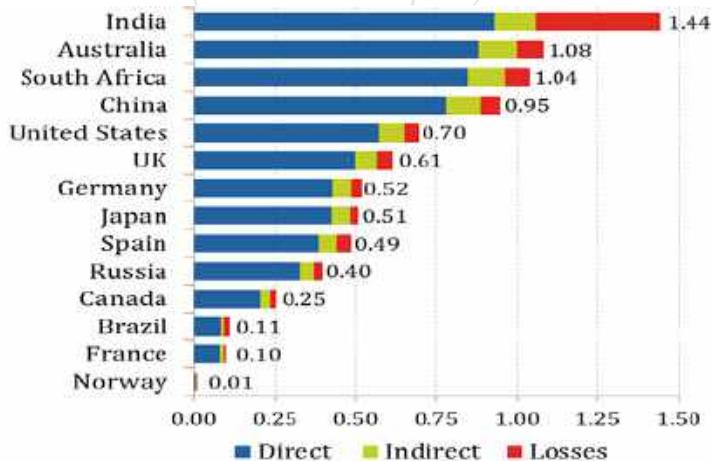
github.com/unsw-ceem

The challenge – our failure to serve the long-term interests of consumers



Electricity emissions intensity comparison

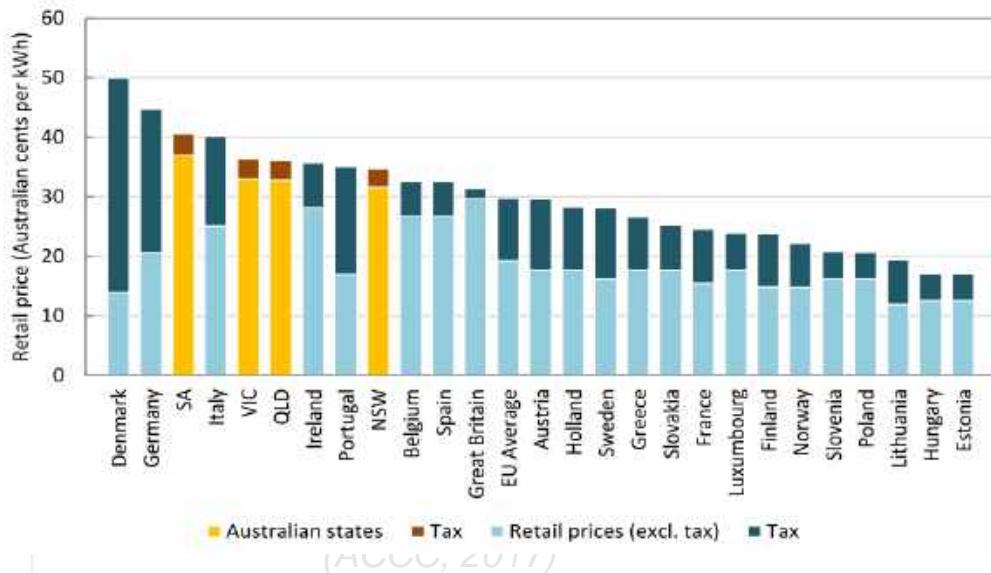
(shrink that footprint)



International retail electricity price comparison

(ACCC Retail Price Competition Inquiry, 2017)

Figure 1.9: Comparison of residential electricity prices (before and after tax) (Australian cents per kWh) (May 2017 prices in Australia, 2015 prices in European countries)⁶²



Australian residential energy prices index

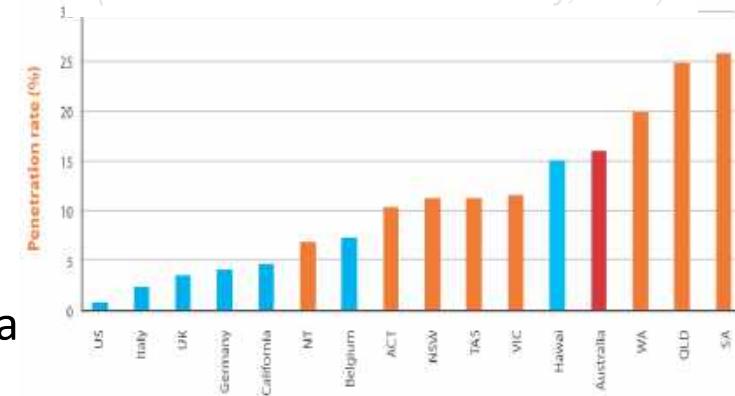
(Australian Energy Statistics Update 2017)



The opportunity - a greater role for energy-users in our energy future

- A growing appreciation of our diverse energy users and contexts
 - Citizens, consumers, customers.... now increasingly possible partners, competitors, communities, collectives
 - Contexts – housing types, vulnerable consumers...
- New opportunities for energy users to engage
 - PV, Storage, demand-side participation, energy efficiency
- Improving regulatory, market and policy efforts to appropriately facilitate end-user engagement enga
 - From assumptions of rational, utility maximising individual customers driven by prices... to a more complex appreciation of energy decision making, individual yet also collective goals and actions, and hence coordination, sharing
- *New ways to explore these challenges & opportunities; learn, disseminate and broaden the conversation*

Australia's residential PV penetration
(Finkel Review into NEM Security, 2017)



Open data, tools ... and processes

Energy scientists must show their workings

Public trust demands greater openness from those whose research is used to set policy, argues Stefan Plenninger.

The global momentum towards cleaner and sustainable energy futures is well under way. New figures from Europe this month show that the continent is on track to reach its goal of a 20% renewable-energy share by 2020, and renewable capacity in China and the United States is also rising. But many technical, political and economic uncertainties remain, particularly in the data and models used to underpin such policies. These uncertainties need open discussion, and yet energy managers all over the world are based on research output that is closed to the public.

Research is who sets, for example, the economic and social models used by governments and regulators. This is a bit like having a black box in your car's dashboard. One is welcome, but the Energy Information Administration, which is developing the model, pronounces: "Most people who have requested NEMS in the past have said that it is too difficult or rigid to use."

At least NEMS (National Energy Modelling System) is publicly available. Most assumptions, systems, models and data used to set energy policy are not. These black-box limitations cannot be verified, discussed or challenged. This is bad for citizens, bad for the public and spends tax-payer money. It is time to catch up with the times, update and open up our data sets. We energy researchers should make our computer programs and data freely accessible and academic publishing should demand it.

Our community's models are relevant to policy because they explore alternative scenarios or seek to understand the technical constraints in deploying new energy technologies. If modelling can't help, then it is time to change the rules. The European Union has mandated open access to electricity market data, resulting in the creation of the ENTSO-E Transparency Platform to hold it, and there are good arguments for the creation of national energy data agencies to coordinate the collection and archiving of a range of important data.

The vast majority of published research is still satisfied by these fledgling initiatives. Only one energy journal — *Energy Economics* — correctly requires data and models alongside submission. Other journals should follow suit.

The open sharing of code and data is also important because it

is in research that innovation is constituted in policies and



Openmod in a nutshell

The Open Energy Modelling (openmod) Initiative promotes open energy modeling in Europe.

Energy models are widely used for policy advice and research. They serve to help answer questions on energy policy, decarbonization, and transitions towards renewable energy sources. Currently, most energy models are black boxes – even to fellow researchers.

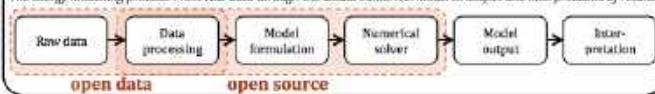
"Open" refers to model source code that can be studied, changed and improved as well as freely available energy system data.

We believe that more openness in energy modelling increases transparency and credibility, reduces wasteful double-work and improves overall quality. This allows the community to advance the research frontier and gain the highest benefit from energy modelling for society.

We, energy modellers from various institutions, want to promote the idea and practice of open energy modeling among fellow modellers, research institutions, funding bodies, and recipients of our work.

The idea of openmod

The energy modelling process: From raw data through the actual numerical model to output and interpretation of results



The screenshot shows the CEEM website with a banner image of solar panels. The navigation bar includes Home, About Us, Research, Open Source Tools, Publications, Events, and Contact us. The "Open Source Tools" page features a large image of solar panels and the title "Open Source Tools". Below the title, a paragraph discusses the value of open source modelling in the energy and environmental research space, mentioning a series of open source tools developed by CEEM researchers. A link to their GitHub page is provided.

CEEM's researchers believe in the value of open source modelling in the Energy and Environmental research space. In this regard, we have developed a series of open source tools which are listed below. For a list of some of our under development tools you can refer CEEM's Github page.

NEMOSIS - NEM Open Source Information Service:

Open-source access to Australian National Electricity Market data

Links: [Github](#)

NEMO - National Electricity Market Optimiser Tool:

NEMO, the National Electricity Market Optimiser, is a chronological dispatch model for testing and optimising different portfolios of conventional and renewable electricity generation technologies. It has been developed since 2011 and is maintained by Ben Elliston through his PhD at CEEM. NEMO is available under a free software license (GPL version 3) and requires no proprietary software to run, making it particularly accessible to the governments of developing countries, academic researchers and students. The model is available for others to inspect and to validate results.

Links: [Github](#), [OzLabs](#)

TDA - Tariff Design and Analysis Tool:

We have developed a modelling tool to assist stakeholders wishing to contribute to network tariff design in the Australian National Electricity Market. It is an open source modelling tool to assist stakeholders in assessing the implications of different possible network tariff designs, and hence facilitate broader engagement in the relevant rule making and regulatory processes in the NEM. Our tool takes public energy consumption data from over 5000 households in NSW, and allows users test a wide range of existing, proposed and possible tariffs structures to see their impacts on network revenue and household bills. Demographic survey data of the households allows you to explore the impacts of these tariffs on particular household types – for example, families with young children. The tool can also show how well different tariffs align these household bills with a households' contribution to network peak demand. The tool and data are open source – you can check, validate and add your own data sets; test existing or even design your own tariffs, and validate and even modify the underlying algorithms.

Links: [Project page](#), [Github](#), [Researchgate](#)

Local Solar Sharing Scheme Model:

Intended for modelling embedded networks, local solar and peer to peer electricity networks. This software was developed by Naomi Stringer, Luke Marshall and Rob Passey at CEEM. A working build with a simple user interface for OSX can be found [here](#).

Links: [Github](#)

NemLite - Open Source model of NEM Dispatch Engine:

Intended to replicate the performance of the National Electricity Market Dispatch Engine (NEMDE).

Links: [Github](#)



Centre for Energy and
Environmental Markets

The Day

Tariff Design and Assessment Tool: Progress and Next Steps

This project, funded by Energy Consumers Australia, builds on the earlier work in developing a tool that stakeholders can use to assess the impacts of different network tariff proposals on end-users. It will extend the functionality of the existing tool by incorporating retail tariffs, incorporating the impact of DER and DR, as well as a range of other enhancements. Navid will present the progress to date and seek feedback.

| | |
|---------------|---|
| 10 to 10:15am | Project intro: Tariff Design Challenges Iain MacGill |
| 10:15 to 11am | Tool Introduction and plans for new functionality Navid Haghdadi |
| 11 to 12pm | Stakeholder panel and Q&A |
| 12 - 12:15pm | Break |

PV on Apartment Buildings

This project, funded by Energy Consumers Australia, assesses the opportunities and challenges for PV deployment on apartments across Australia, and includes a comparative analysis of technical and financial arrangements and an exploration of the distribution of costs and benefits between owners and residents and between different households. Mike will present the findings from this project, discuss potential policy approaches and invite feedback to inform the focus of the final report.

| | |
|--------------|--|
| 12:15 to 1pm | Dissemination of Findings and policy options Mike Roberts |
| 1 to 1:15pm | Lunch Provided: Grab sandwiches and a cuppa |
| 1.15 to 2pm | Stakeholder panel and feedback (over sandwiches) |
| 2pm to 2:15 | Coffee break |

Tools for Community Sharing, Trading and Aggregation

Here we will showcase two new models that we have developed with funding from ECA and CRC for Low Carbon Living: one for embedded networks in apartment buildings and one for local network areas, including those owned by network operators. We are now developing a User Interface (UI) for both models to broaden accessibility to a range of different stakeholders. Both models will be demonstrated as will a proposed UI, and we are seeking feedback on the models and the UI.

| | |
|----------------|---|
| 2:15 to 2:45pm | Model for Community Trading in Local Network Areas Naomi Stringer |
| 2:45 to 3:15pm | Model for Community Aggregation in Embedded Networks Mike Roberts |
| 3:15 to 4:30pm | User Interface and Functionality Options and stakeholder feedback Luke Marshall |

Our collective task

- Updating you on progress
- Panel contributions from some key stakeholders
- Discussion
- Your ideas, guidance, comments and suggestions on how we can improve our analysis and tools and impact

Feedback Form: Tools for Community Sharing, Trading & Aggregation
You can also complete this questionnaire online at <https://www.surveymonkey.com/r/QDWZHGS>

Feedback Form: Tariff Design and Analysis tool

You can also complete this questionnaire online at <https://www.surveymonkey.com/r/J5H1H27Z>

Name (optional of course):

Your comments and suggestions, particularly on how we might extend and improve the tariff tool

New data or inputs?

New types of analyses?

New ways of visualizing or delivering the outputs?

Are you happy for us to follow up with you on this feedback? If yes, please provide contact details. Also please let us know if you would like to join the discussion web forum.

(feel free to add further thoughts over the page as well)

We greatly appreciate your feedback. Further suggestions and comments are always welcome.

You can provide these via surveymonkey or email us directly:

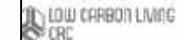
<https://www.surveymonkey.com/r/J5H1H27Z> n.haghbadi@unsw.edu.au

Also feel free to join the web discussion group at: <https://groups.google.com/forum/#!forum/ceem-tde>



ide contact
ng of the tool?

always welcome:
n.haghbadi@unsw.edu.au



Tariff Design and Assessment Tool: Progress and Next Steps



| PROJECT OVERVIEW | | | |
|--|------------------------|----------------|----------------|
| Grant no | AP_814 | Date of report | 11 / 01 / 2018 |
| Grant recipient | UNSW | | |
| Project title | Tariff Assessment Tool | | |
| PROJECT OUTCOMES: outline the project outcomes during the reporting period | | | |
| Describe the intended project outcome/s, and whether they were met. Where the outcomes were different from those proposed in the grant application, explain the reasons for the variation | | | |
| The research project aimed to provide tools and stakeholder engagement in order to build knowledge and capacity for effective evidence-based advocacy around network tariff design and regulation. | | | |
| An open source tool was developed with stakeholder input via the reference committee, at three workshops in Canberra, Sydney and Melbourne, and made available for free download via the CEEM website. | | | |
| Stakeholder engagement was established via the reference committee, the workshops and direct consultations with key stakeholders. Knowledge and capacity for stakeholders to engage in advocacy was built via: | | | |
| <ul style="list-style-type: none">- a series of presentations of industry perspectives and discussion around the challenges and opportunities of tariff design at the project workshops- demonstration and training around the tool at the workshops and during further focused training with key stakeholders- dissemination of peer reviewed research papers on tariff design and regulation using the tool as the basis for the analysis. | | | |

944 2017/18 UNSW

An expanded open source modelling tool for assessing how different network and retail tariffs, and distributed energy options, impact on small energy consumers

The proposed project would deliver on these three major extended capabilities as well as ongoing tool development in response to changing approaches to network tariff design.

- 10:15 – 11am Tool Introduction and plans for new functionality
Navid Haghadi

- 11:00 – 12pm Stakeholder Panel

Bob Telford, AER
Craig Chambers, ARENA

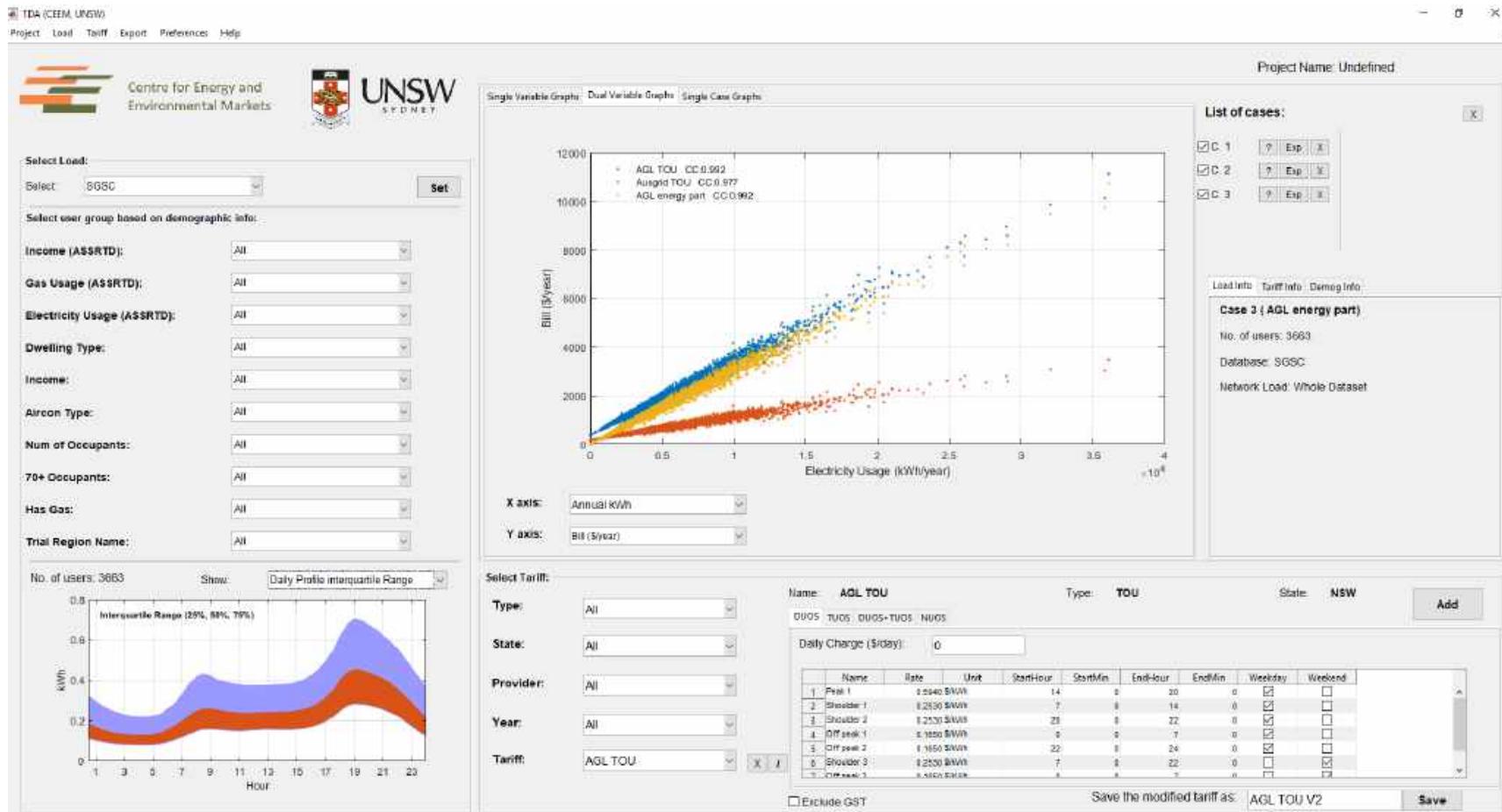
Q&A and Discussion

Agenda

- Introduction to the TDA tool
 - Aim
 - Quick tour
- Status report
 - Development
 - Moving to Python
 - Moving to API
 - Adding new functionalities
- Plans for improvement
 - Retail price and analysis
 - Distributed energy analysis
 - Demand response analysis
- Feedback and Questions

Tariff Design and Analysis tool

The open source TDA tool aims to assist stakeholders to investigate how different tariff structures impact on the expected bills of different types of residential consumers, while also estimating how well the tariffs align these customer bills with their impact on longer-term and wider electricity industry costs.



Tariff Design and Assessment (TDA) tool

Where to find it?

https://github.com/UNSW-CEEM/TDA_Matlab

<http://ceem.unsw.edu.au/open-source-tools>

<https://www.researchgate.net/project/Tariff-Design-and-Analysis-TDA-Tool>

Project

Tariff Design and Analysis (TDA) Tool

5 Novard Haghdasi · 5 Robert J Passey · 5 Anna Thrice · Show all 5 collaborators

Our Tariff Design and Analysis (TDA) tool is developed by Centre for Energy and Environmental Markets (CEEM), at the University of New South Wales with support from the Australian PV Institute (APV). This TDA project was supported by Energy Consumers Australia. The open [Show details](#)

Overview Project log References Questions Add research Add update

Project log

Build your reputation by sharing a project update

Add update

You added an update

Next TDA workshop

We are running a workshop to discuss recent progress and possible next steps of the tariff design and analysis tool. More information on this workshop and a number of other events organised by CEEM can be found here: <http://ceem.org.au/our-research-conferences/workshops/>

The workshop will be on Monday 3rd Dec 10am to 12pm at UNSW. It is free for everyone but requires registration. For more info check out the above link.

Comment Share 1 Recommendation · 0 Reads

← → ⌂ ⌂ ⌂ GitHub, Inc. [US] | https://github.com/UNSW-CEEM ⌂

Centre for Energy and Environmental Markets

Sydney Australia · http://ceem.unsw.edu.au/

Repositories 8 People 5 Teams 0 Projects 0 Settings

Find a repository... Type: All Language: All

TDA_Matlab

Electricity networks Tariff Design and Analysis (TDA) tool

Not secure | ceem.unsw.edu.au/open-source-tools

UNSW Centre for Energy and Environmental Markets

Home About Us Research Open Source Tools Publications Events

Open Source Tools

NEMOSIS - NEM Open Source Information Service: Open-source access to Australian National Electricity Market data. Links: GitHub

NEMO - National Electricity Market Optimiser Tool: NEMO, the National Electricity Market Optimiser, is a chronological dispatch model for testing and optimising different electricity generation technologies. It has been developed since 2011 and is maintained by Ben Elton through his free software license (GPL version 3) and requires no proprietary software to run, making it freely accessible to academic researchers and students. The model is available for others to inspect and to validate results. Links: GitHub, Details

TDA - Tariff Design and Analysis Tool: We have developed a modelling tool to assist stakeholders wishing to contribute to network tariff design in the Australian retail electricity market. The tool allows users to explore the implications of different possible network tariff designs on the NEM. Our interface allows users to explore the impacts of different possible network tariffs on household bills and allows users test a wide range of existing, proposed and possible tariffs themselves to see their impacts on Demographic survey data of the households allowing you to explore the impacts of those tariffs on particular household children. The tool can also show how well different tariffs align these household bills with a households' contribution data are open source – you can check, validate and add your own data sets test existing or even design your own underlying algorithms.



Tariff Design and Assessment (TDA) tool

How to install it?

https://github.com/UNSW-CEEM/TDA_Matlab/releases

The screenshot shows the GitHub release page for the 'TDA' release of the 'TDA Matlab' repository. The release is titled 'TDA' and was made by 'NavidHaghdadi' on 2 Aug. It contains 6 commits and has 279 MB of assets. The assets include four files: 'TDA_mac.zip', 'TDA_win.zip', 'Source code (zip)', and 'Source code (tar.gz)'. A note at the bottom of the release page instructs users to unzip the appropriate file (TDA_win for windows or TDA_mac for mac) and run the executable (TDA.exe for windows or TDA.app for mac).

UNSW-CEEM / TDA_Matlab

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Releases Tags Draft a new release

Latest release v1.0m · 2d8312c

TDA

NavidHaghdadi released this on 2 Aug · 6 commits to master since this release

Assets 4

- TDA_mac.zip
- TDA_win.zip
- Source code (zip)
- Source code (tar.gz)

Please first unzip the file (TDA_win for windows, or TDA_mac for mac) and run the TDA.exe (windows) or TDA.app (mac).

Tariff Design and Assessment (TDA) tool

How to find more information about it?

The tariff design and analysis tool is designed to assist stakeholders to investigate how different tariff structures impact on the expected bills of different types of residential consumers. The tool offers a range of different analysis and result visualisations as described in this section. In summary the tool allows users to:

- Create projects and add analysis to different projects for later referral
- Choose from the existing load profiles (more than 5000 annual household load profiles)
- Filter the load profiles based on the available demographic information
- Import new load profile and demographic information
- Visualise the individual and aggregate load profiles using multiple methods including seasonal pattern, peak analysis, annual energy distribution, daily interquartile range, etc
- Apply the network tariffs available in the tool (60+ tariffs for different Australian States) to calculate the annual bill based on any subset of the load profiles
- Apply the retail tariffs available in the tool
- Modify the parameters of the tariffs to investigate the impacts on annual bills
- Investigate different components of the network bill (DUOS, TUOS, and NUOS) to calculate the revenue for different sectors (distribution, transmission, etc). This can also be done for the retail component where retail tariffs are available
- Adjusting the network peak time to see the impact on the tariffs based on the coincident peak demand
- Create different types of new tariffs including, flat rate, time of use, block usage, demand charge, etc

+ Add a custom sidebar

Clone this wiki locally

<https://github.com/UNSW-CEE>

Tariff Design and Assessment (TDA) tool

What does the previous version do?

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: SGSC

Select user group based on demographic info:

Income (ASSRTD): All

Gas Usage (ASSRTD): All

Electricity Usage (ASSRTD): All

Dwelling Type: All

Income: All

Aircon Type: All

Num of Occupants: All

70+ Occupants: All

Has Gas: All

Trial Region Name: All

No. of users: 3663 Show Daily Profile interquartile Range

Hourly electricity usage distribution plot showing Intersquare Range (25%, 50%, 75%) over 24 hours.

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Bill (\$/year)

Electricity Usage (kWh/year)

AGL TOU CC 0.992

Ausgrid TOU CC 0.977

AGL energy part CC 0.992

X axis: Annual kWh

Y axis: Bill (\$/year)

List of cases:

C. 1 C. 2 C. 3

Load Info Tariff Info Demog Info

Case 3 (AGL energy part)

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Select Tariff:

Name: AGL TOU Type: TOU State: NSW Add

DUOS TUOS DUOS-TUOS NUOS

Daily Charge (\$/day): 0

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU

Table: Name Rate Unit StartHour StartMin EndHour EndMin Weekday Weekend

1 Peak 1 \$0.40/kWh 14 0 20 0

2 Shoulder 1 \$0.30/kWh 7 0 14 0

3 Shoulder 2 \$0.20/kWh 21 0 22 0

4 Off peak 1 \$0.10/kWh 0 0 7 0

5 Off peak 2 \$0.10/kWh 22 0 24 0

6 Shoulder 3 \$0.20/kWh 7 0 22 0

7 Critical 1 \$0.40/kWh 0 0 7 0

Exclude GST Save the modified tariff as: AGL TOU V2 Save



Tariff Design and Assessment (TDA) tool

Select load from a range of existing load profiles, or upload your own set of loads!

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: SGSC Set

Select user group based on demographic info:

Income (ASSRTD): All

Gas Usage (ASSRTD): All

Electricity Usage (ASSRTD): All

Dwelling Type: All

Income: All

Aircon Type: All

Num of Occupants: All

70+ Occupants: All

Has Gas: All

Trial Region Name: All

No. of users: 3663 Show Daily Profile interquartile Range

Hourly load profile showing Intersquare Range (25%, 50%, 75%) over 24 hours.

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Bill (\$/year)

Electricity Usage (kWh/year)

AGL TOU CC 0.992
Ausgrid TOU CC 0.977
AGL energy part CC 0.992

X axis: Annual kWh Y axis: Bill (\$/year)

List of cases:

C. 1 C. 2 C. 3

Load Info Tariff Info Demog Info

Case 3 (AGL energy part)

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Select Tariff:

Name: AGL TOU Type: TOU State: NSW Add

DUOS TUOS DUOS-TUOS NUOS

Daily Charge (\$/day): 0

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU X I

Name Rate Unit StartHour StartMin EndHour EndMin Weekday Weekend

1 Peak 1 0.540 kWh 14 0 20 0

2 Shoulder 1 0.290 kWh 7 0 14 0

3 Shoulder 2 0.250 kWh 21 0 22 0

4 Off peak 1 0.160 kWh 0 0 7 0

5 Off peak 2 0.160 kWh 22 0 24 0

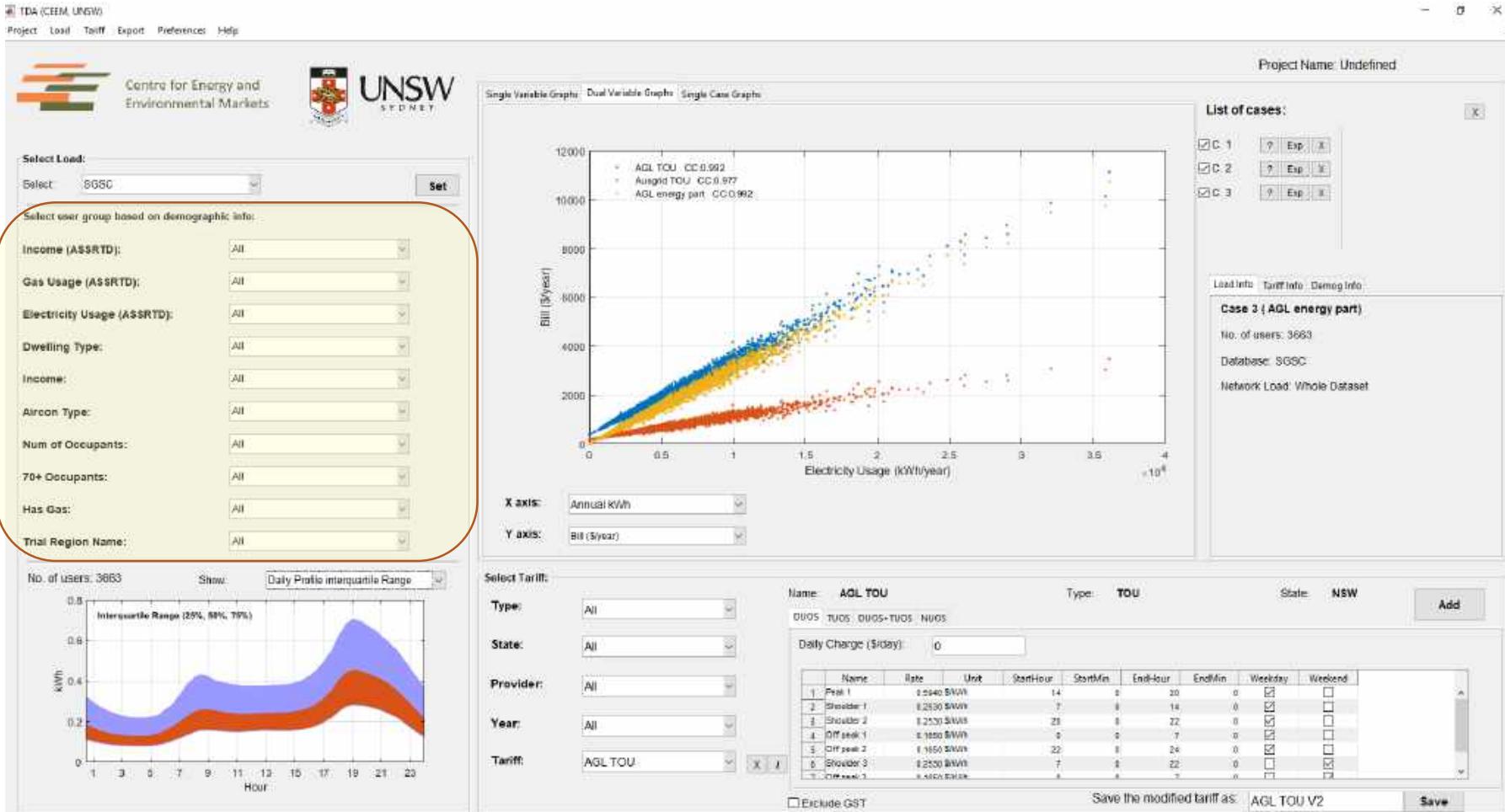
6 Shoulder 3 0.250 kWh 7 0 22 0

7 Critical 1 0.400 kWh 0 0 7 0

Exclude GST Save the modified tariff as: AGL TOU V2 Save

Tariff Design and Assessment (TDA) tool

Filter the load profiles by the demographic information



Tariff Design and Assessment (TDA) tool

Get quick analysis of the set of selected loads

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

Select Load: SGSC

Select user group based on demographic info:

Income (ASSRTD): All

Gas Usage (ASSRTD): All

Electricity Usage (ASSRTD): All

Dwelling Type: All

Income: All

Aircon Type: All

Num of Occupants: All

70+ Occupants: All

Has Gas: All

Trial Region Name: All

No. of users: 3663 Show Daily Profile interquartile Range

Interquartile Range (25%, 50%, 75%)

KWh

Hour

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Bill (\$/year)

Electricity Usage (kWh/year)

Bill (\$/year)

Case 3 (AGL energy part)

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

List of cases:

C. 1 C. 2 C. 3

Load Info Tariff Info Demog Info

Name: AGL TOU Type: TOU State: NSW

DUOS TUOS DUOS-TUOS NUOS

Daily Charge (\$/day): 0

Name Rate Unit StartHour StartMin EndHour EndMin Weekday Weekend

| | | | | | | | | | |
|---|------------|--------|-------|----|---|----|---|-------------------------------------|-------------------------------------|
| 1 | Peak 1 | 0.2540 | S/kWh | 14 | 0 | 20 | 0 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2 | Shoulder 1 | 0.2390 | S/kWh | 7 | 0 | 14 | 0 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3 | Shoulder 2 | 0.2530 | S/kWh | 21 | 0 | 22 | 0 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 4 | Off peak 1 | 0.1650 | S/kWh | 0 | 0 | 7 | 0 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 5 | Off peak 2 | 0.1650 | S/kWh | 22 | 0 | 24 | 0 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 6 | Shoulder 3 | 0.2550 | S/kWh | 7 | 0 | 22 | 0 | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 7 | Off peak 3 | 0.1650 | S/kWh | 0 | 0 | 7 | 0 | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Exclude GST Save the modified tariff as: AGL TOU V2 Save



Tariff Design and Assessment (TDA) tool

Add a network tariff (and some limited retail tariffs) and optionally change any parameters

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets

UNSW SYDNEY

Project Name: Undefined

Select Load:

Select SGSC Set

Select user group based on demographic info:

Income (ASSRTD): All

Gas Usage (ASSRTD): All

Electricity Usage (ASSRTD): All

Dwelling Type: All

Income: All

Aircon Type: All

Num of Occupants: All

70+ Occupants: All

Has Gas: All

Trial Region Name: All

No. of users: 3863 Show: Daily Profile Interquartile Range

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Bill (\$/year)

Electricity Usage (kWh/year)

AGL TOU CC 0.992
Ausgrid TOU CC 0.977
AGL energy part CC 0.992

X axis: Annual kWh
Y axis: Bill (\$/year)

List of cases:

- C. 1 [? Exp. X]
- C. 2 [? Exp. X]
- C. 3 [? Exp. X]

Load Info Tariff Info Demographic Info

Case 3 (AGL energy part)

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Select Tariff:

| Type: | All | Name: | AGL TOU | Type: | TOU | State: | NSW | Add | | | | | |
|--------------------------|---------|--------------------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|-------------------------------------|-------------|--------------------------|
| DUOS TUOS DUOS+TUOS NUOS | | Daily Charge (\$/day): 0 | | | | | | | | | | | |
| Provider: | All | StartHour: | 14 | StartMin: | 0 | EndHour: | 20 | EndMin: | 0 | Weekday: | <input checked="" type="checkbox"/> | Weekend: | <input type="checkbox"/> |
| Year: | All | Shoulder 1: | 1230 SWW | Shoulder 2: | 1230 SWW | Shoulder 3: | 1230 SWW | Off-peak 1: | 1160 SWW | Off-peak 2: | 1160 SWW | Off-peak 3: | 1230 SWW |
| Tariff: | AGL TOU | Peak 1: | 1.5940 SWW | Peak 2: | 1.5940 SWW | Peak 3: | 1.5940 SWW | Peak 4: | 1.5940 SWW | Peak 5: | 1.5940 SWW | Peak 6: | 1.5940 SWW |

Exclude GST Save the modified tariff as: AGL TOU V2 Save

Tariff Design and Assessment (TDA) tool

Visualize the results of the analysis by a range of different graphing options

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Project Name: Undefined

No. of users: 732 Show: Daily kWh Histogram

Probability Bill (\$/year)

X axis: Annual kWh Y axis: Bill (\$/year)

Selected Users All

Bill (\$/year)

kWh/day

0 10 20 30 40 50 60 70 80 90 100

0.02 0.04 0.06 0.08 0.1 0.12

0 10 20 30 40 50 60 70 80 90 100

0.02 0.04 0.06 0.08 0.1 0.12

No. of users: 3683 Show: Daily Profile Interquartile Range

Hour 1 3 5 7 9 11 13 15 17 19 21 23

0.8 0.6 0.4 0.2 0

Interquartile Range (25%, 50%, 75%)

0.8 0.6 0.4 0.2 0

Name: AGL TOU Type: TOU State: NSW Add

Daily Charge (\$/day): 0

DUOS TUOS DUOS+TUOS NUOS

Type: All State: All Provider: All Year: All Tariff: AGL TOU

Name Rate Unit StartHour StartMin EndHour EndMin Weekday Weekend

1 Peak 1 0.540 kWh 14 0 20 0

2 Shoulder 1 0.290 kWh 7 0 14 0

3 Shoulder 2 0.250 kWh 21 0 22 0

4 Off peak 1 0.160 kWh 0 0 7 0

5 Off peak 2 0.160 kWh 22 0 24 0

6 Shoulder 3 0.250 kWh 7 0 22 0

7 Critical 1 0.400 kWh 0 0 7 0

Exclude GST Save the modified tariff as: AGL TOU V2 Save

Single Variable Graphs Dual Variable Graphs Single Case Graphs

List of cases:

C 1 C 2 C 3

Load Info Tariff Info Demog Info

Case 3 (AGL energy part)

No. of users: 3683

Database: SGSC

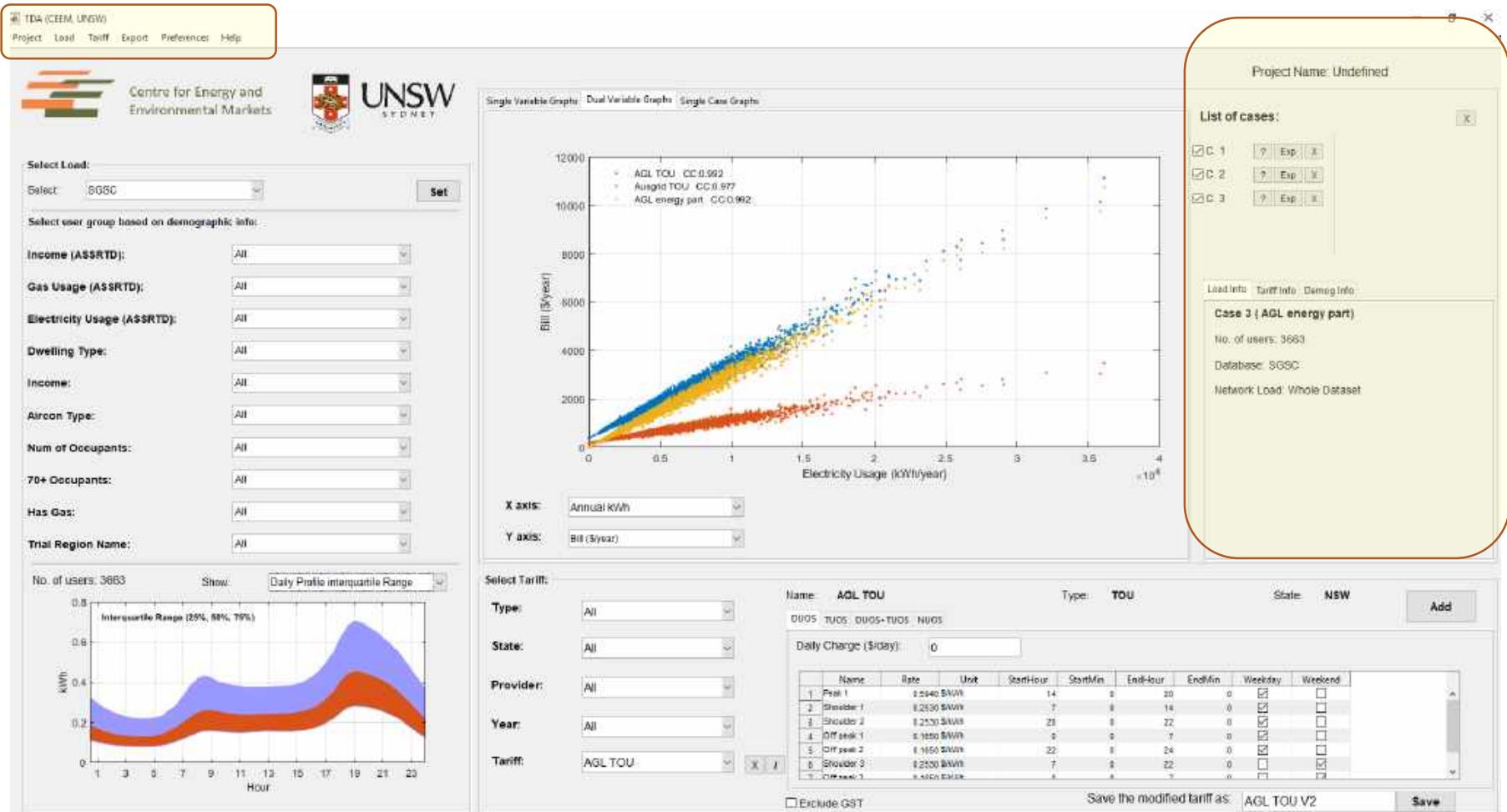
Network Load: Whole Dataset

f in 19

Centre for Energy and Environmental Markets

Tariff Design and Assessment (TDA) tool

Add up to 10 analysis case and compare the results



Tariff Design and Assessment (TDA) tool

Add tariffs, loads and projects; exports the results to excel, and change the preferences in the context menu

Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets UNSW SYDNEY

Select Load: SGSC Set

Select user group based on demographic info:

Income (ASSRTD): All

Gas Usage (ASSRTD): All

Electricity Usage (ASSRTD): All

Dwelling Type: All

Income: All

Aircon Type: All

Num of Occupants: All

70+ Occupants: All

Has Gas: All

Trial Region Name: All

No. of users: 3663 Show Daily Profile interquartile Range

Hourly electricity usage profile showing Intersquare Range (25%, 50%, 75%) over 24 hours.

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Project Name: Undefined

Bill (\$/year)

Electricity Usage (kWh/year)

X axis: Annual kWh Y axis: Bill (\$/year)

AGL TOU CC 0.992 Ausgrid TOU CC 0.977 AGL energy part CC 0.992

List of cases:

C. 1 C. 2 C. 3

Load Info Tariff Info Demog Info

Case 3 (AGL energy part)

No. of users: 3663 Database: SGSC Network Load: Whole Dataset

Name: AGL TOU Type: TOU State: NSW Add

DUOS TUOS DUOS-TUOS NUOS

Daily Charge (\$/day): 0

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU

Name Rate Unit StartHour StartMin EndHour EndMin Weekday Weekend

1 Peak 1 0.540 kWh 14 0 20 0

2 Shoulder 1 0.290 kWh 7 0 14 0

3 Shoulder 2 0.290 kWh 21 0 22 0

4 Off peak 1 0.160 kWh 0 0 7 0

5 Off peak 2 0.160 kWh 22 0 24 0

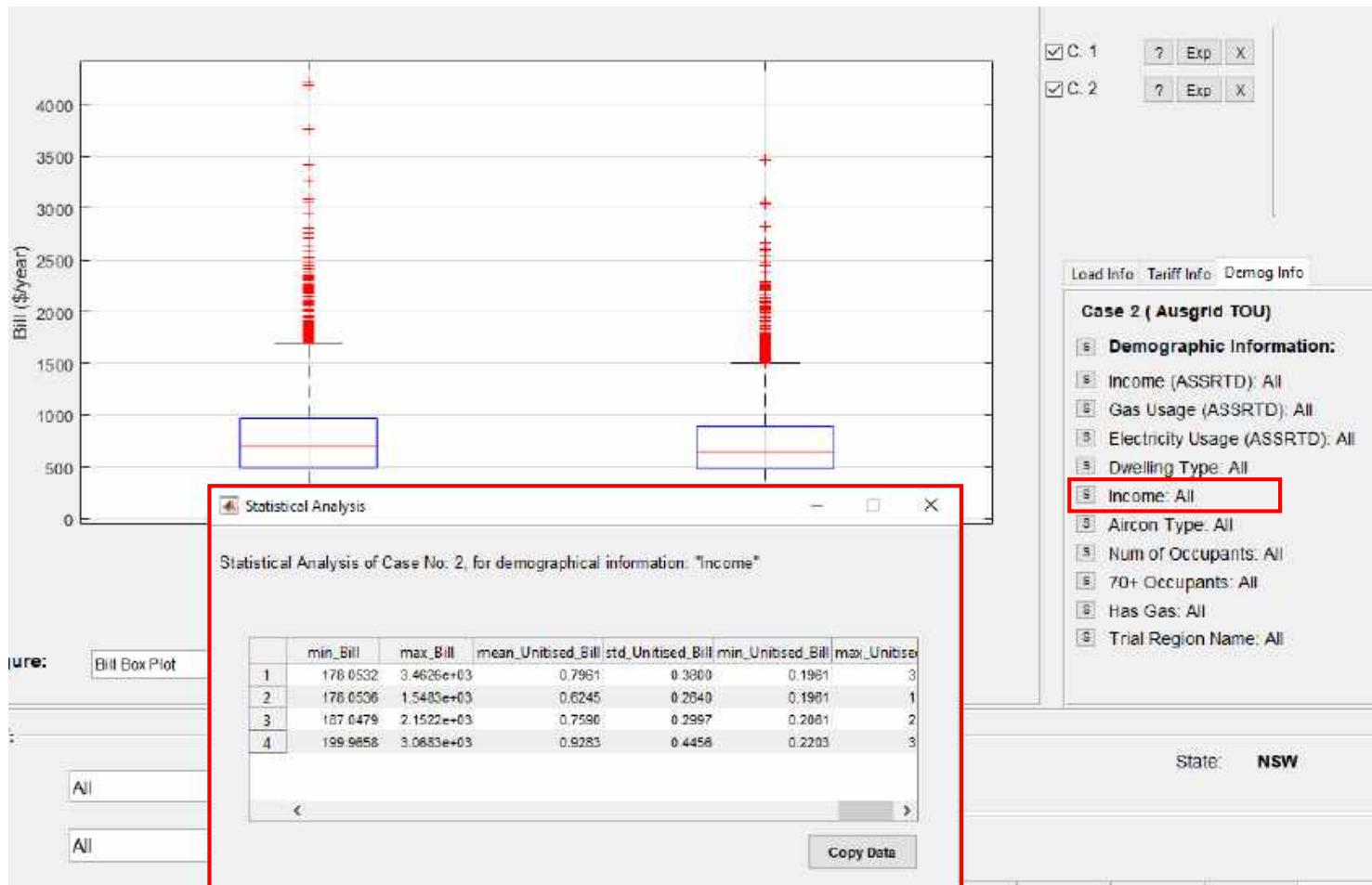
6 Shoulder 3 0.250 kWh 7 0 22 0

7 Critical 1 0.400 kWh 0 0 7 0

Exclude GST Save the modified tariff as: AGL TOU V2 Save

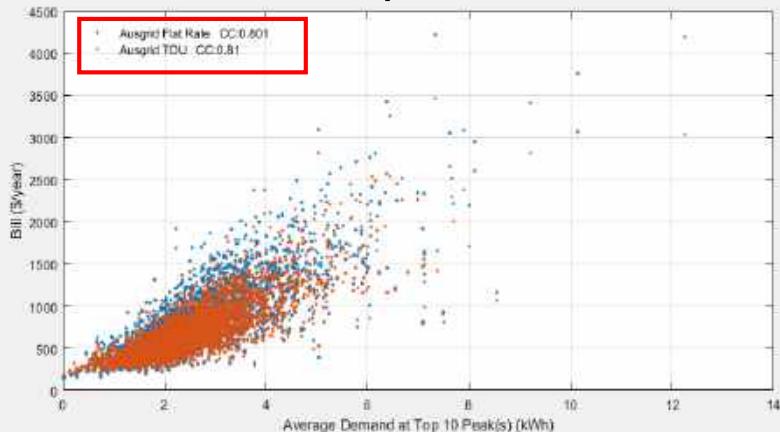


Use case example: Comparison of tariffs

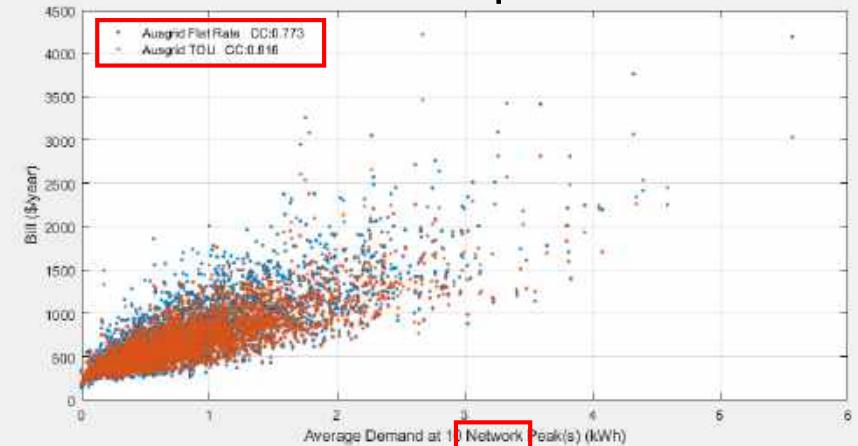


Use case example: Comparison of tariffs

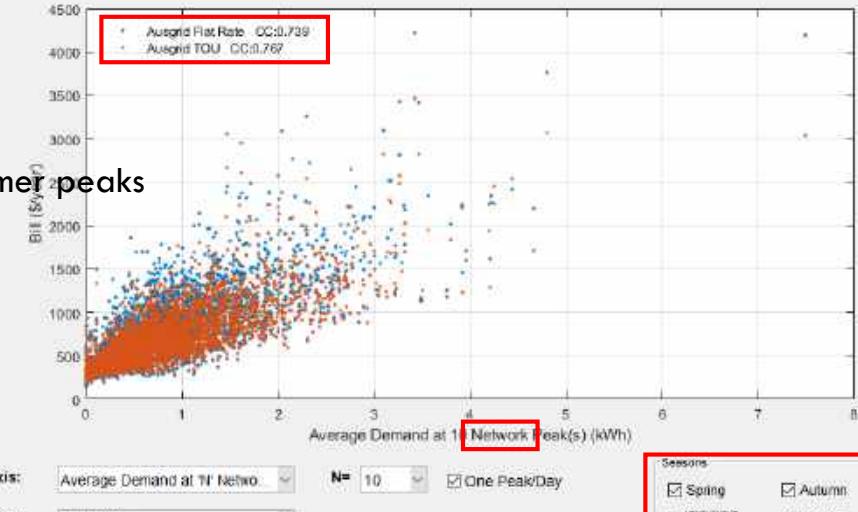
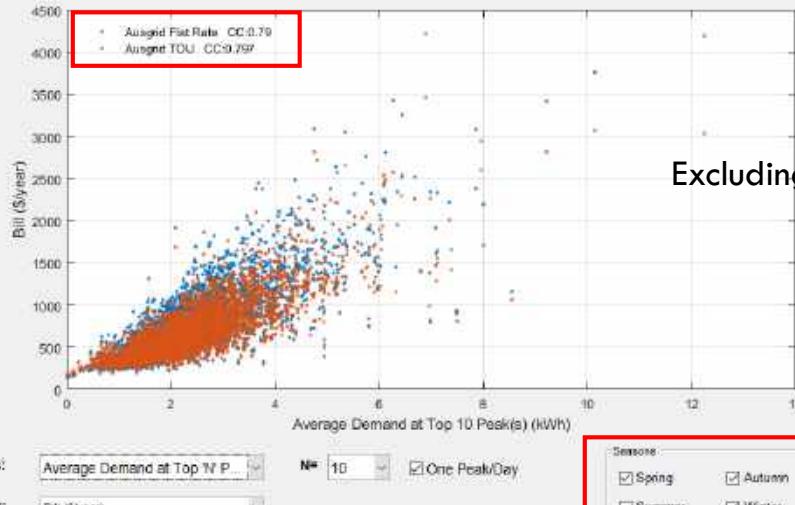
User's peak



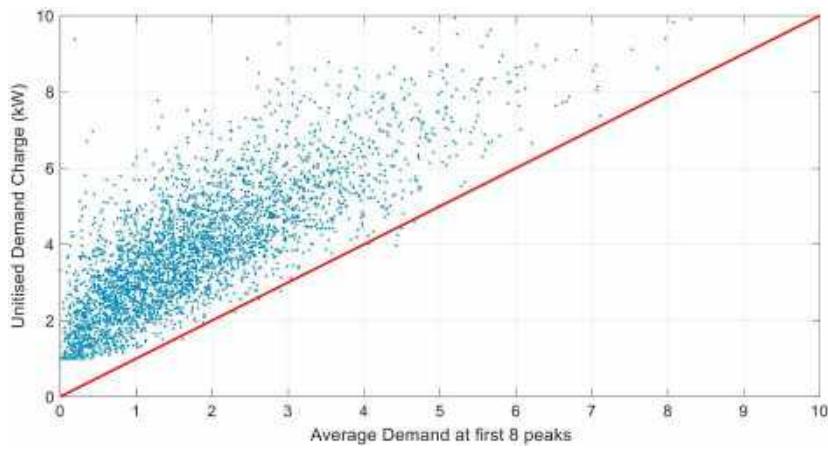
Coincident peak



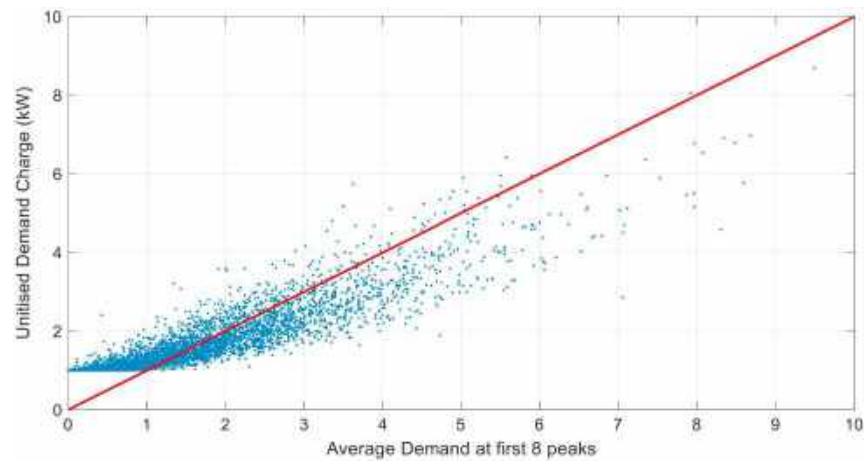
Excluding summer peaks



Use case example: Assessing tariffs



Unutilised Standard Demand Charge vs Average Demand at Time of Eight Highest network Peaks.

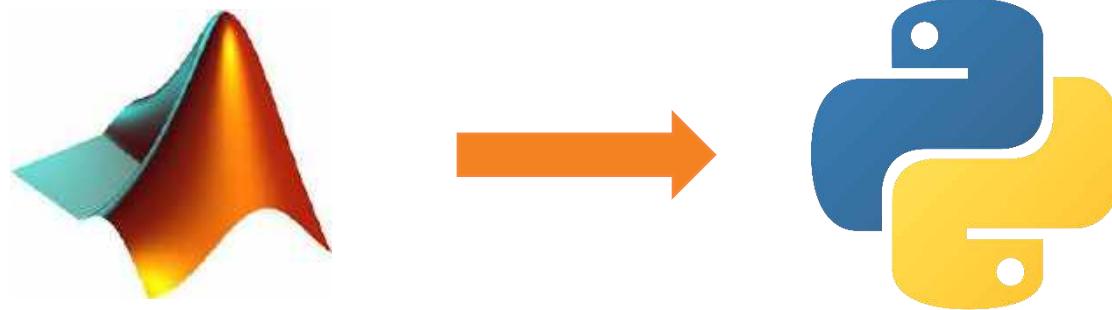


Unutilised Demand Charge (applied to customer demand at time of 12 monthly network peaks) vs Average Demand at Time of Eight Highest Network Peaks.

New Developments

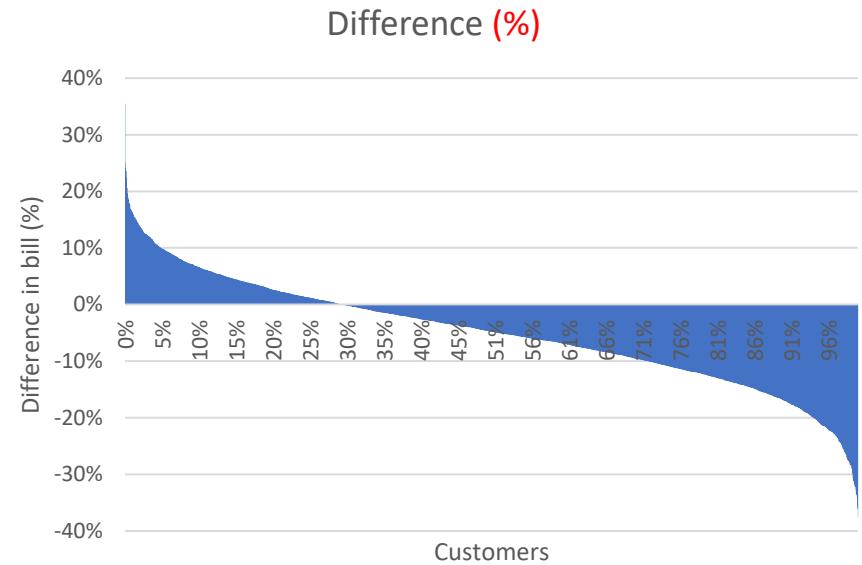
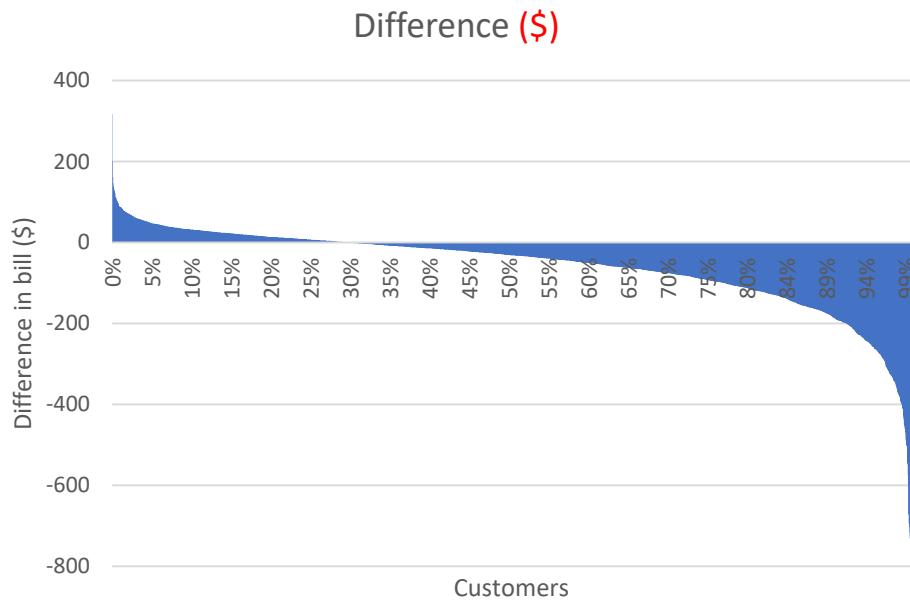
- Moving to Python
- More Analyses and Visualisation features
- Retail Tariffs (and Categorising them)
- Network, Wholesale, Retail Tariff Combined Analysis
- Distributed Resources/Response:
 - PV
 - Battery
 - Appliances
 - Demand response
 - Energy Efficiency
- Load Clustering

New Development: Converting to Python



- Even more open source!
- Easier collaboration in non-academic environment
- Reduced size

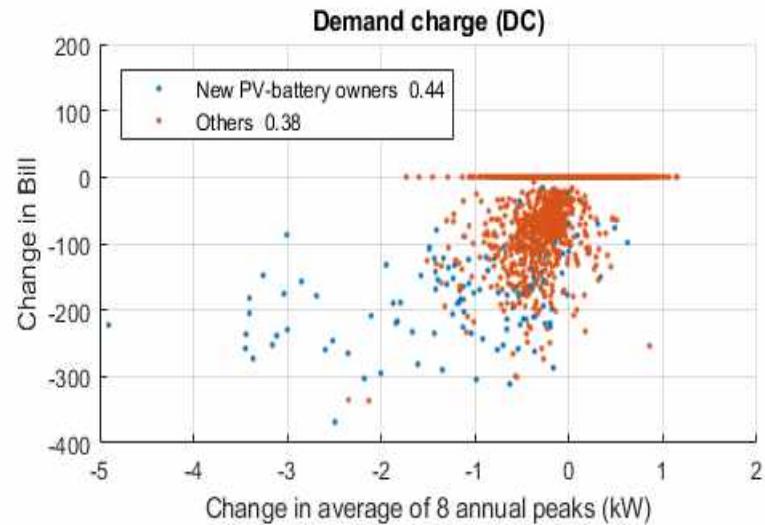
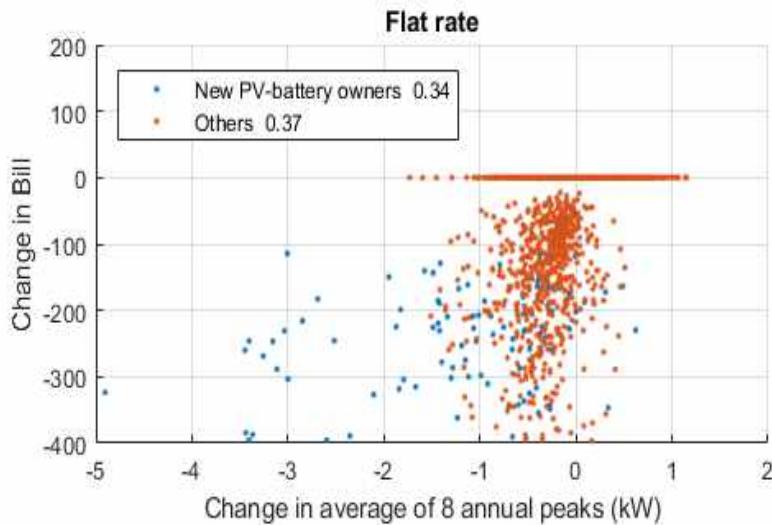
New Developments: Comparison of tariffs



Going from Ausgrid Flat rate tariff (2017/18) to Time of use (2017/18)

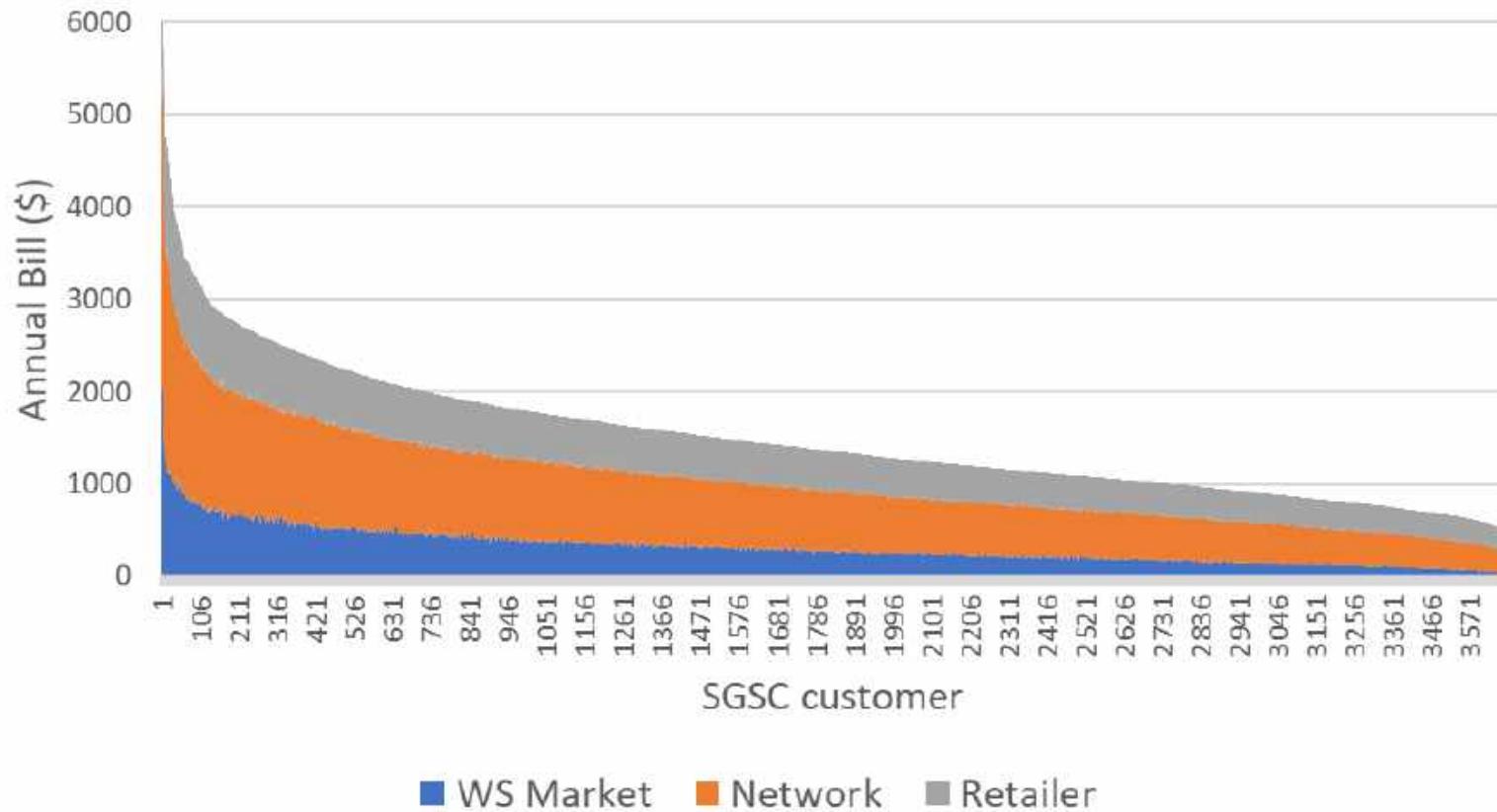
New Developments: Distributed resources

PV and battery impact on peak and other users



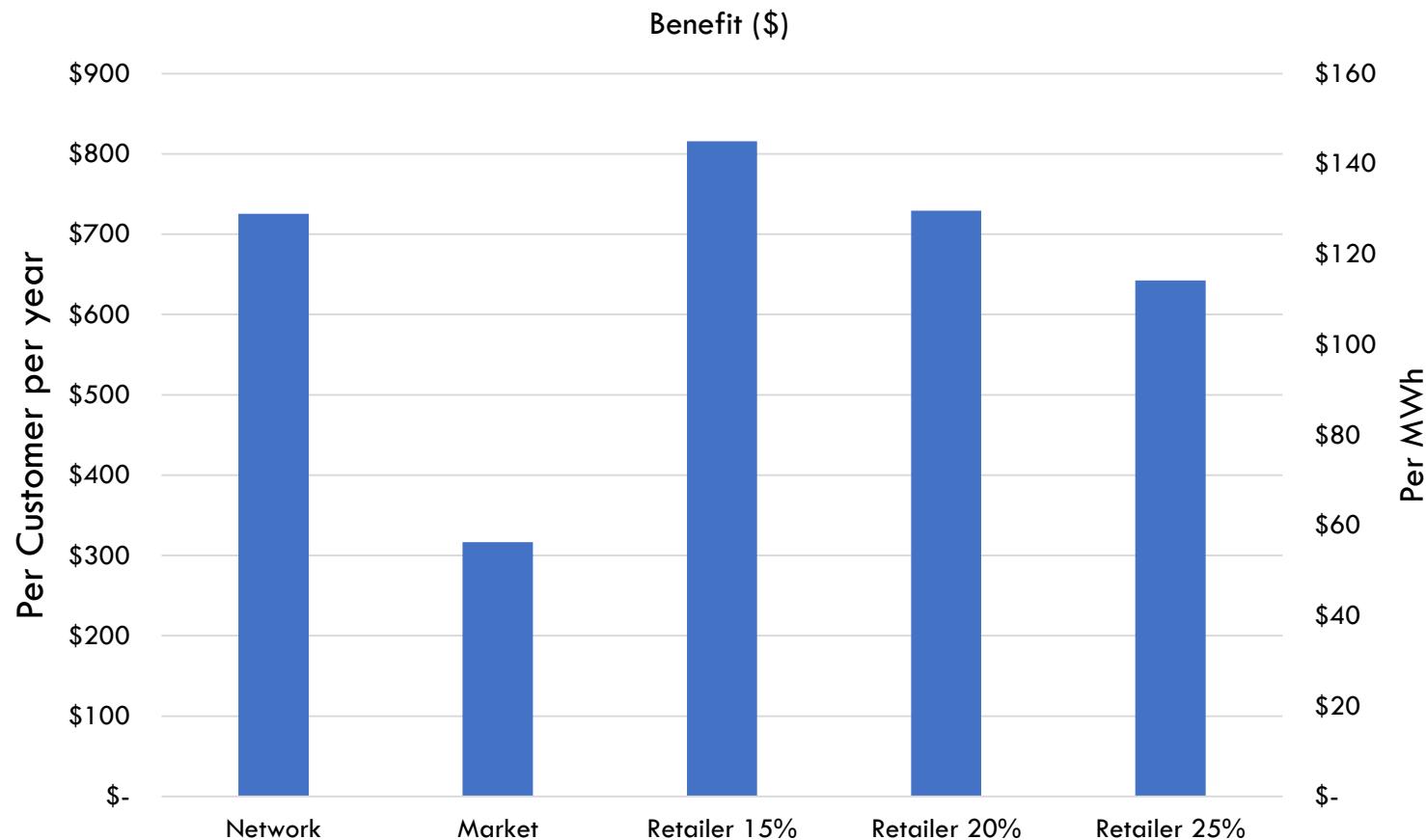
Preliminary results, using SAPN network tariffs for SGSC homes, 15% of customers having PV and battery

New Development: Comparison of the network, wholesale and retail revenue



WS price and SGSC load profile are for 2013, but retail tariff is for 2018

New Development: How about different discount levels?

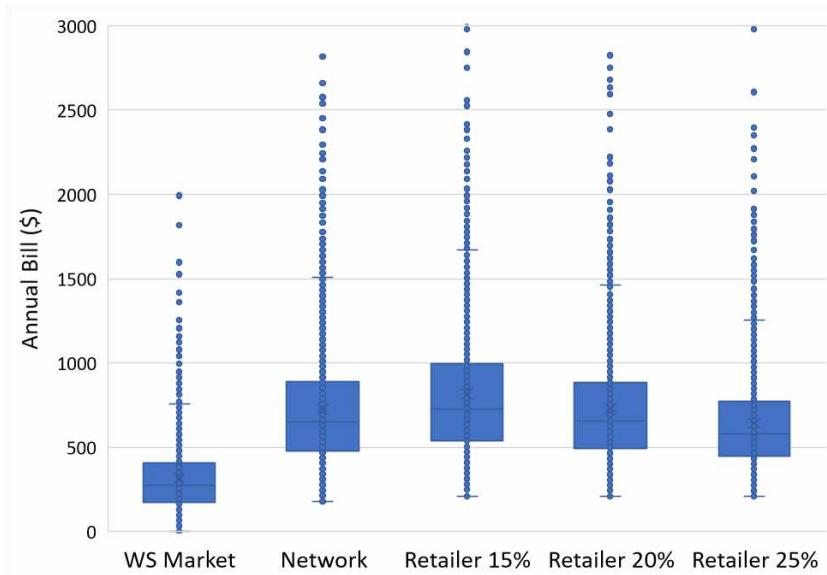


WS price and SGSC load profile are for 2013, but retail tariff is for 2018

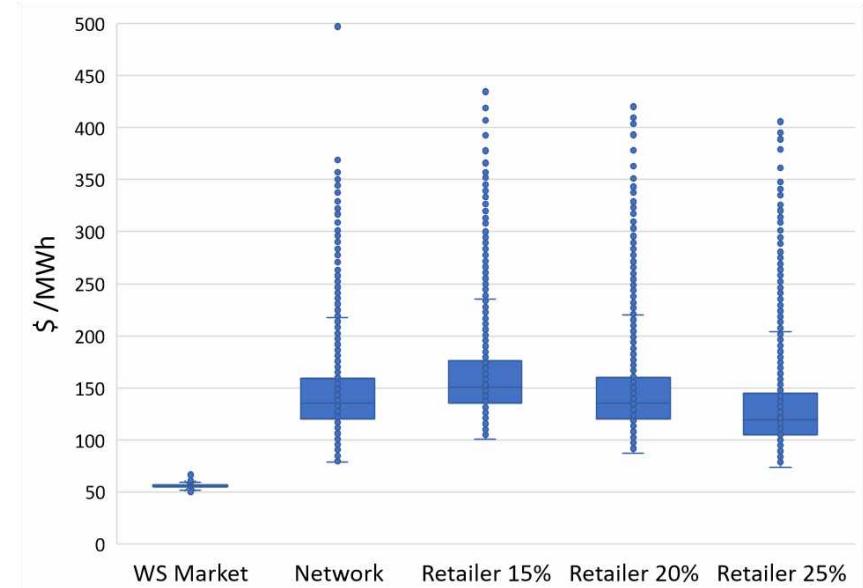
New Development: How about different discount levels?

Distribution of bills

Annual Bill (\$)

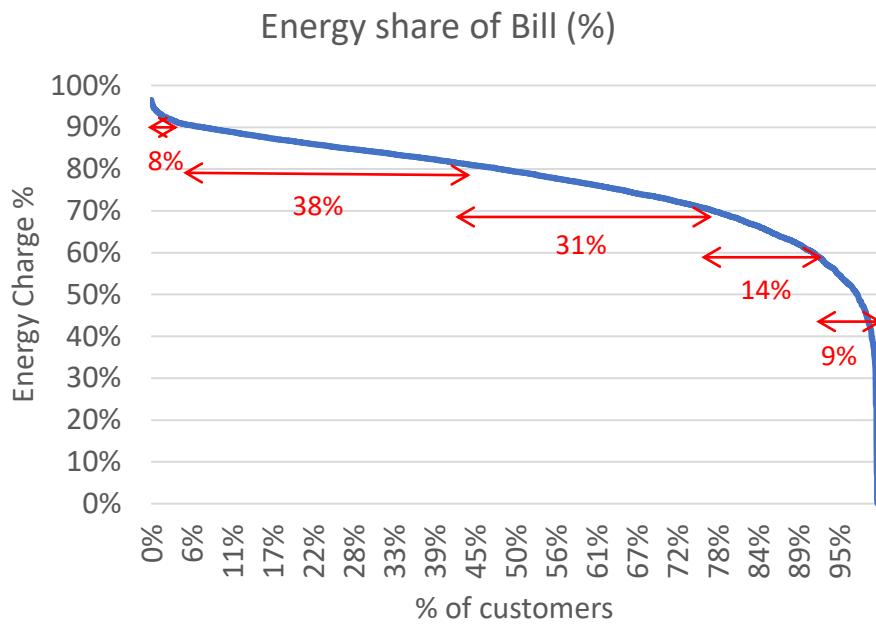


Annual Bill (\$/MWh)

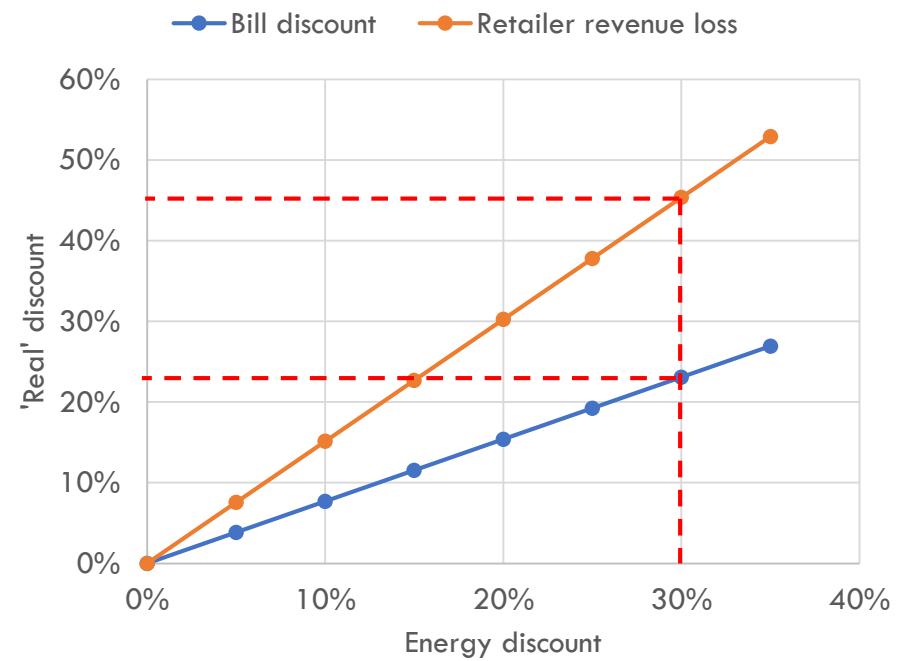


WS price and SGSC load profile are for 2013, but retail tariff is for 2018

New Development: Bill Discount, Energy Discount, Retailer Discount?



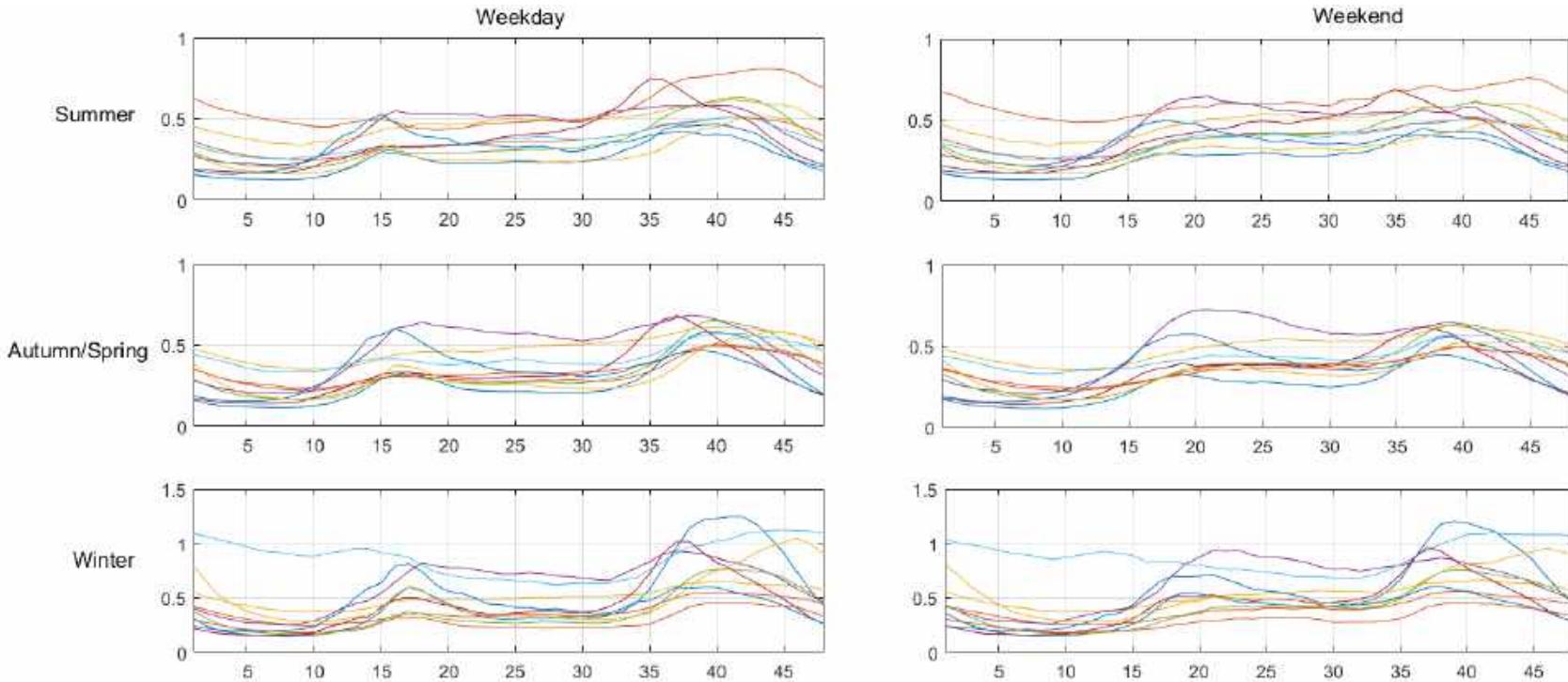
54% of customers have more than 30% of their bill from fixed charge



30% Energy Discount means 23% Bill discount, but 45% less revenue for retailer!

New Development: Clustering load profiles

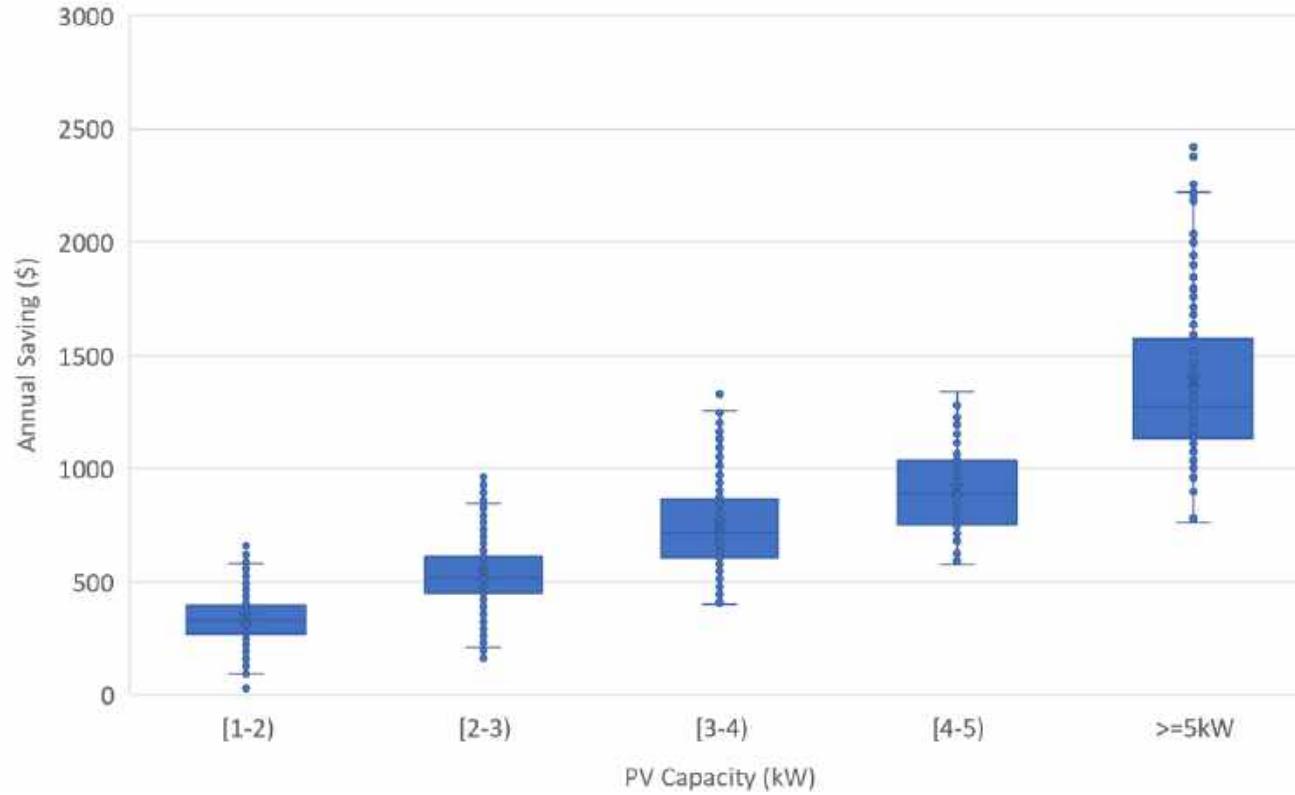
Generating groups of load profile based on daily pattern



More load profiles are [very] welcome!

New Development: Financial calculation of RE

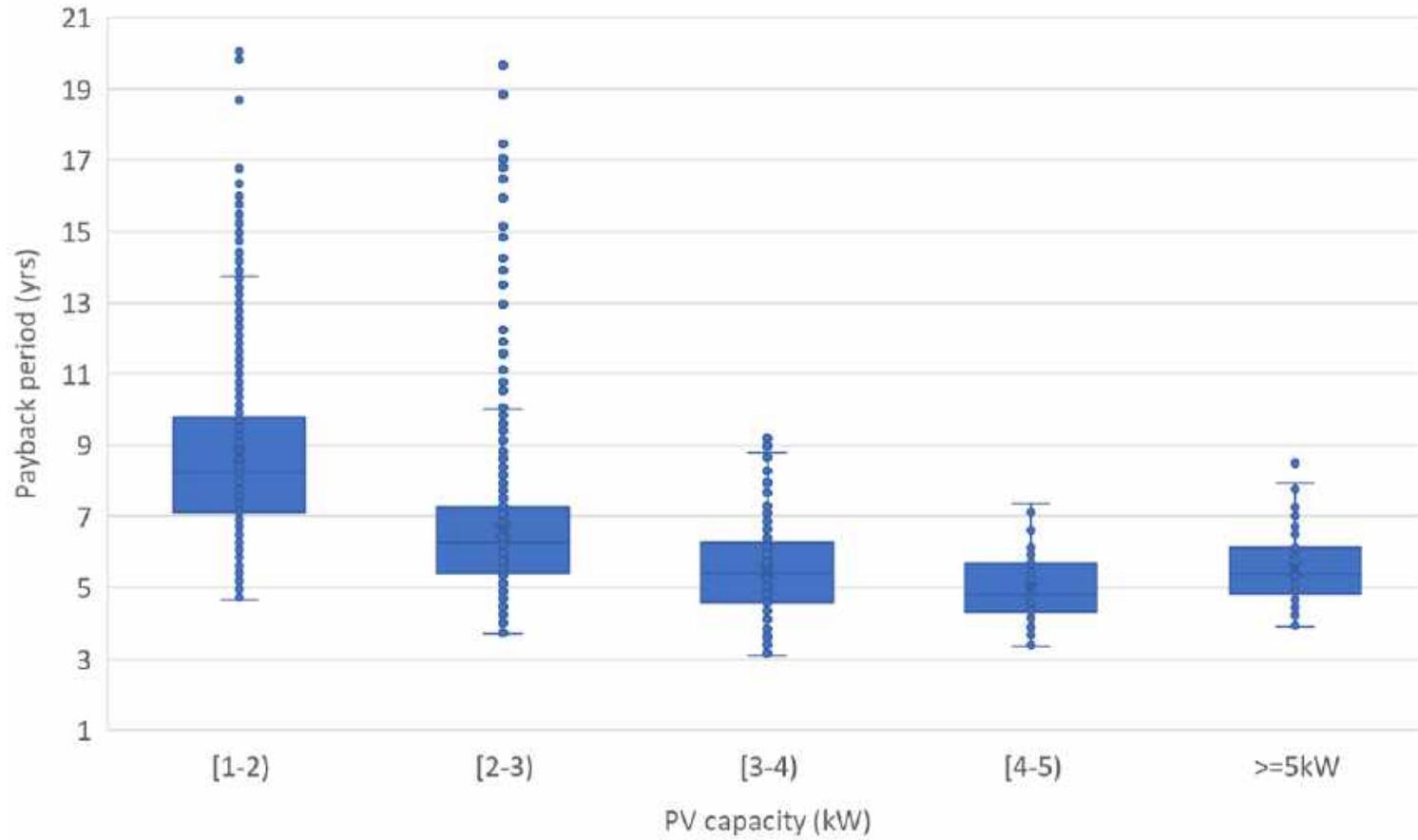
Annual saving of putting PV categorised by different size range



Data: 300 solar homes Ausgrid, 6 retail tariffs in NSW, PV cost retrieved from SolarChoice

New Development: Financial calculation of RE

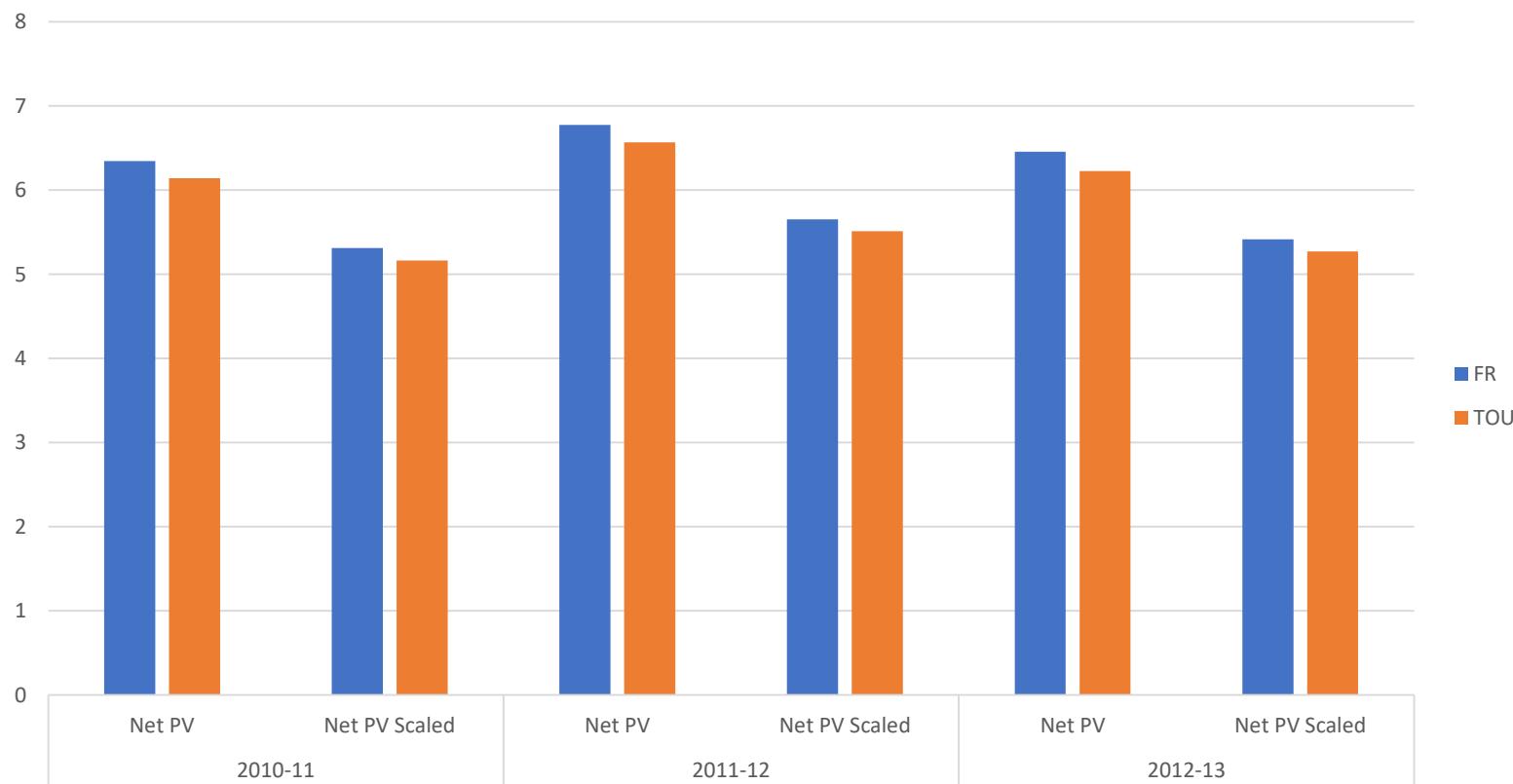
Payback period (years) of putting PV categorised by different size range



Data: 300 solar homes Ausgrid, 6 retail tariffs in NSW, PV cost retrieved from SolarChoice

New Development: Financial calculation of RE

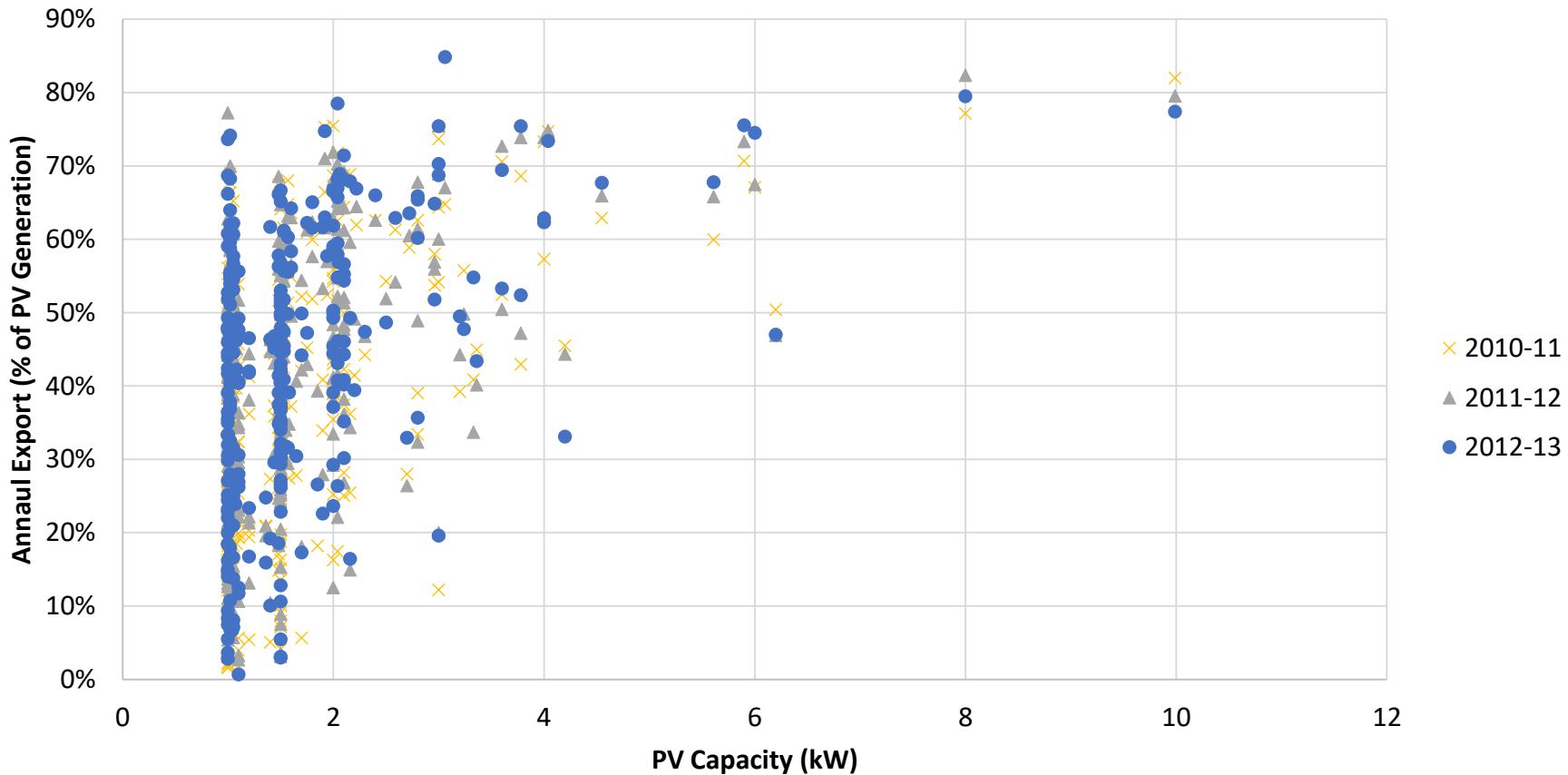
Payback period based on different years data and for scaling PV to 4 kW for flat rate and TOU tariffs



Data: 300 solar homes Ausgrid, 6 retail tariffs in NSW, PV cost retrieved from SolarChoice

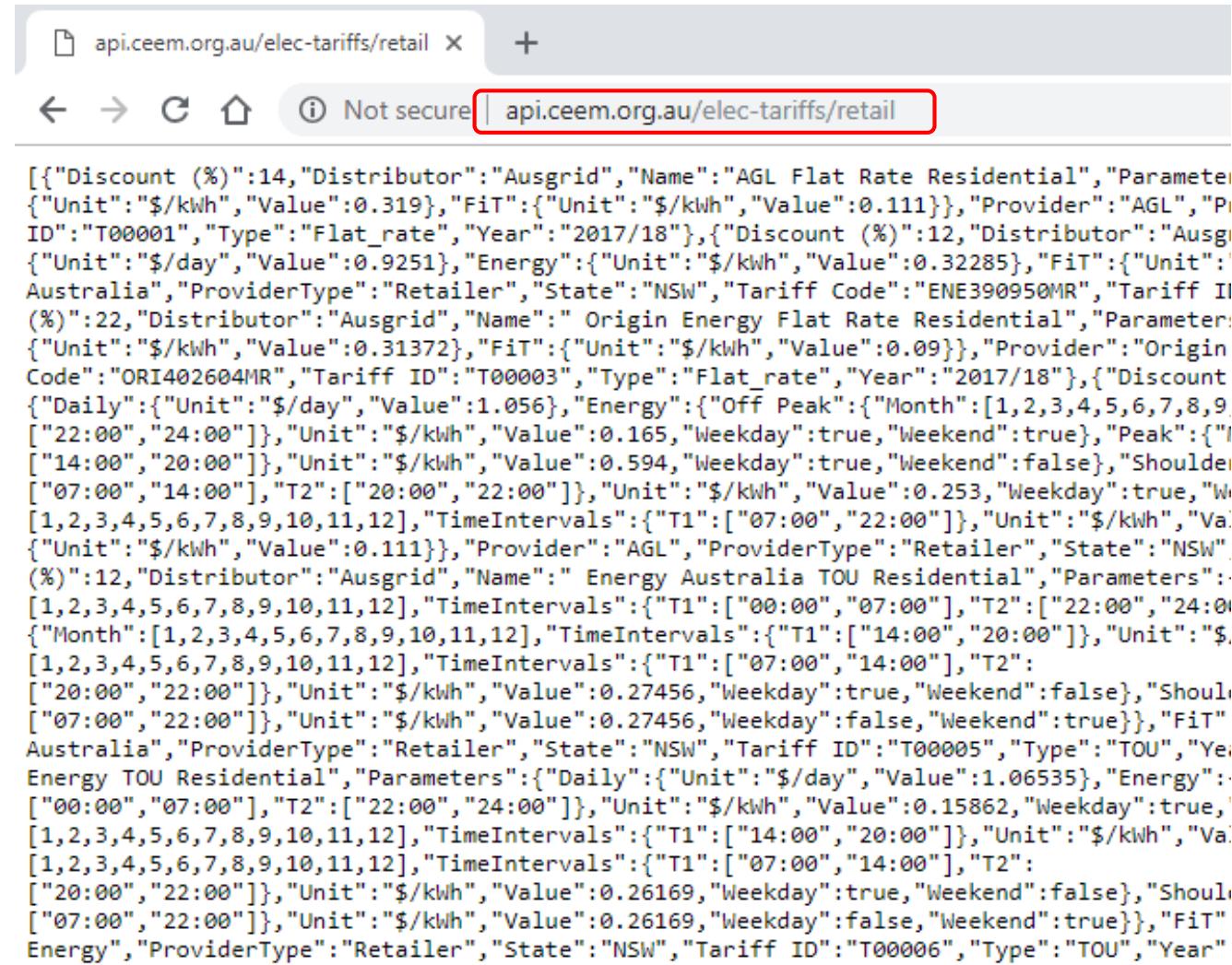
New Development: Financial calculation of RE

Percentage of export (100% - self consumption %) for different PV and load profiles



Data: 300 solar homes Ausgrid, 6 retail tariffs in NSW

New Development: Online list of tariffs with continues update



The screenshot shows a browser window with the URL api.ceem.org.au/elec-tariffs/retail highlighted with a red box. The page displays a large amount of JSON data representing electricity tariffs.

```
[{"Discount (%)":14,"Distributor":"Ausgrid","Name":"AGL Flat Rate Residential","Parameters":{"Unit":"/kWh","Value":0.319}, "FiT":{"Unit":"/kWh","Value":0.111}}, {"Provider":"AGL","PID":"T00001","Type":"Flat_rate","Year":"2017/18"}, {"Discount (%)":12,"Distributor":"Ausgrid","Unit":"/day","Value":0.9251}, {"Energy":{"Unit":"/kWh","Value":0.32285}, "FiT":{"Unit":Australia,"ProviderType":"Retailer"}, "State":NSW,"Tariff Code":ENE390950MR,"Tariff ID":T00002,"Type":Flat_rate,"Year":2017/18}, {"Discount (%)":22,"Distributor":Ausgrid,"Name":Origin Energy Flat Rate Residential,"Parameters":{"Unit":"/kWh","Value":0.31372}, "FiT":{"Unit":"/kWh","Value":0.09}}, {"Provider":Origin,"Code":ORI402604MR,"Tariff ID":T00003,"Type":Flat_rate,"Year":2017/18}, {"Discount {"Daily": {"Unit": "/day", "Value": 1.056}, "Energy": {"Off Peak": {"Month": [1,2,3,4,5,6,7,8,9,22:00,24:00]}, "Unit": "/kWh", "Value": 0.165, "Weekday": true, "Weekend": true}, "Peak": {"T1": [14:00,20:00], "Unit": "/kWh", "Value": 0.594, "Weekday": true, "Weekend": false}, "Shoulder": {"T1": [07:00,14:00], "T2": [20:00,22:00]}, "Unit": "/kWh", "Value": 0.253, "Weekday": true, "Weekend": true}, {"TimeIntervals": {"T1": [07:00,22:00]}, "Unit": "/kWh", "Value": 0.111}, "Provider": AGL, "ProviderType": Retailer, "State": NSW, "Year": 2017/18}, {"Discount (%)": 12, "Distributor": Ausgrid, "Name": Energy Australia TOU Residential, "Parameters": [{"Month": [1,2,3,4,5,6,7,8,9,10,11,12]}, {"TimeIntervals": {"T1": [00:00,07:00], "T2": [22:00,24:00]}, "Unit": "/kWh", "Value": 0.111}, {"TimeIntervals": {"T1": [14:00,20:00]}, "Unit": "/kWh", "Value": 0.27456, "Weekday": true, "Weekend": false}, {"Shoulder": {"T1": [07:00,14:00], "T2": [20:00,22:00]}, "Unit": "/kWh", "Value": 0.27456, "Weekday": false, "Weekend": true}, {"FiT": {"Unit": Australia, "ProviderType": Retailer}, "State": NSW, "Tariff ID": T00005, "Type": TOU, "Year": 2017/18}, {"Energy TOU Residential, "Parameters": {"Daily": {"Unit": "/day", "Value": 1.06535}, "Energy": [{"TimeIntervals": {"T1": [00:00,07:00], "T2": [22:00,24:00]}, "Unit": "/kWh", "Value": 0.15862, "Weekday": true, "Weekend": false}, {"TimeIntervals": {"T1": [14:00,20:00]}, "Unit": "/kWh", "Value": 0.26169, "Weekday": true, "Weekend": false}, {"Shoulder": {"T1": [07:00,14:00], "T2": [20:00,22:00]}, "Unit": "/kWh", "Value": 0.26169, "Weekday": false, "Weekend": true}, {"FiT": {"Unit": Energy, "ProviderType": Retailer}, "State": NSW, "Tariff ID": T00006, "Type": TOU, "Year": 2017/18}]]}
```

Join the discussion group at:

<https://groups.google.com/forum/#!forum/ceem-tda>

Take the online survey here:

<https://www.surveymonkey.com/r/J5HH277>

Q&A



ENERGY
CONSUMERS
AUSTRALIA



AUSTRALIAN
PV INSTITUTE

