

Tariff Design and Assessment Tool Workshop

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

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www.ceem.unsw.edu.au

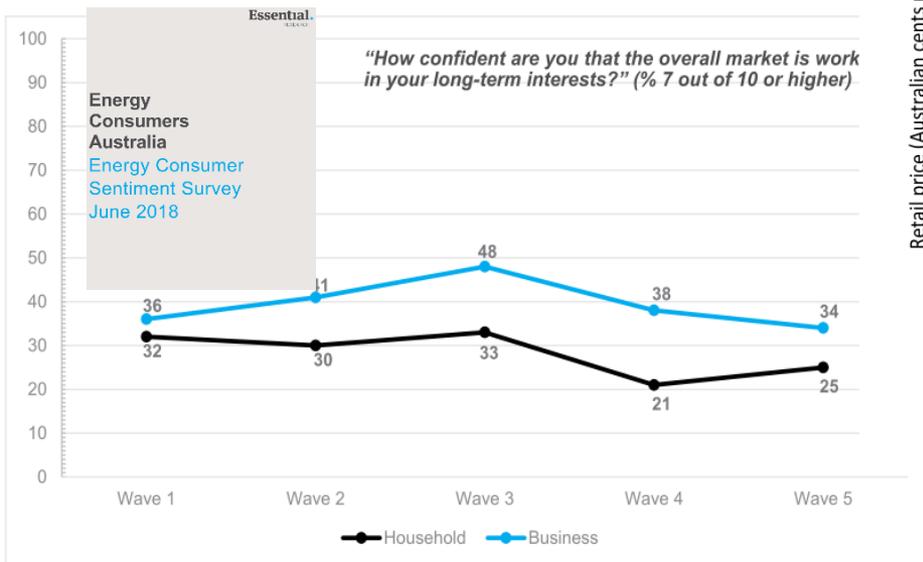
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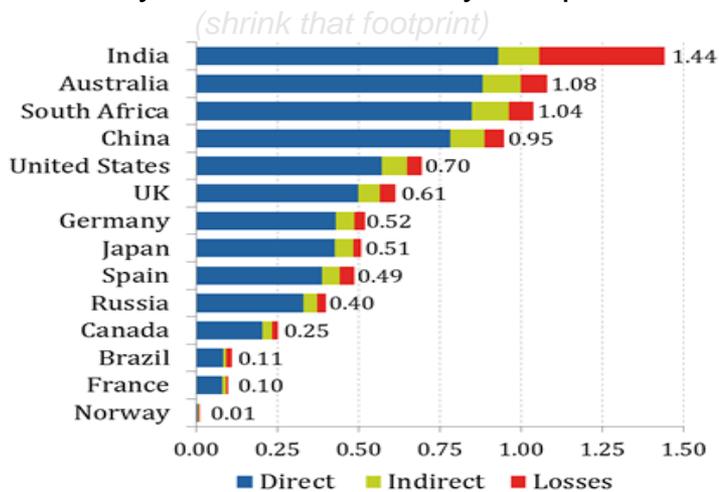
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github.com/unsw-ceem

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



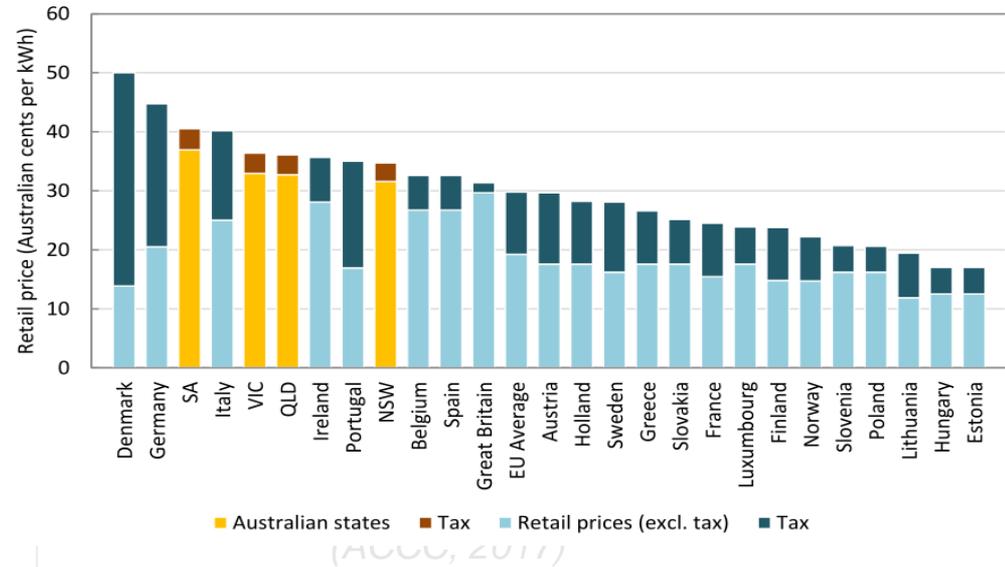
Electricity emissions intensity comparison



International retail electricity price comparison

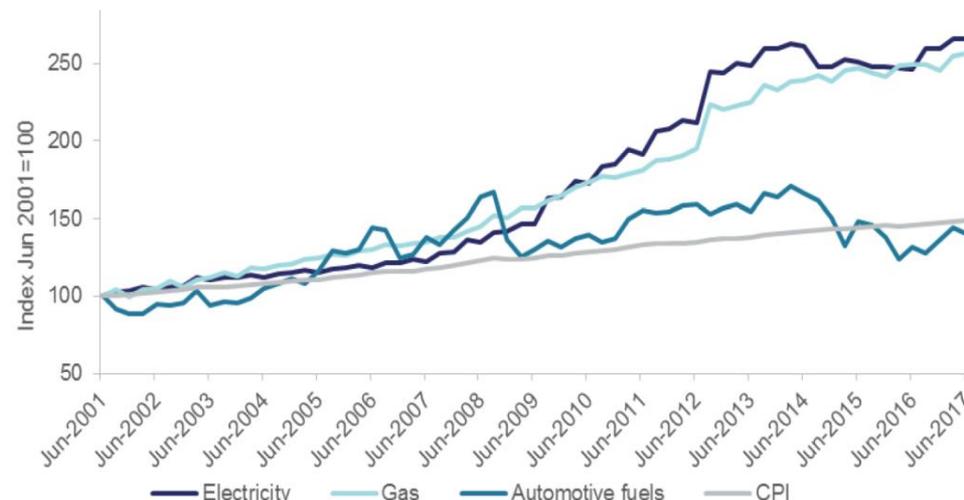
(ACCC Retail Price Competition Inquiry, 2017)

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



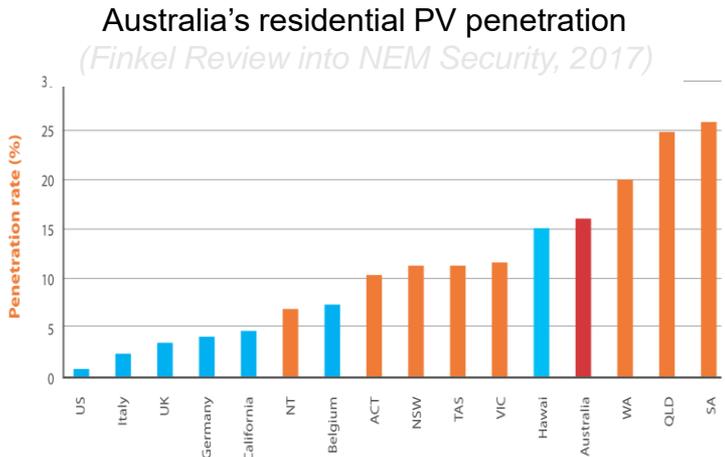
Australian residential energy prices index

(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
 - 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*



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 Pfenniger.

The global transition towards a clean and sustainable energy future 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, not least in the data and models used to underpin such policies. These uncertainties need open discussion, and yet energy strategies all over the world are based on research not open to scrutiny. Researchers who seek, for example, to study the economic and energy model used by the US government (called NEMS) are met with a forbidding warning. On its website, the Energy Information Administration, which is developing the model, pronounces: "Most people who have requested NEMS in the past have found out that it was 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 simulations cannot be verified, discussed or challenged. This is bad for science, bad for the public and spreads distrust. Energy research needs to catch up with the open-software and open-data movements. We energy researchers should make our computer programs and data freely accessible, and academic publishing should shun us until we do.

Our community's models are relevant to policy because they explore alternative scenarios or seek to understand the technical constraints on deploying new energy technologies. It is modelling for insight (by an academic exploring a range of qualitatively different scenarios for a clean energy supply, say) and for numbers (as in a government agency deciding on the remuneration level of a technology-support scheme).

Trust in this research matters because it contributes to policies on energy.

that remain hidden, like the costs of technologies, can largely determine what comes out of such models. In the United Kingdom, opaque and overly optimistic cost assumptions for onshore wind went into models used for policymaking, and that may well have delayed the country's decarbonization.

This closed culture is alien to younger researchers, who grew up with collaborative online tools and share code and data on platforms such as GitHub. Yet academia's love affair with metrics and the pressure to publish set the wrong incentives: every hour spent on cleaning up a data set for public release or writing open-source code is time not spent working on a peer-reviewed paper.

Nevertheless, some academic-led projects are pushing towards more openness. The Enipedia project is building a worldwide open database on power plants, with data such as their locations and emissions. The Open Power System Data project gathers data such as electricity consumption from government agencies and transmission-network operators, and pushes for clarity on the licensing under which these data are made available. The Open Energy Modelling Initiative is emerging as a platform for coordinating and strengthening such efforts.

Regulation can also help. 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 untouched by these fledgling initiatives. Only one energy journal – *Energy Economics* – currently requires data and models alongside submissions. Other journals should follow suit.

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

BLACK-BOX SIMULATIONS CANNOT BE VERIFIED, DISCUSSED OR CHALLENGED.

openmod open energy modelling initiative

Openmod in a nutshell

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

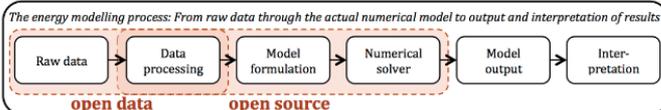
Energy models are widely used for policy advice and research. They serve to help answer questions on energy policy, decarbonization, and transitions towards renewable energy sources. Currently, most energy models are black boxes – even to fellow researchers.

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

The idea of openmod



Open Source Tools

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](#)



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/J5HH277>

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/J5HH277> n.haghdadi@unsw.edu.au

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



rove:
el:
vide contact
ing of the tool?
always welcome.
sw.edu.au
LOW CARBON LIVING
CRC

Tariff Design and Assessment Tool: Progress and Next Steps

PROJECT OVERVIEW			
Grant no	AP 814	Date of report	11 / 01 / 20 18
Grant recipient	UNSW		
Project title	Tariff Assessment Tool		
PROJECT OUTCOMES: <i>outline the project outcomes during the reporting period</i>			
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 

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 Haghdadi

- 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.

The screenshot displays the TDA (CEEM, UNSW) software interface. The main window shows a scatter plot of Bill (\$/year) on the Y-axis (0 to 12000) versus Electricity Usage (kWh/year) on the X-axis (0 to 4 x 10⁴). Three data series are plotted: AGL TOU (blue dots, CC:0.992), Ausgrid TOU (yellow dots, CC:0.977), and AGL energy part (orange dots, CC:0.992). The plot shows a positive correlation between electricity usage and bill amount, with the AGL TOU series having the highest bills for a given usage level.

On the left, the 'Select Load' dropdown is set to 'SGSC'. Below it, 'Select user group based on demographic info' includes dropdowns for Income (ASSRTD), Gas Usage (ASSRTD), Electricity Usage (ASSRTD), Dwelling Type, Income, Aircon Type, Num of Occupants, 70+ Occupants, Has Gas, and Trial Region Name, all set to 'All'. A 'Set' button is present. Below this, 'No. of users: 3663' and 'Show: Daily Profile interquartile Range' are displayed. A line graph shows the interquartile range (25%, 50%, 75%) of electricity usage (kWh) over a 24-hour period, with a peak around 19:00.

On the right, the 'List of cases:' panel shows three cases (C. 1, C. 2, C. 3) with expand/collapse icons. Below it, the 'Load Info' tab is active, showing 'Case 3 (AGL energy part)' with 'No. of users: 3663', 'Database: SGSC', and 'Network Load: Whole Dataset'.

At the bottom, the 'Select Tariff:' panel is shown. The 'Name' is 'AGL TOU', 'Type' is 'TOU', and 'State' is 'NSW'. The 'Daily Charge (\$/day)' is set to 0. A table lists the tariff components:

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

The 'Save the modified tariff as:' field is set to 'AGL TOU V2' and the 'Save' button is visible.

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

Updates: 5 1 new
Recommendations: 5 1 new
Followers: 7 0 new
Reads: 96 6 new

Navid Haghdadi · Robert J Passey · Anna Bruce · [Show all 5 collaborators](#)

Goal: 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 (APVI). The TDA project was supported by Energy Consumers Australia. [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 Nov 20

Next TDA workshop

Hi all,

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://apvi.org.au/solar-research-conference/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 · 6 Reads

← → ↻ 🏠 GitHub, Inc. [US] | <https://github.com/UNSW-CEEM> ☆

Centre for Energy and Environmental Markets

Sydney Australia <http://ceem.unsw.edu.au/>

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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 AUSTRALIA Centre for Energy and Environmental Markets

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Open Source Tools

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CEEM's researchers believe in the value of open source modelling in the Energy and Environmental research space of open source tools which are listed below. For a list of some of our under development tools you can refer CEEM's

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TDA - Tariff Design and Analysis Tool
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Tariff Design and Assessment (TDA) tool

How to install it?

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

UNSW-CEEM / TDA_Matlab

Watch 0 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Releases Tags Draft a new release

Latest release

v1.0m
2d9312c

TDA

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

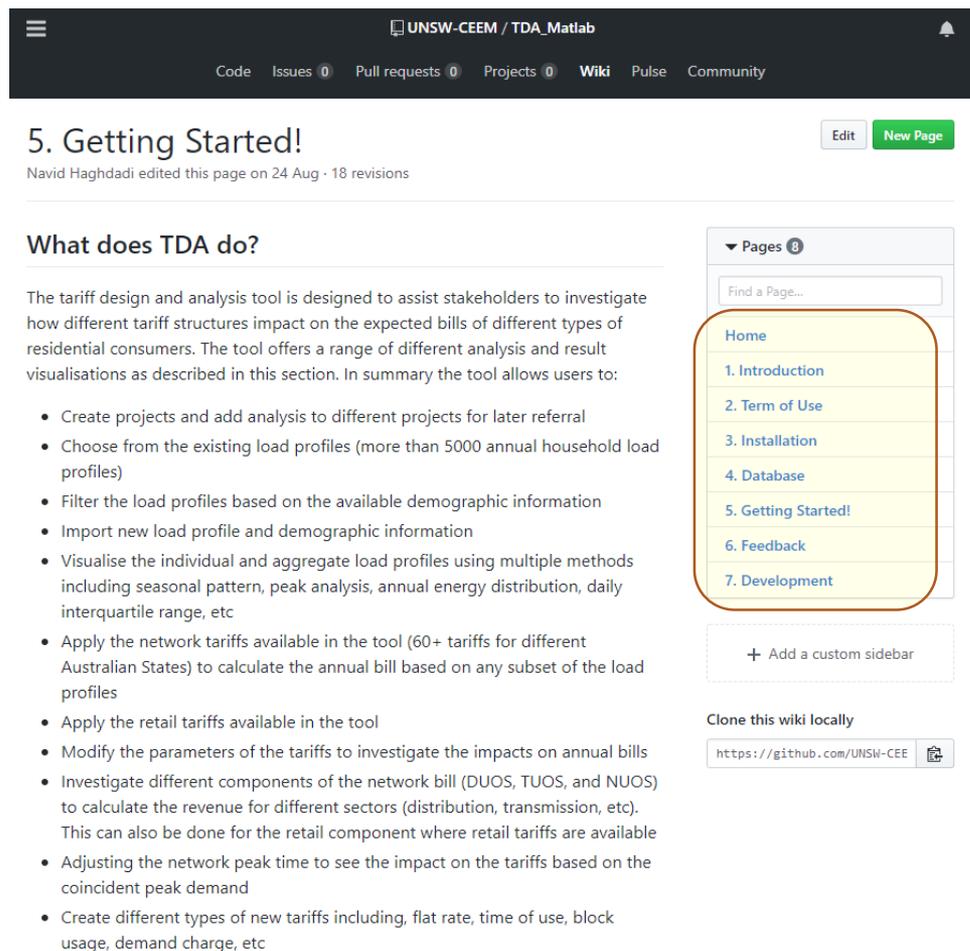
Assets 4

- TDA_mac.zip 279 MB
- TDA_win.zip 279 MB
- 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 screenshot shows the GitHub Wiki page for the UNSW-CEEM / TDA_Matlab repository. The page title is "5. Getting Started!". Below the title, it says "Navid Haghdamadi edited this page on 24 Aug · 18 revisions". The main content is under the heading "What does TDA do?". It describes the tool's purpose and lists several features and capabilities. A sidebar on the right contains a table of contents with 8 pages, where "5. Getting Started!" is highlighted. Below the sidebar, there is a "Clone this wiki locally" section with a GitHub repository link.

UNSW-CEEM / TDA_Matlab

Code Issues 0 Pull requests 0 Projects 0 Wiki Pulse Community

5. Getting Started!

Navid Haghdamadi edited this page on 24 Aug · 18 revisions

What does TDA do?

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

Pages 8

Find a Page...

- Home
- 1. Introduction
- 2. Term of Use
- 3. Installation
- 4. Database
- 5. Getting Started!
- 6. Feedback
- 7. Development

+ 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?

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: 3663 Show: Daily Profile interquartile Range

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

Single Variable Graphs Dual Variable Graphs Single Case Graphs

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 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

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

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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7 Off peak 3	0.1650 \$/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

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

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: 3663 Show: Daily Profile interquartile Range

Single Variable Graphs Dual Variable Graphs Single Case Graphs

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 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

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU X I

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/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

Filer the load profiles by the demographic information

TDA (CEEM, UNSW)
Project Load Tariff Export Preferences Help

Centre for Energy and Environmental Markets
UNSW SYDNEY

Project Name: Undefined

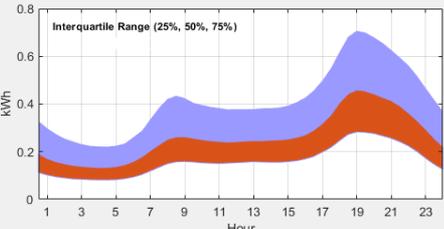
Select Load:
Select: SGSC Set

Select user group based on demographic info:

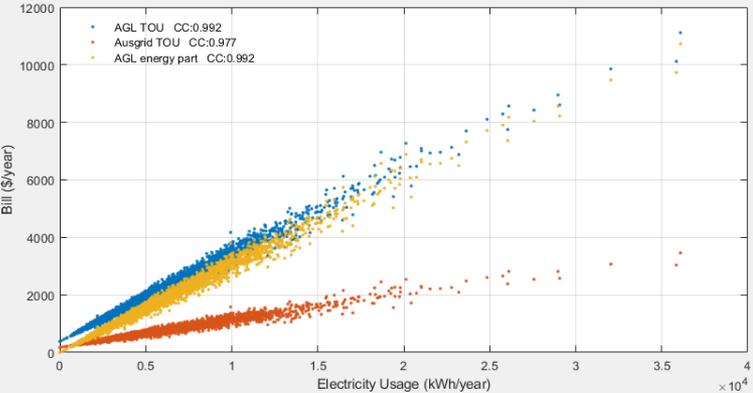
- Income (ASSRTD): All
- Gas Usage (ASSRTD): All
- Electricity Usage (ASSRTD): All
- Dwelling Type: All
- Income: All
- Aircon Type: All
- Num of Occupants: All
- 70+ Occupants: All
- Has Gas: All
- Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range

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



Single Variable Graphs Dual Variable Graphs Single Case Graphs



Bill (\$/year)

Electricity Usage (kWh/year) $\times 10^4$

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 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

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

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/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

Get quick analysis of the set of selected loads

TDA (CEEM, UNSW)

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

Single Variable Graphs Dual Variable Graphs Single Case Graphs

Bill (\$/year)

Electricity Usage (kWh/year) $\times 10^4$

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 Demog Info

Case 3 (AGL energy part)

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

No. of users: 3663 Show: Daily Profile interquartile Range

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

kWh

Hour

Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

Type: All
State: All
Provider: All
Year: All
Tariff: AGL TOU [X] [I]

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/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: 3663 Show: Daily Profile interquartile Range

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

Single Variable Graphs Dual Variable Graphs Single Case Graphs

List of cases:

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

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

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

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/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

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

TDA (CEEM, UNSW)
Project Load Tariff Export Preferences Help

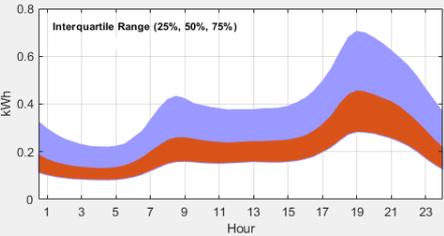
Centre for Energy and Environmental Markets
UNSW SYDNEY

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: 3663 Show: Daily Profile interquartile Range



Project Name: Undefined

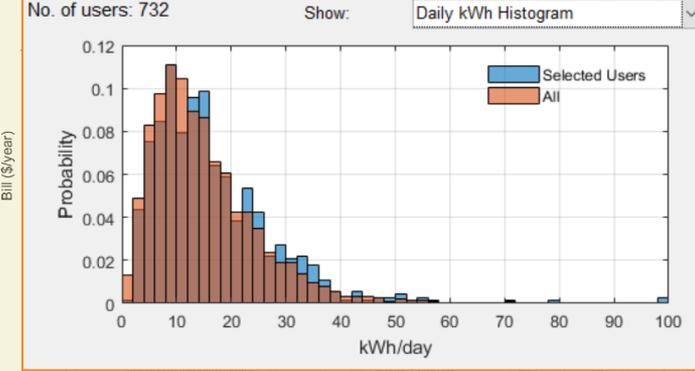
List of cases:
 C. 1 [?] Exp X
 C. 2 [?] Exp X
 C. 3 [?] Exp X

Load Info Tariff Info Demog Info

Case 3 (AGL energy part)
 No. of users: 3663
 Database: SGSC
 Network Load: Whole Dataset

Single Variable Graphs Dual Variable Graphs Single Case Graphs

No. of users: 732 Show: Daily kWh Histogram



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

Select Tariff:

Name: AGL TOU Type: TOU State: NSW [Add]

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/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 up to 10 analysis case and compare the results

TDA (CEEM, UNSW)
Project Load Tariff Export Preferences Help



Centre for Energy and Environmental Markets



UNSW SYDNEY

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

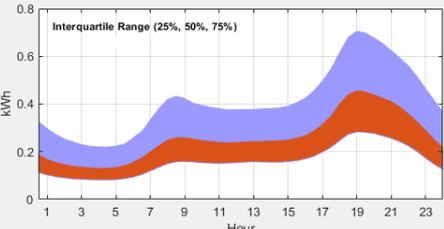
Num of Occupants: All

70+ Occupants: All

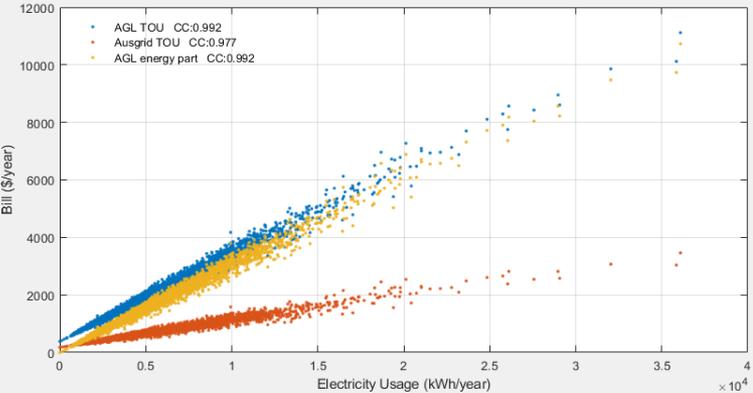
Has Gas: All

Trial Region Name: All

No. of users: 3663 Show: Daily Profile interquartile Range



Single Variable Graphs Dual Variable Graphs Single Case Graphs



X axis: Annual kWh

Y axis: Bill (\$/year)

Select Tariff:

Type: All

State: All

Provider: All

Year: All

Tariff: AGL TOU X |

Name: **AGL TOU** Type: **TOU** State: **NSW** Add

DUOS TUOS DUOS+TUOS NUOS

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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

Project Name: Undefined

List of cases: X

C. 1 ? Exp X

C. 2 ? Exp X

C. 3 ? Exp X

Load Info Tariff Info Demog Info

Case 3 (AGL energy part)

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

Tariff Design and Assessment (TDA) tool

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

TDA (CEEM, UNSW)

Project Load Tariff Export Preferences Help

Project Name: Undefined

Centre for Energy and Environmental Markets

UNSW SYDNEY

Single Variable Graphs
Dual Variable Graphs
Single Case Graphs

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 Demog Info

Case 3 (AGL energy part)

No. of users: 3663

Database: SGSC

Network Load: Whole Dataset

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: 3663 Show: Daily Profile interquartile Range

Select Tariff:

Name: **AGL TOU** Type: **TOU** State: **NSW** Add

Type: All

State: All

Provider: All

Year: All

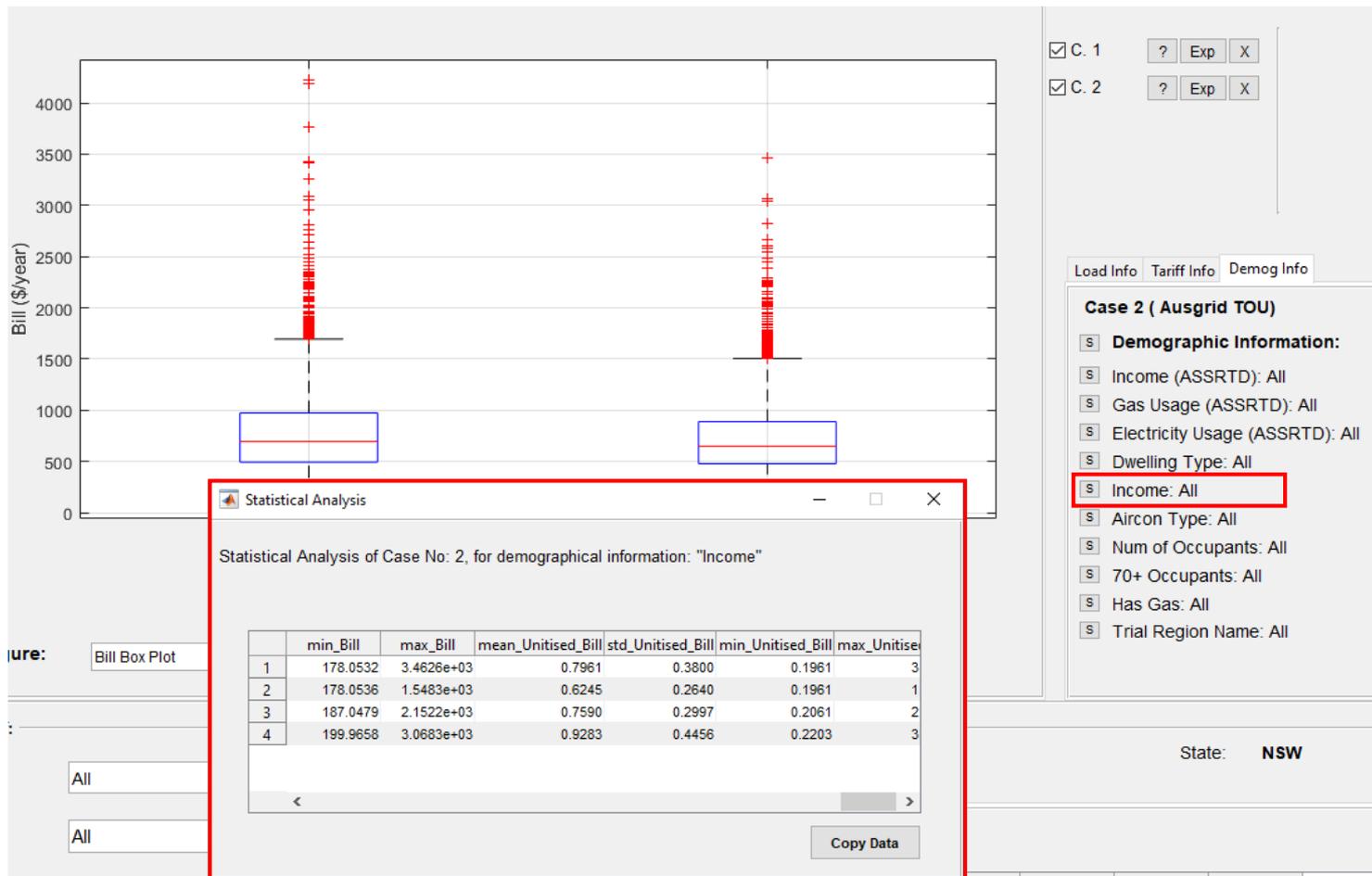
Tariff: AGL TOU X |

Daily Charge (\$/day): 0

Name	Rate	Unit	StartHour	StartMin	EndHour	EndMin	Weekday	Weekend
1 Peak 1	0.5940 \$/kWh		14	0	20	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 Shoulder 1	0.2530 \$/kWh		7	0	14	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3 Shoulder 2	0.2530 \$/kWh		20	0	22	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Off peak 1	0.1650 \$/kWh		0	0	7	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5 Off peak 2	0.1650 \$/kWh		22	0	24	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Shoulder 3	0.2530 \$/kWh		7	0	22	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7 Off peak 3	0.1650 \$/kWh		0	0	7	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>

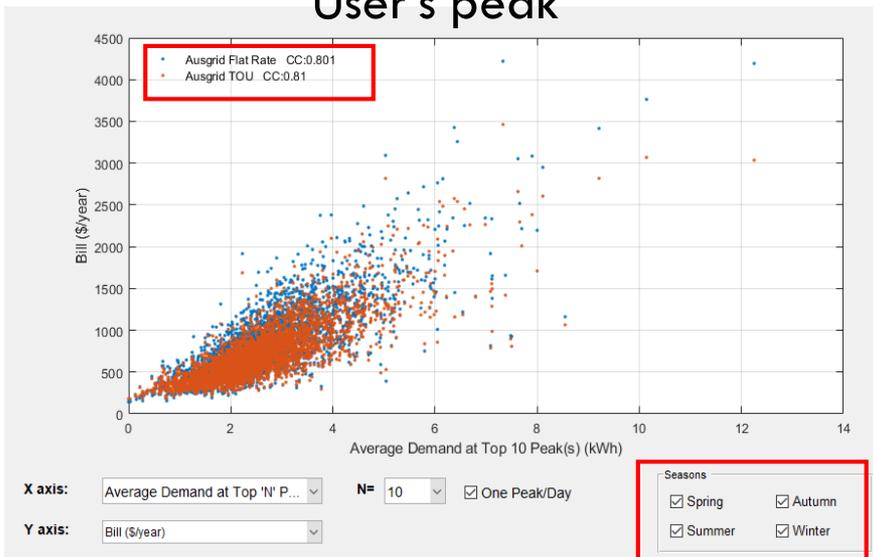
Exclude GST Save the modified tariff as: AGL TOU V2 Save

Use case example: Comparison of tariffs

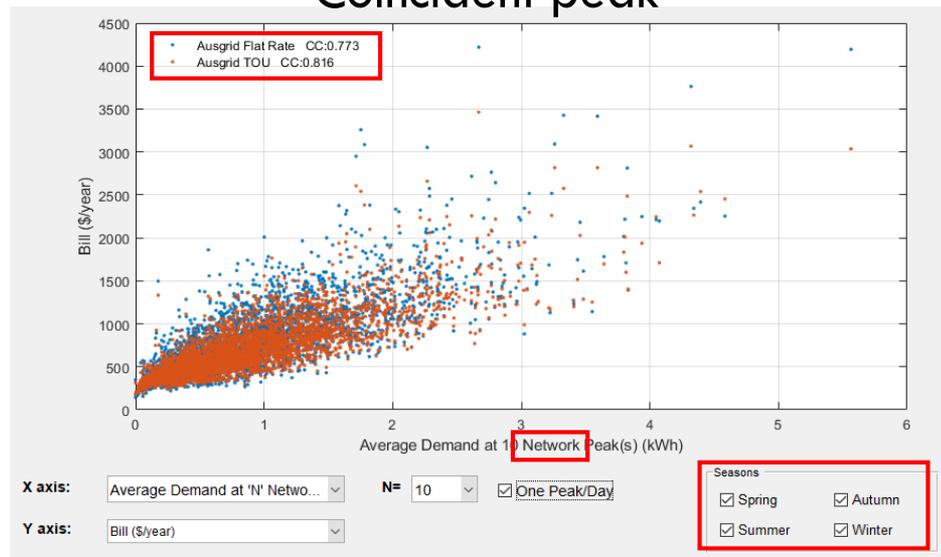


Use case example: Comparison of tariffs

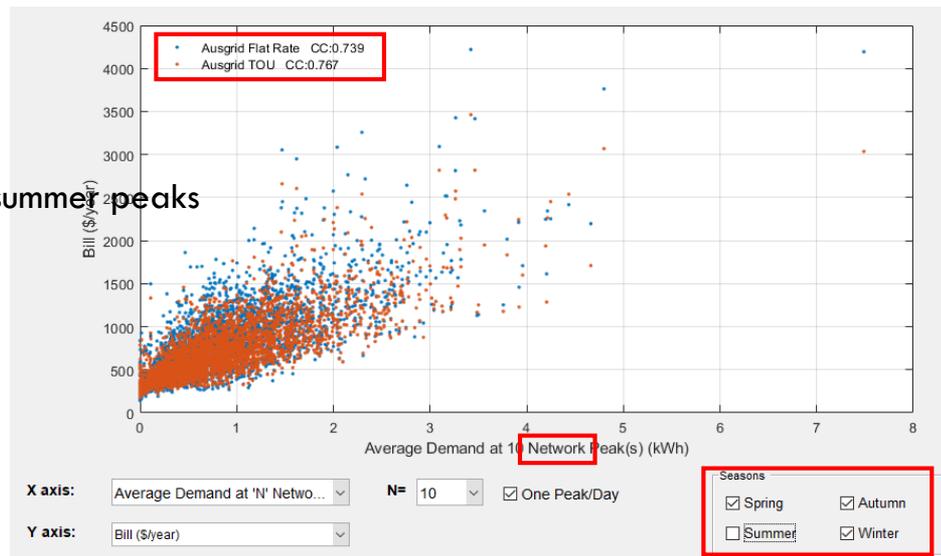
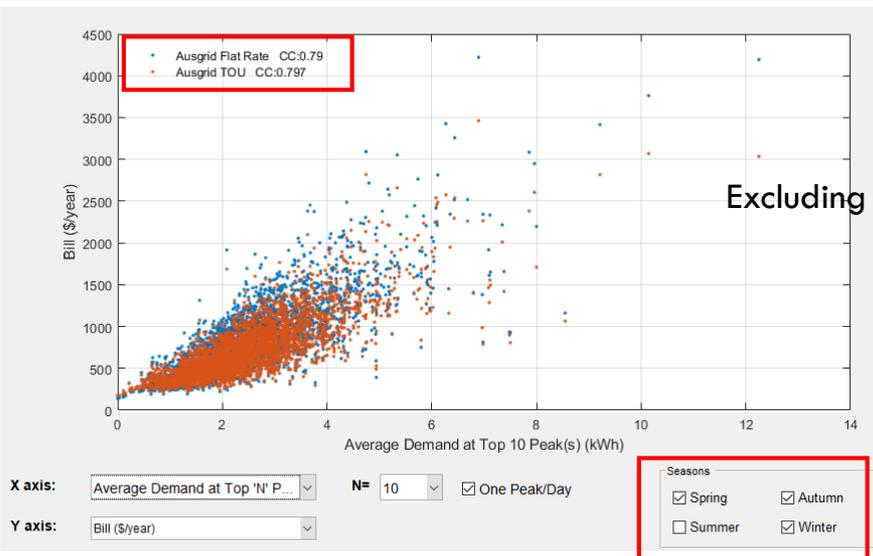
User's peak



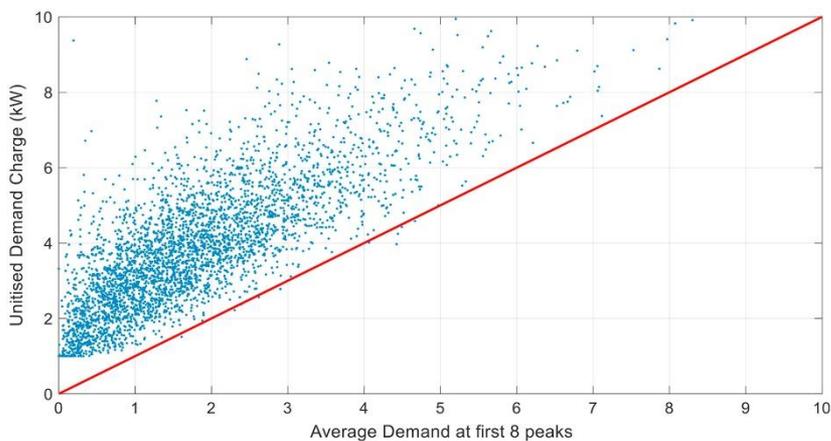
Coincident peak



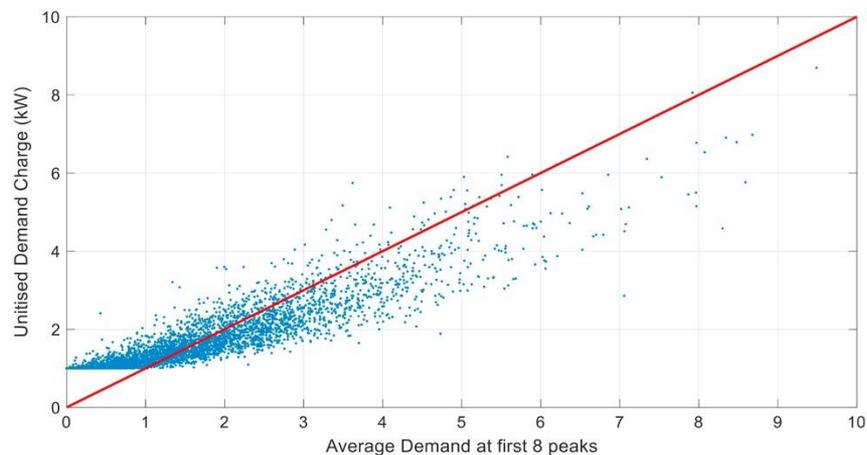
Excluding summer peaks



Use case example: Assessing tariffs



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

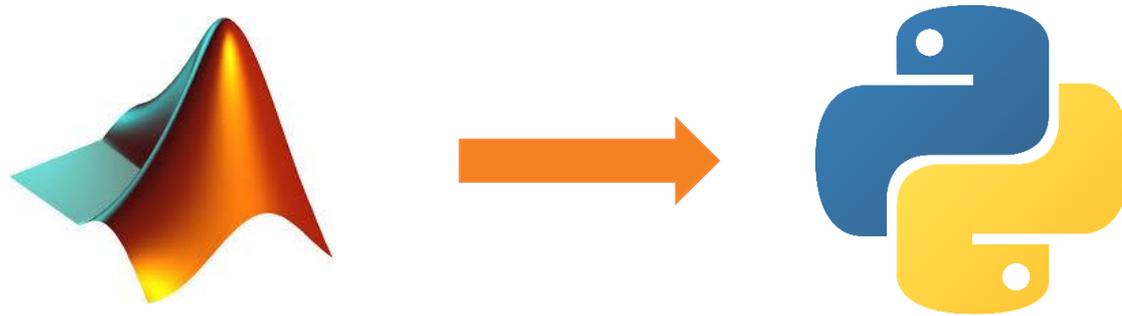


Unitised Demand Charge (applied to customer demand at time of 12 monthly network peaks) vs Average Demand at Time of Eight Highest Network Peaks.

New Developments

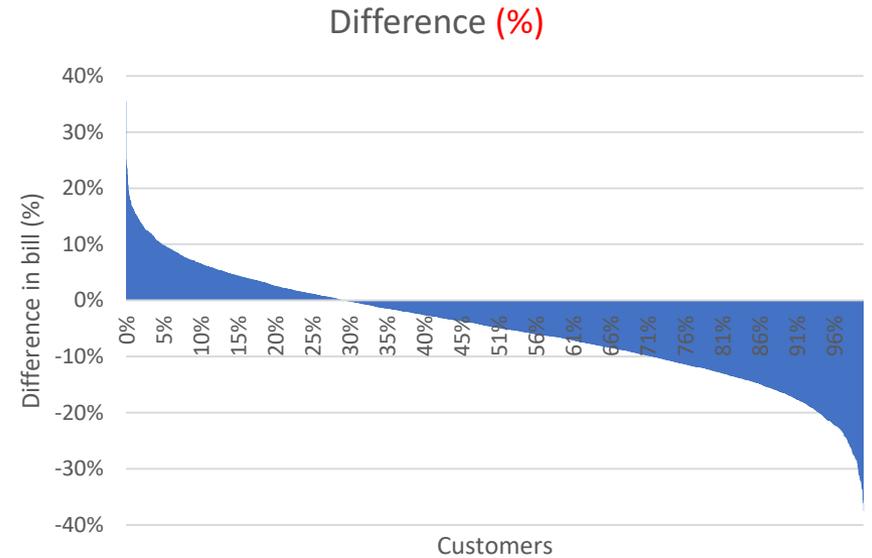
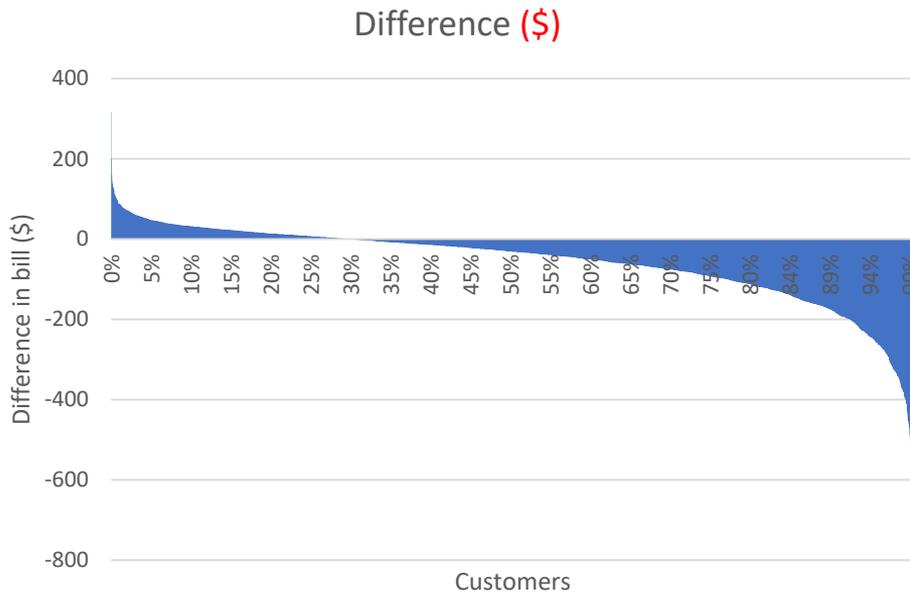
- Moving to Python
- More Analyses and Visualisation features
- Retail Tariffs (and Categorising them)
- Network, Wholesale, Retail Tariff Combined Analysis
- Distributed Resources/Response:
 - PV
 - Battery
 - Appliances
 - Demand response
 - Energy Efficiency
- Load Clustering

New Development: Converting to Python



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

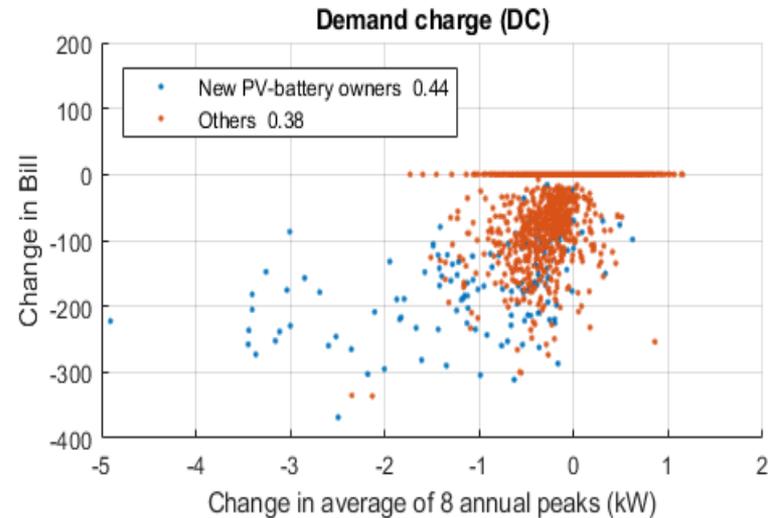
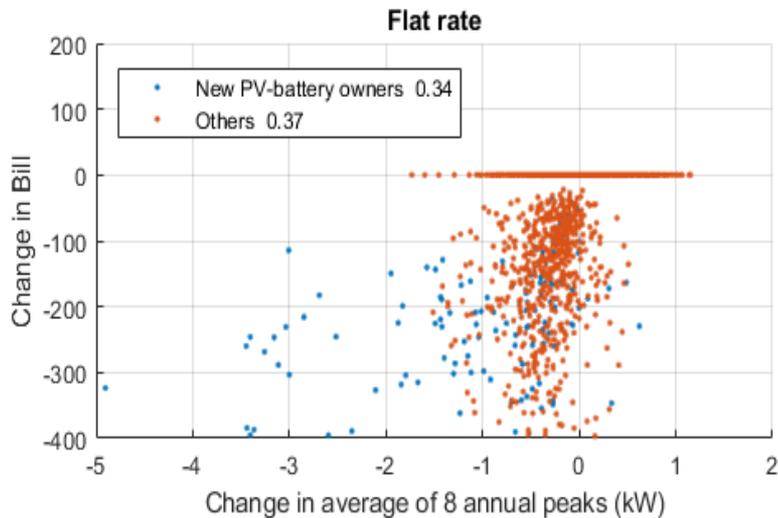
New Developments: Comparison of tariffs



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

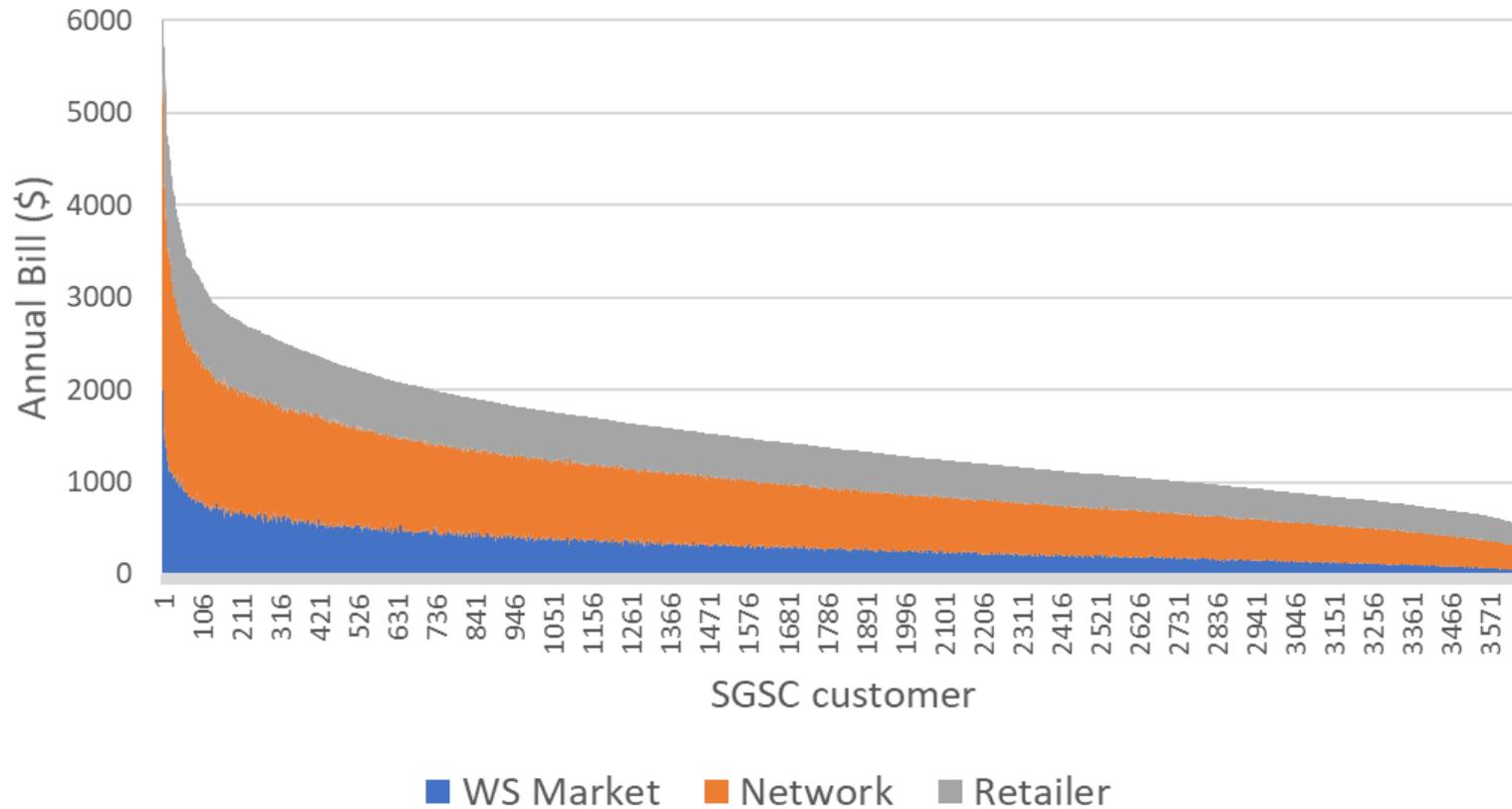
New Developments: Distributed resources

PV and battery impact on peak and other users



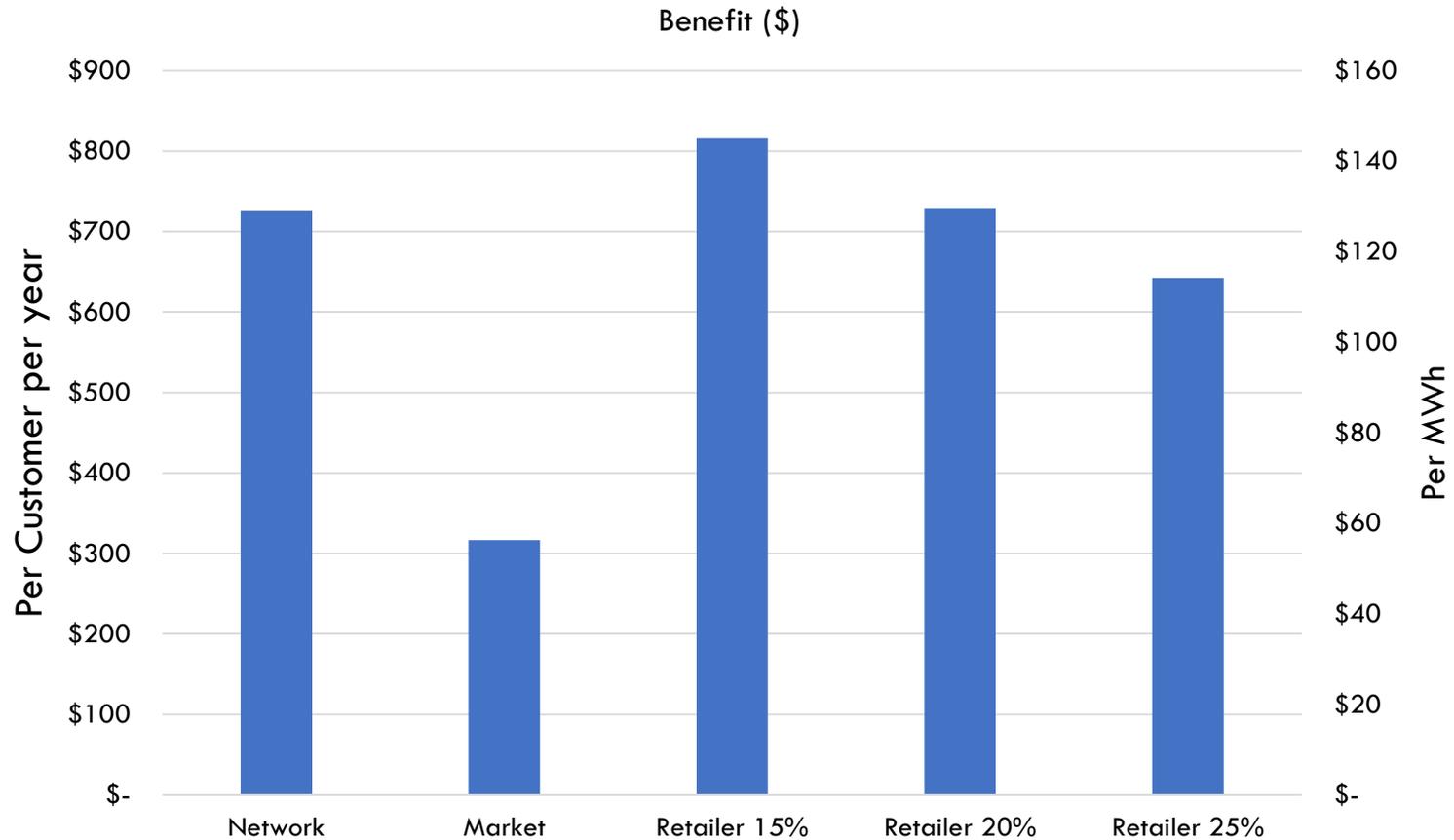
Preliminary results, using SAPN network tariffs for SGSC homes, 15% of customers having PV and battery

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

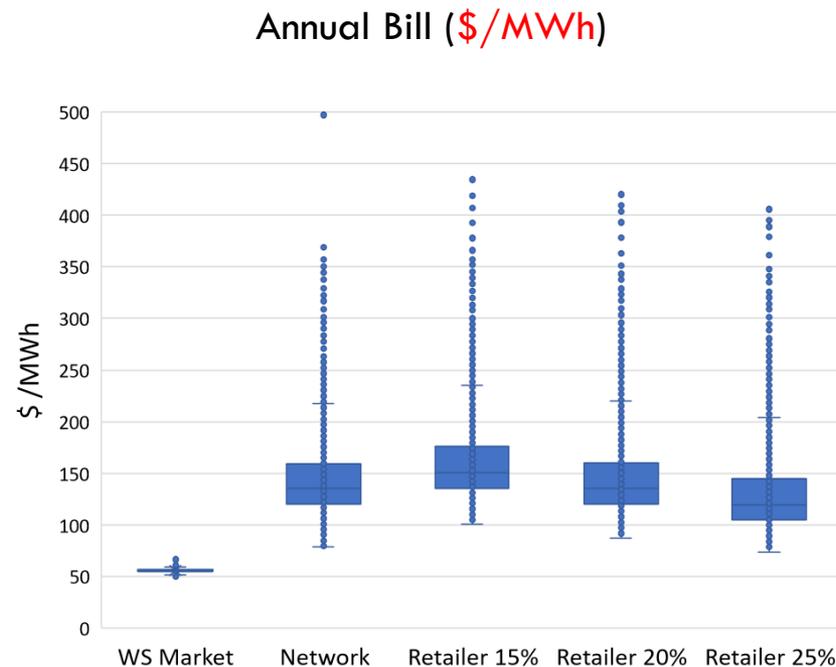
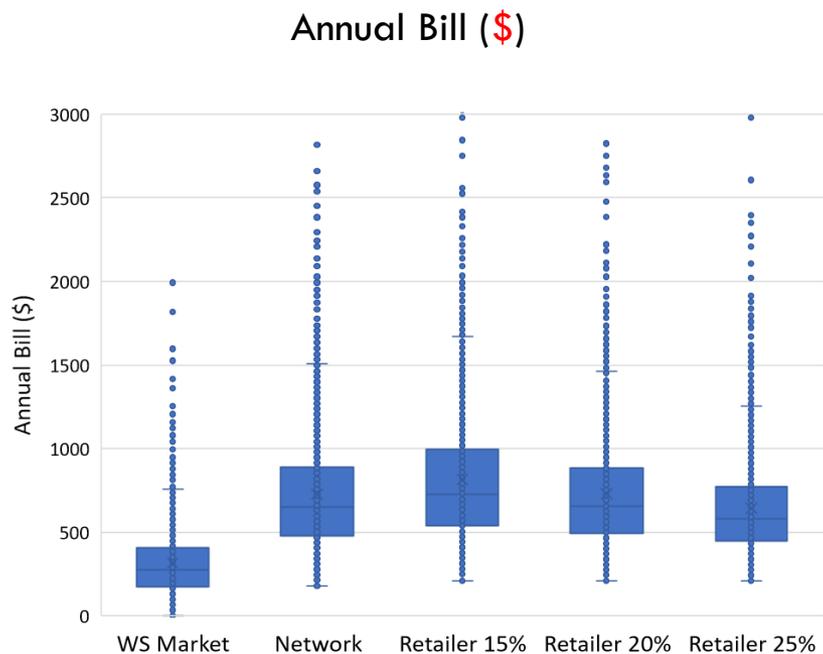
New Development: How about different discount levels?



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

New Development: How about different discount levels?

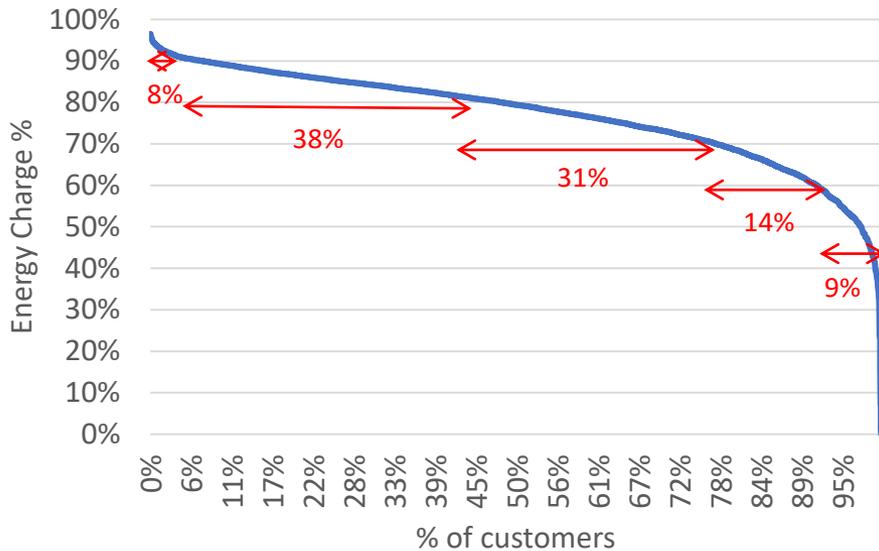
Distribution of bills



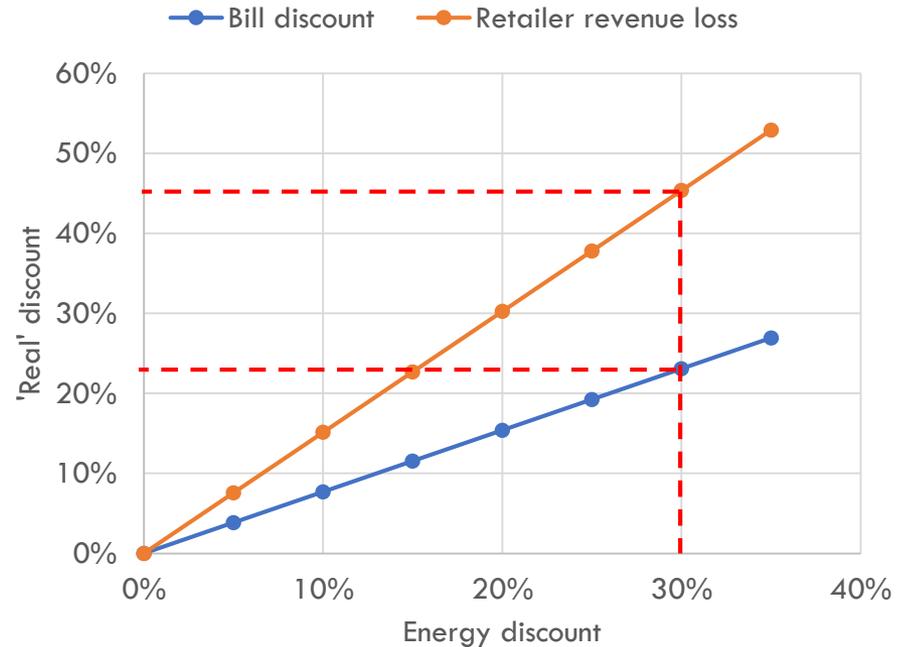
WS price and SGSC load profile are for 2013, but retail tariff is for 2018

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

Energy share of Bill (%)



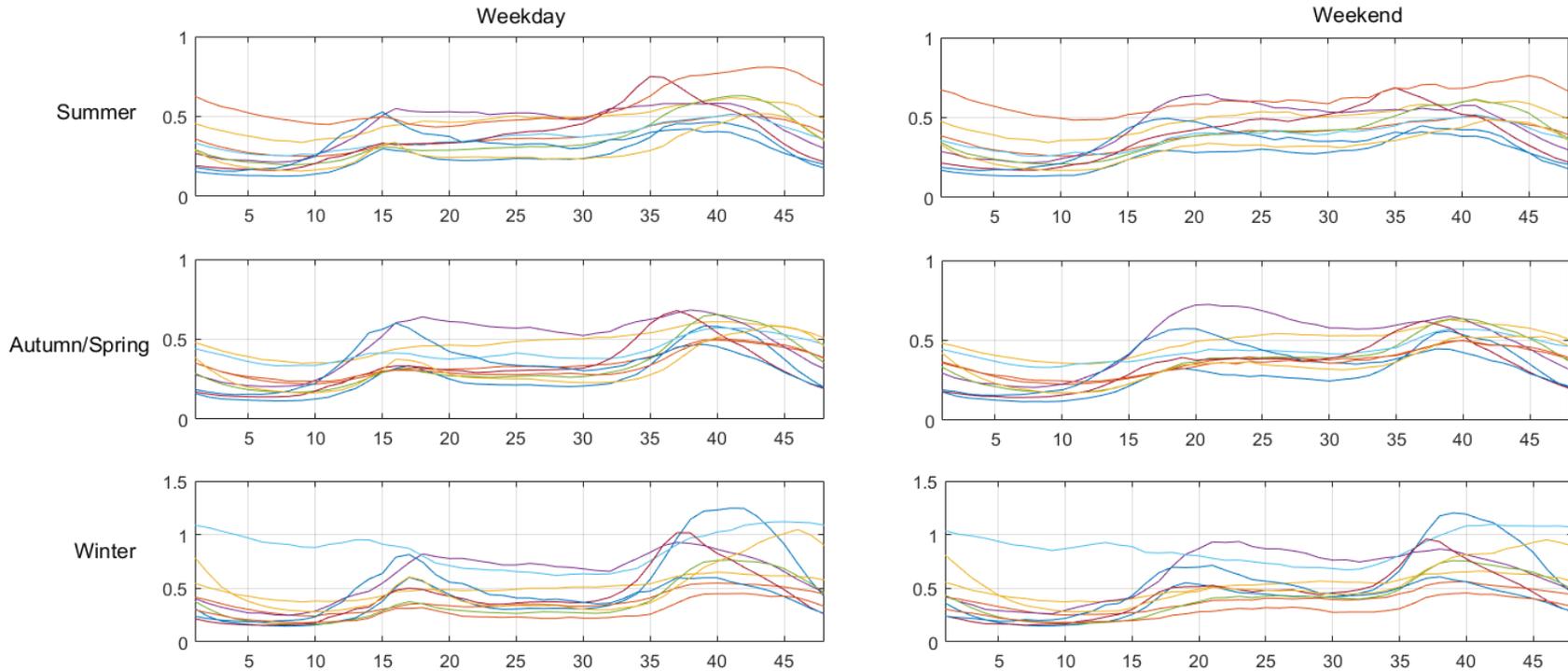
54% of customers have more than 30% of their bill from fixed charge



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

New Development: Clustering load profiles

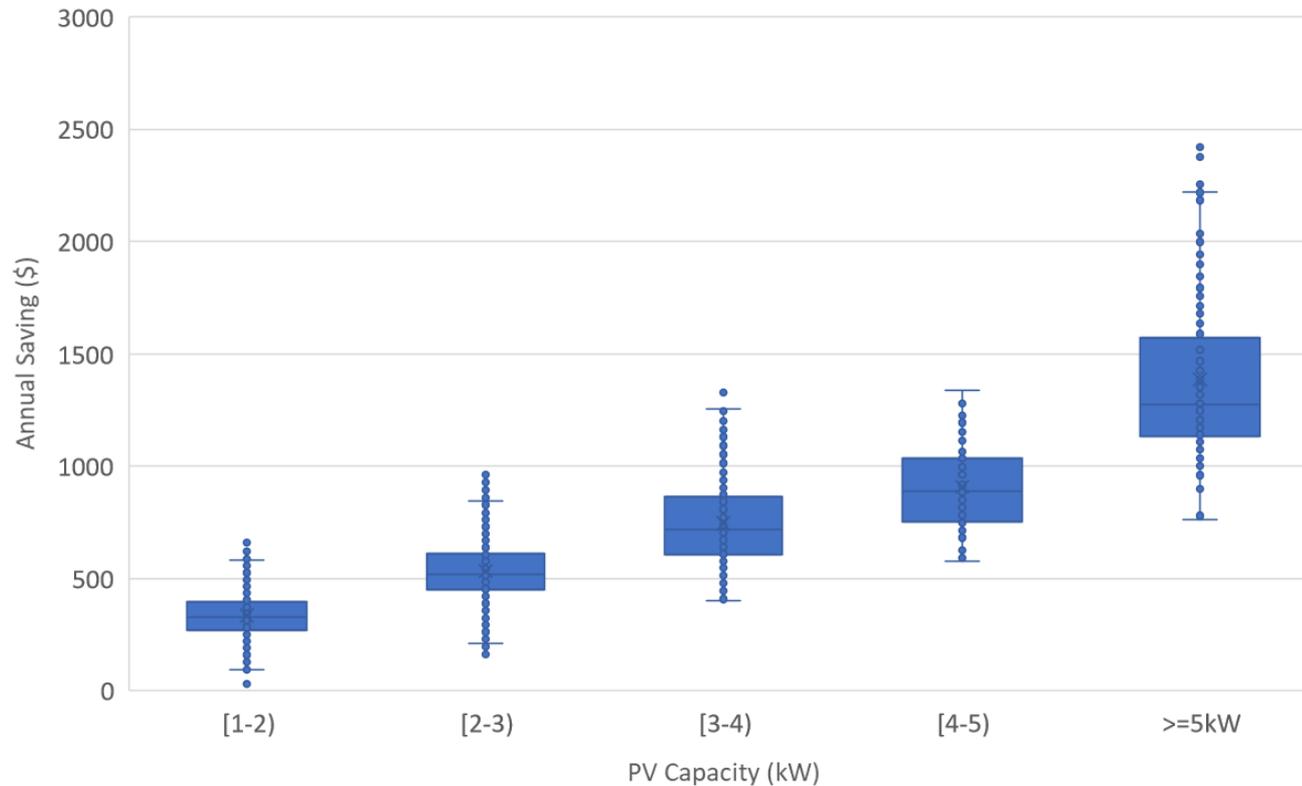
Generating groups of load profile based on daily pattern



More load profiles are [very] welcome!

New Development: Financial calculation of RE

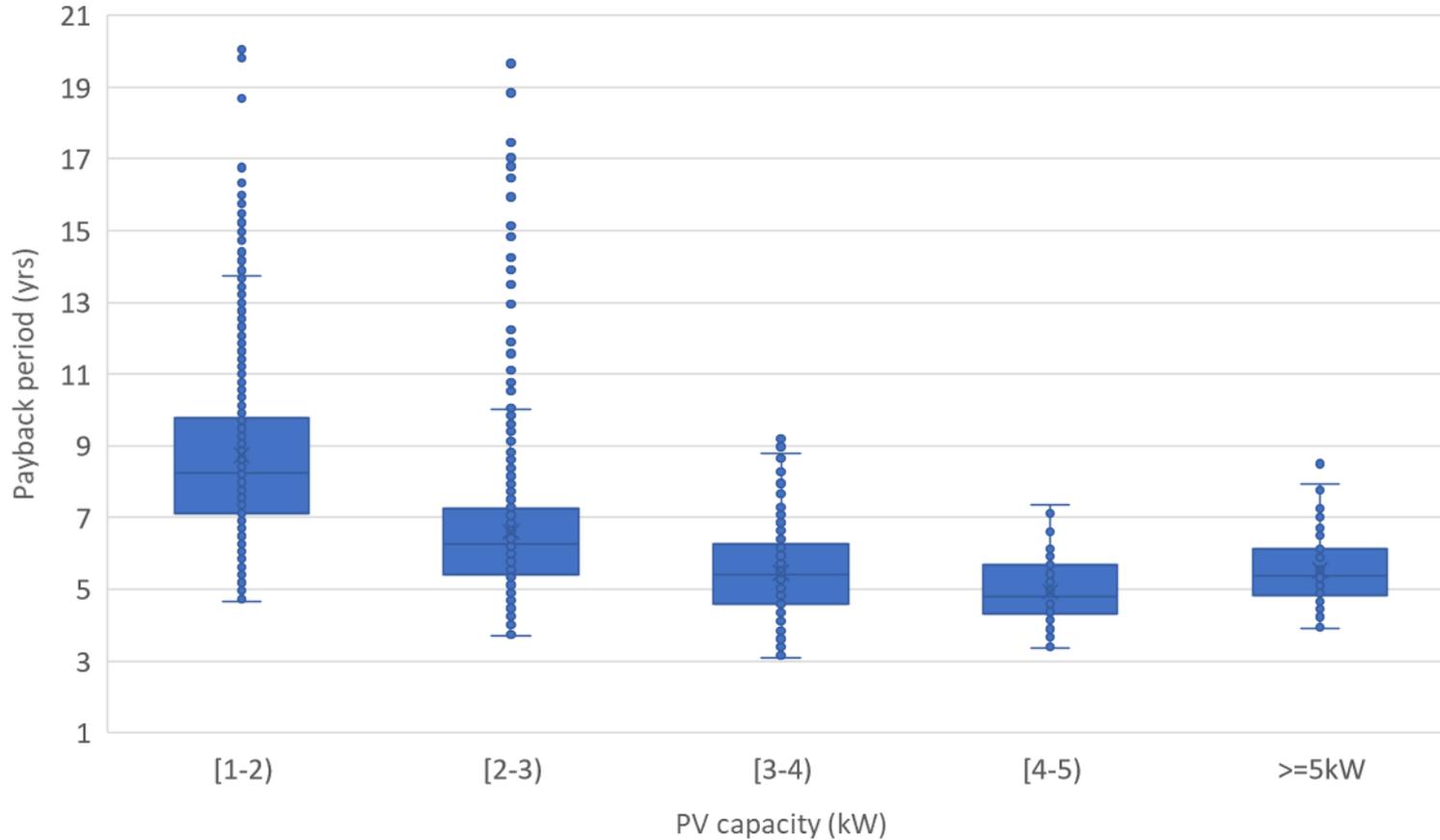
Annual saving of putting PV categorised by different size range



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

New Development: Financial calculation of RE

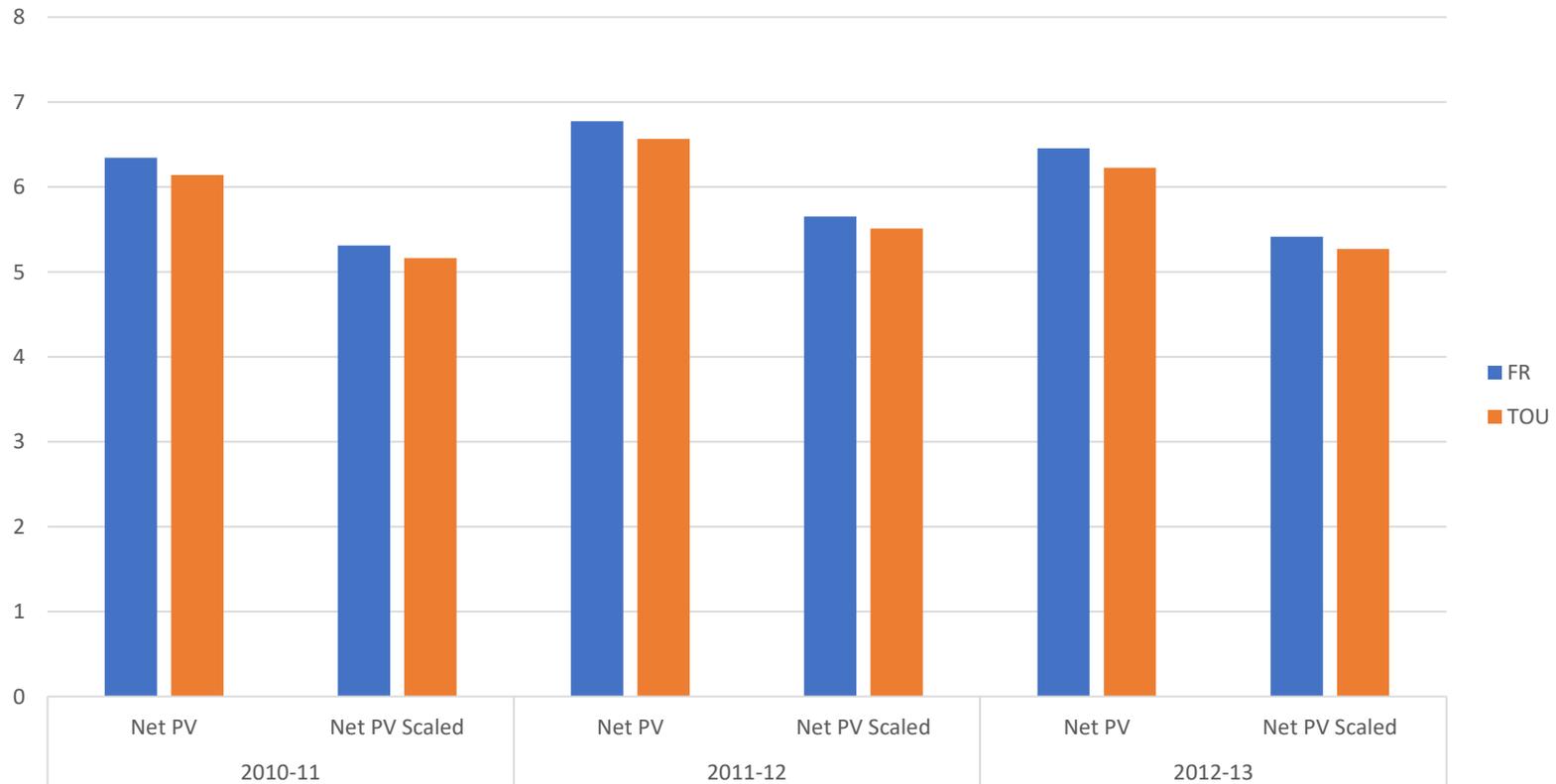
Payback period (years) of putting PV categorised by different size range



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

New Development: Financial calculation of RE

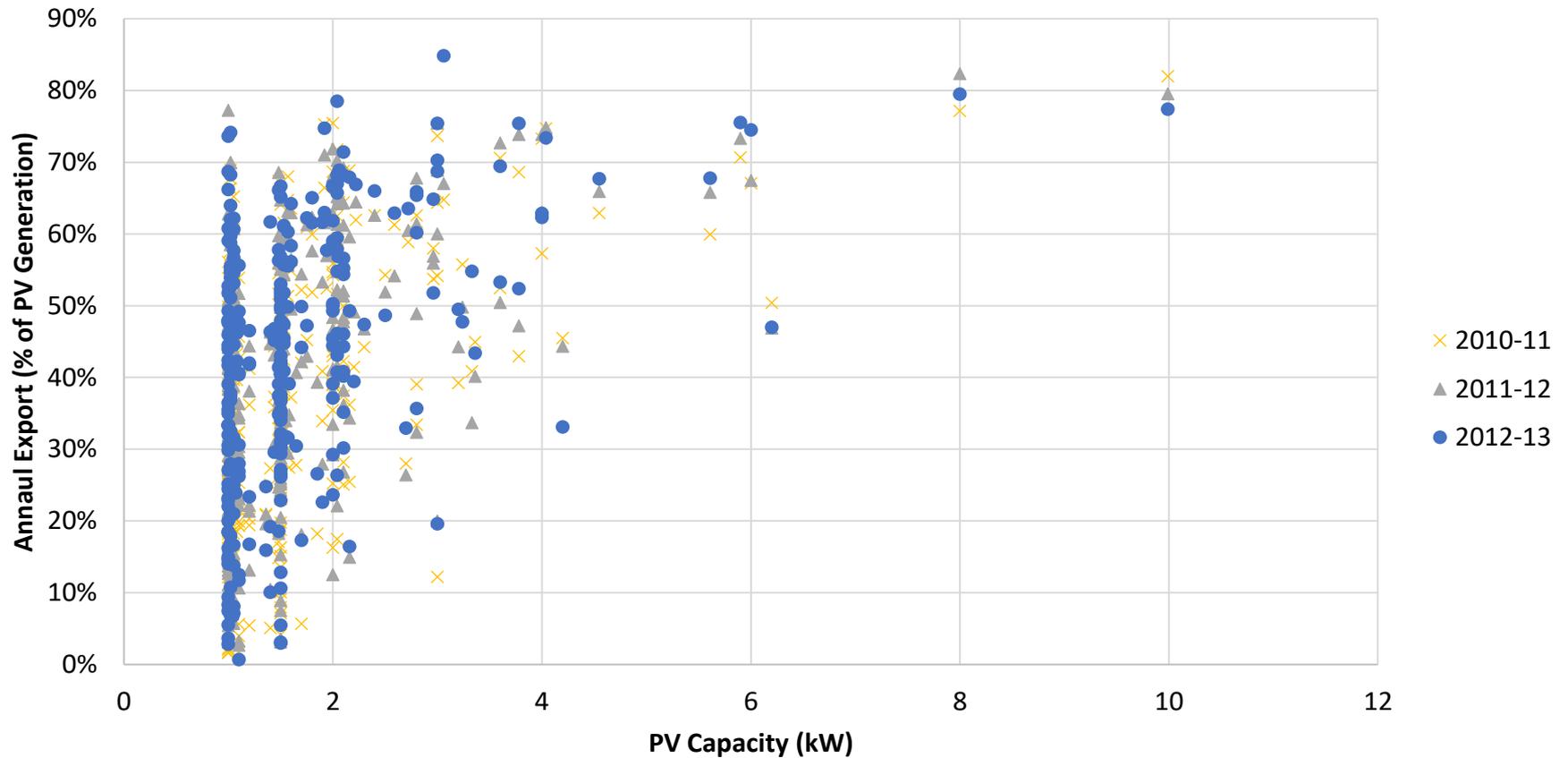
Payback period based on different years data and for scaling PV to 4 kW for flat rate and TOU tariffs



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

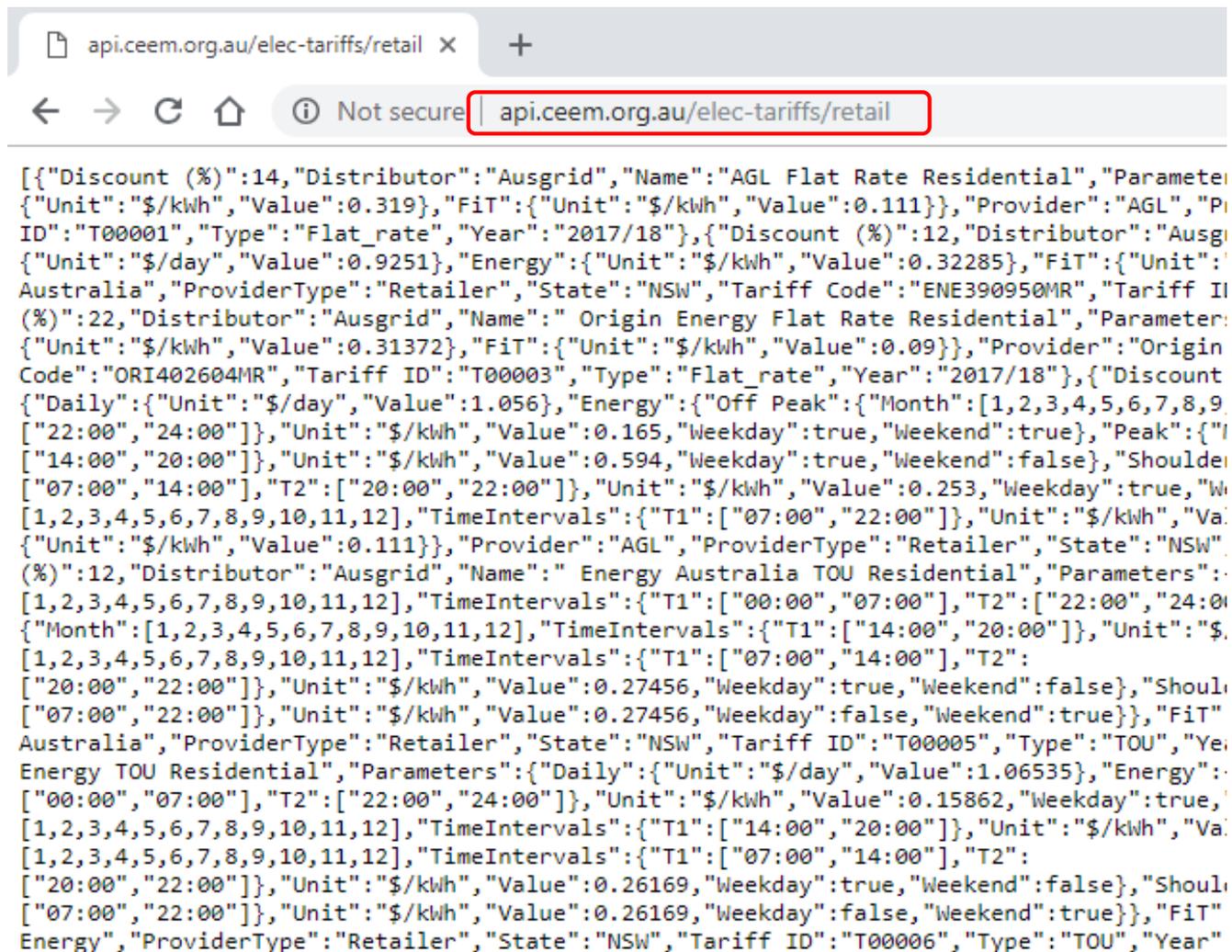
New Development: Financial calculation of RE

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



```
[{"Discount (%)":14,"Distributor":"Ausgrid","Name":"AGL Flat Rate Residential","Parameters":{"Unit":"$/kWh","Value":0.319},"FiT":{"Unit":"$/kWh","Value":0.111},"Provider":"AGL","ProviderType":"Retailer","State":"NSW","Tariff ID":"T00001","Type":"Flat_rate","Year":"2017/18"},{"Discount (%)":12,"Distributor":"Ausgrid","Name":"Origin Energy Flat Rate Residential","Parameters":{"Unit":"$/kWh","Value":0.31372},"FiT":{"Unit":"$/kWh","Value":0.09},"Provider":"Origin Energy","ProviderType":"Retailer","State":"NSW","Tariff ID":"ORI402604MR","Type":"Flat_rate","Year":"2017/18"},{"Discount (%)":22,"Distributor":"Ausgrid","Name":"Energy Australia TOU Residential","Parameters":{"Unit":"$/kWh","Value":0.111},"Provider":"AGL","ProviderType":"Retailer","State":"NSW","Tariff ID":"T00005","Type":"TOU","Year":"2017/18"},{"Discount (%)":12,"Distributor":"Ausgrid","Name":"Energy Australia TOU Residential","Parameters":{"Unit":"$/kWh","Value":0.111},"Provider":"AGL","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

