



LOW CARBON LIVING
CRC

Student Pecha Kucha Presentations

Moiz Syed

Jessica Breadsell

Paula Hansen

Lio Hebert

Sebastian Davies-Slate

Portia Odell

Roberto Minunno and Tim O'Grady



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Next presenter:
Moiz Syed

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>



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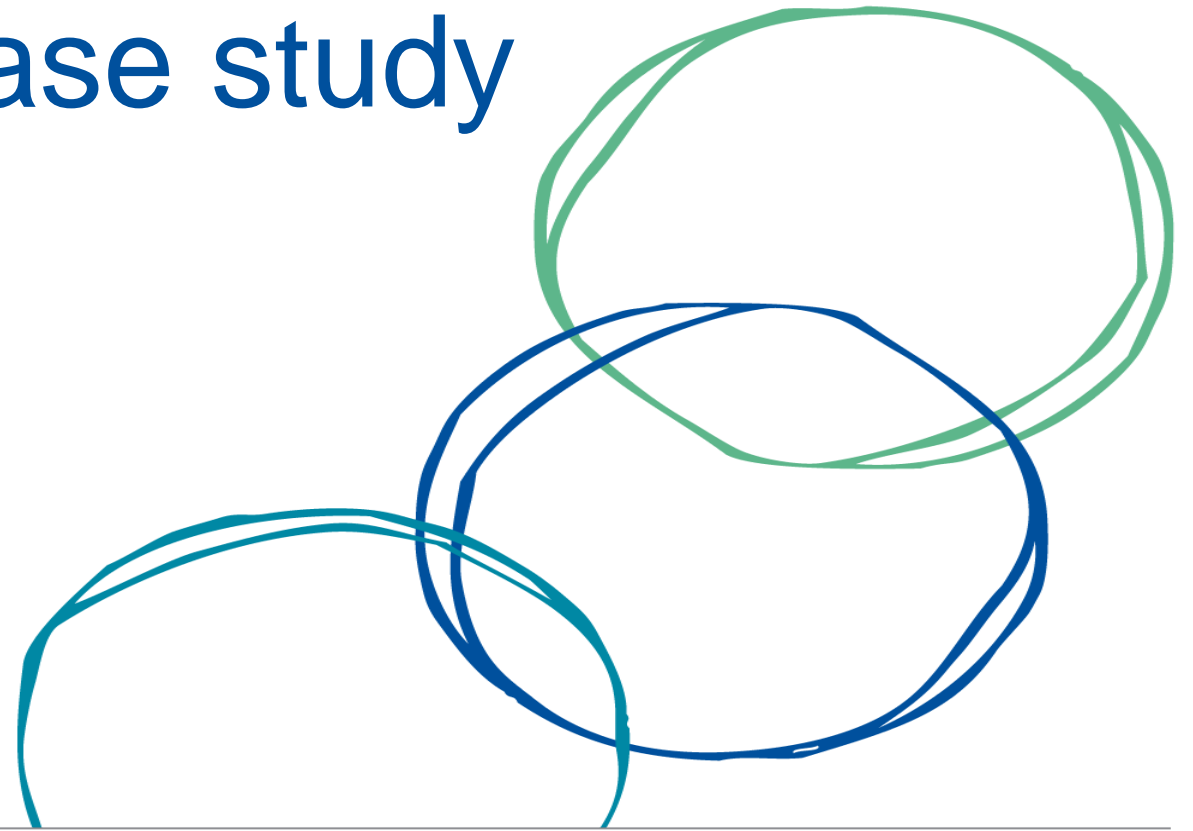


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Solar and battery storage in Apartments: Gen Y case study

Moiz Syed

m.syed13@postgrad.curtin.edu.au



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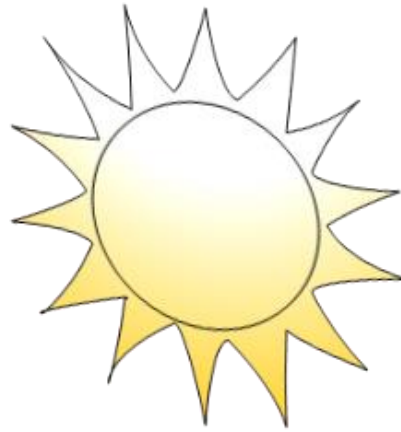
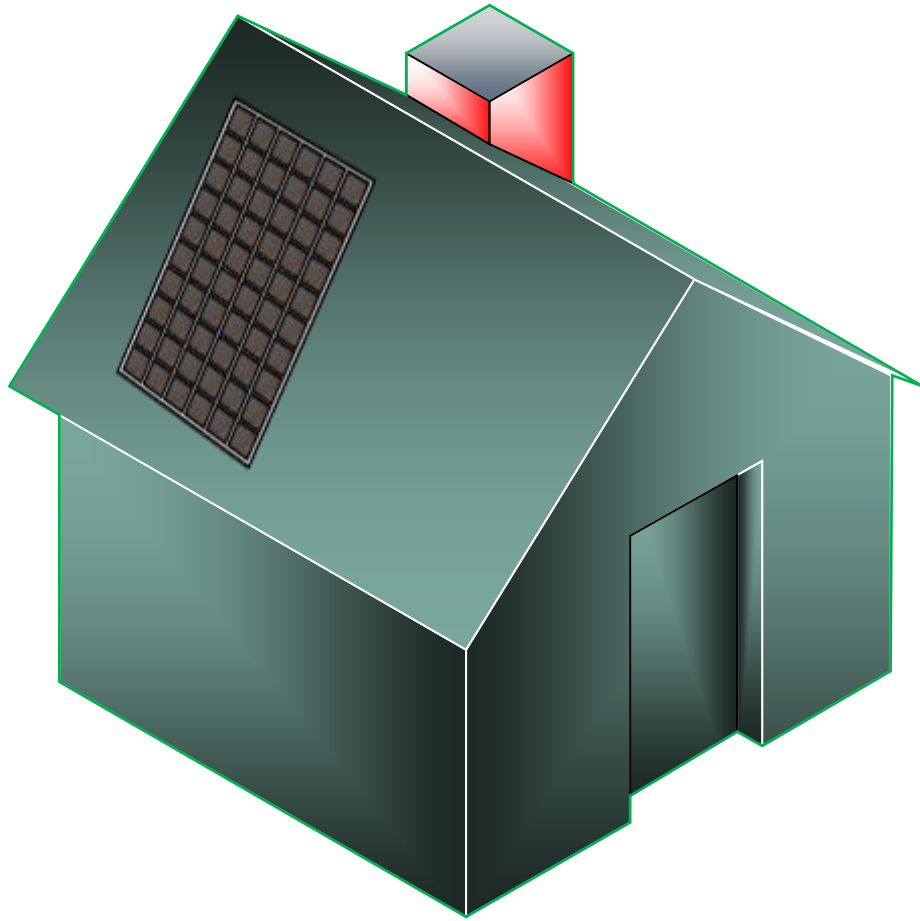


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Credit: http://www.visahelpaustralia.com/resources/skills_assessment_authorities

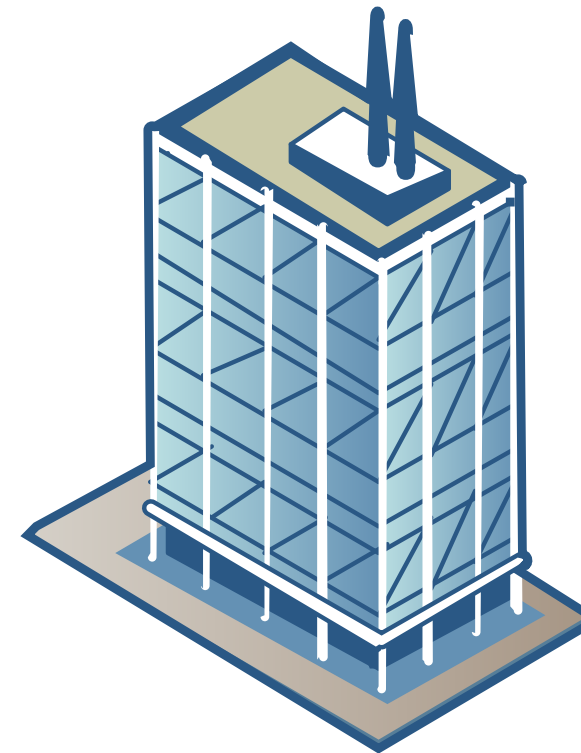
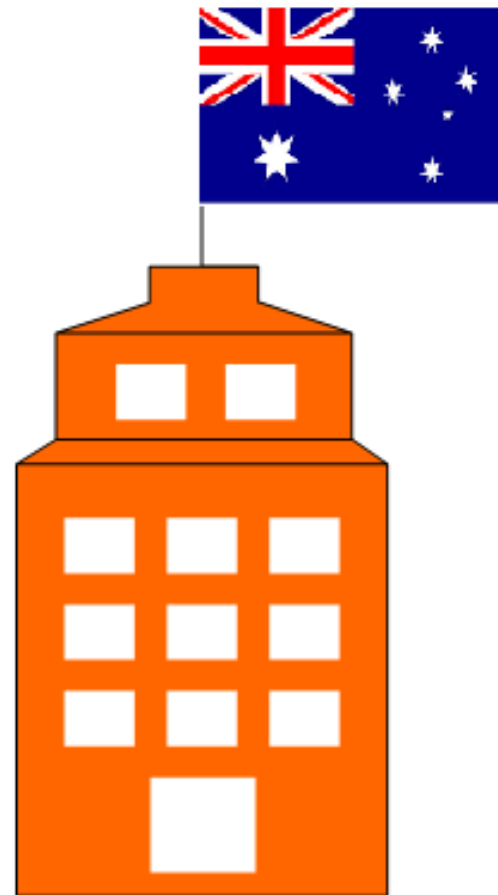
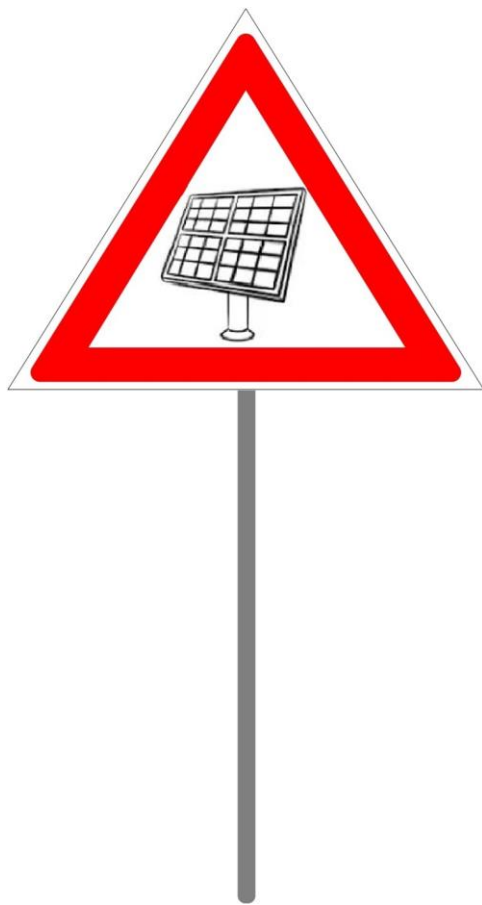


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1.5 million





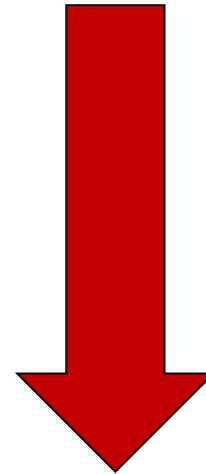
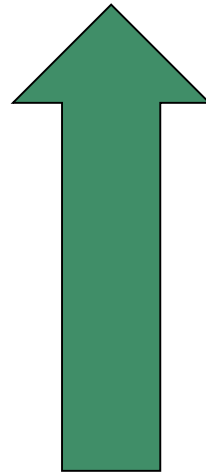
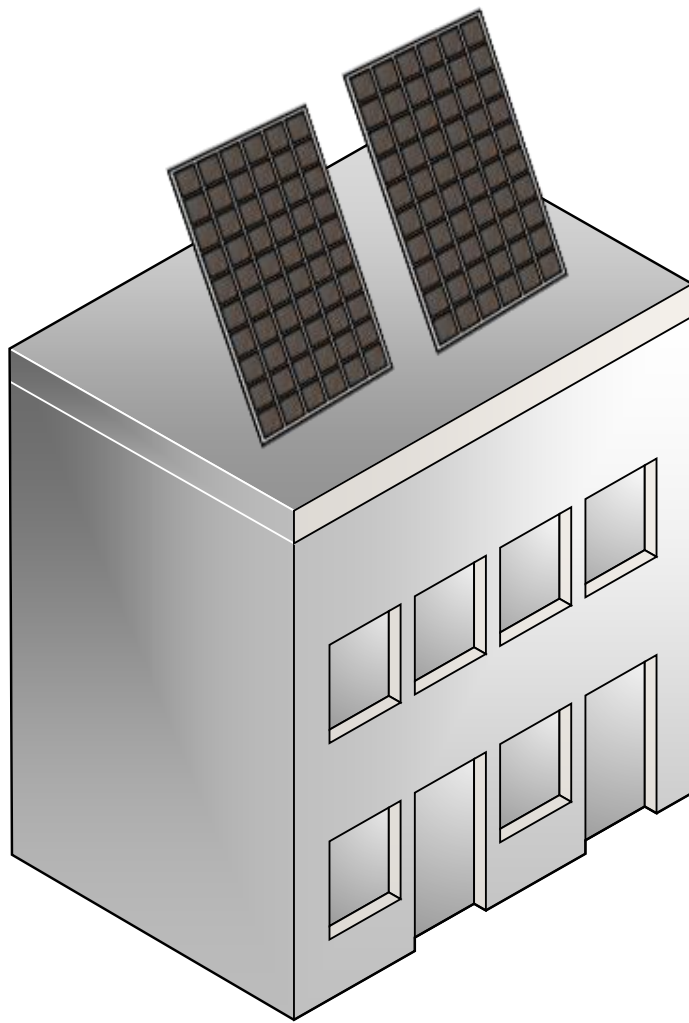


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Credit: Josh Byrne & Associate JBA



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Evermore

GenY



SHAC



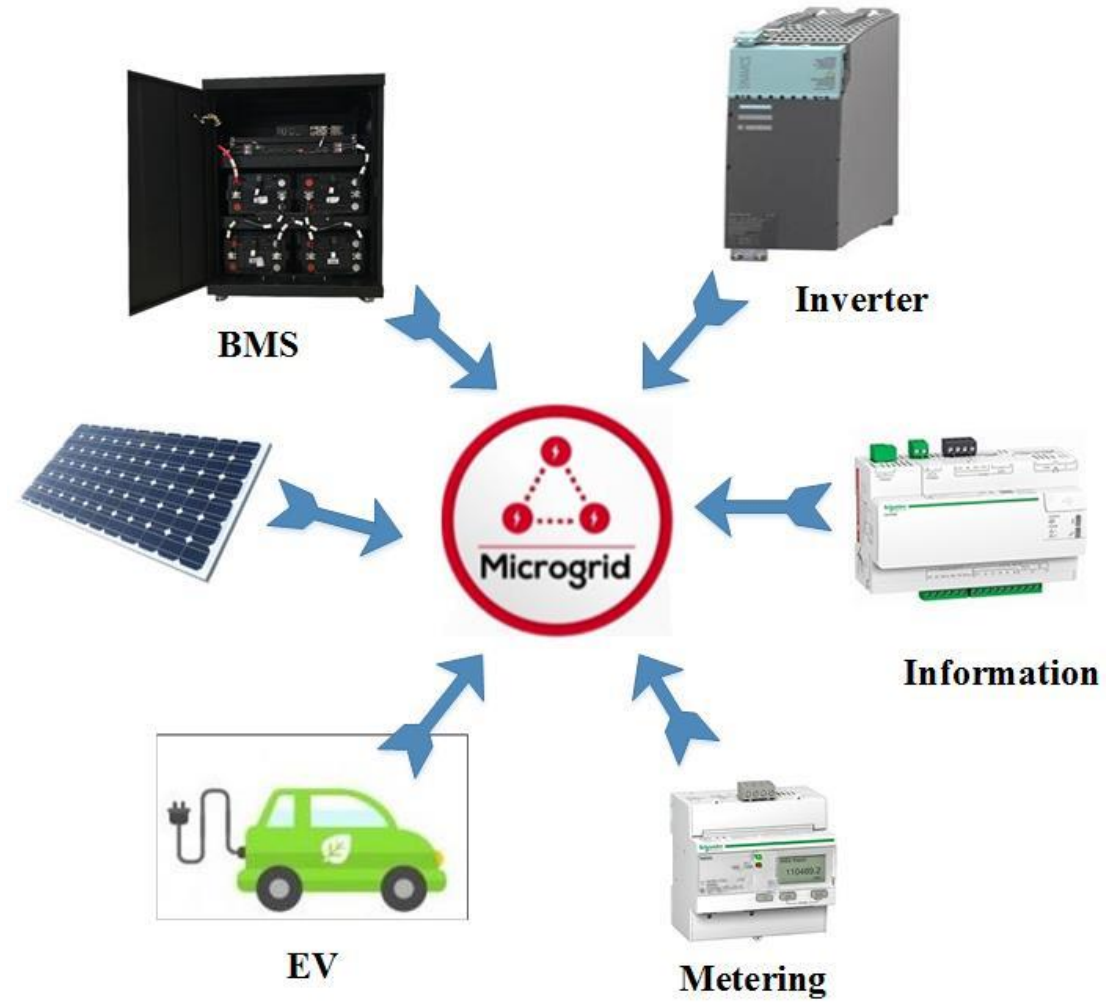
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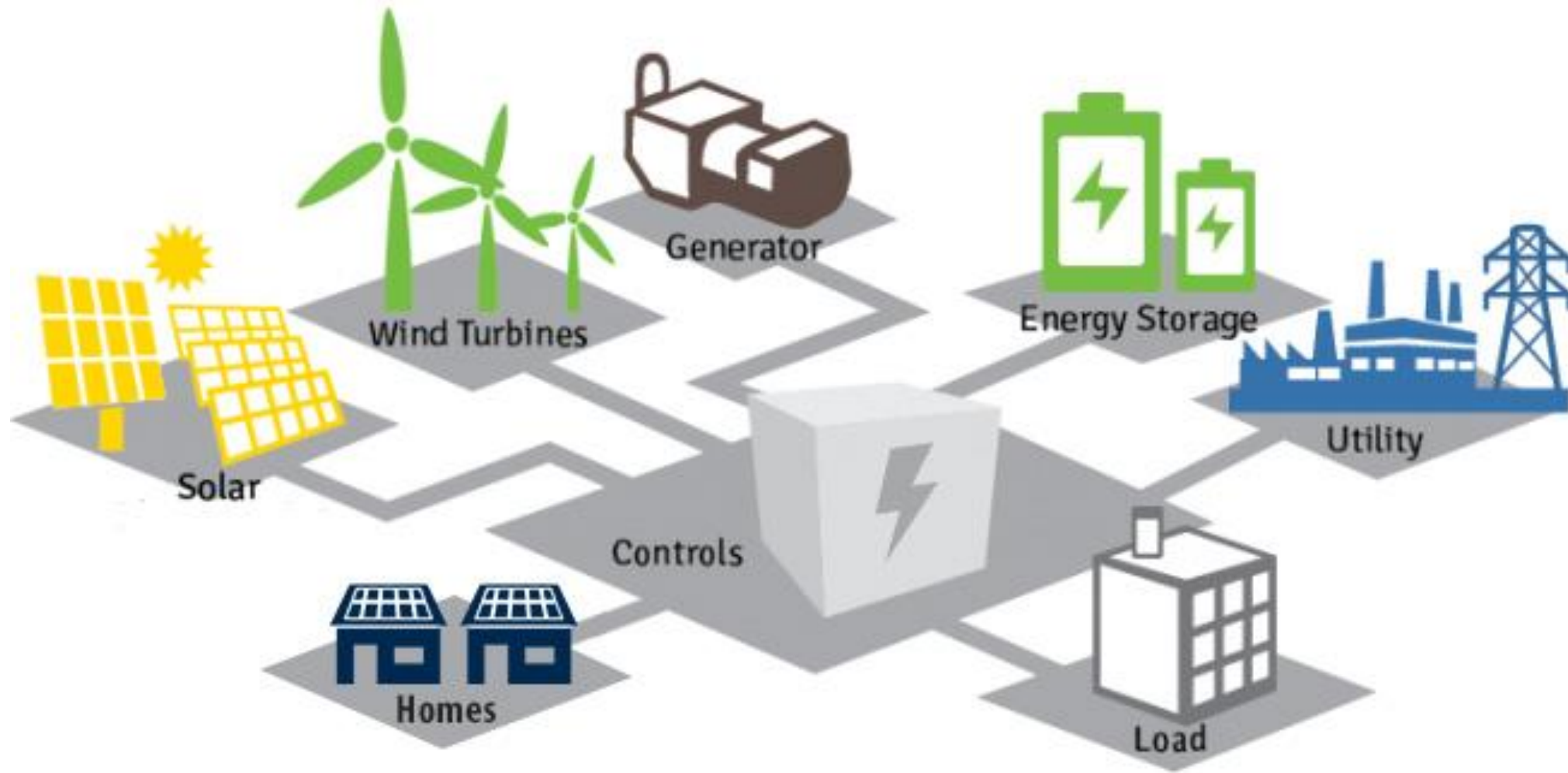
Credit: David Bar Architects; Sustainablehousetoday.com
www.sustainabilitymatters.net.au/content/sustainability/case-study/wa-apartment-building-offers-peer-to-peer-power-trading-1519225557

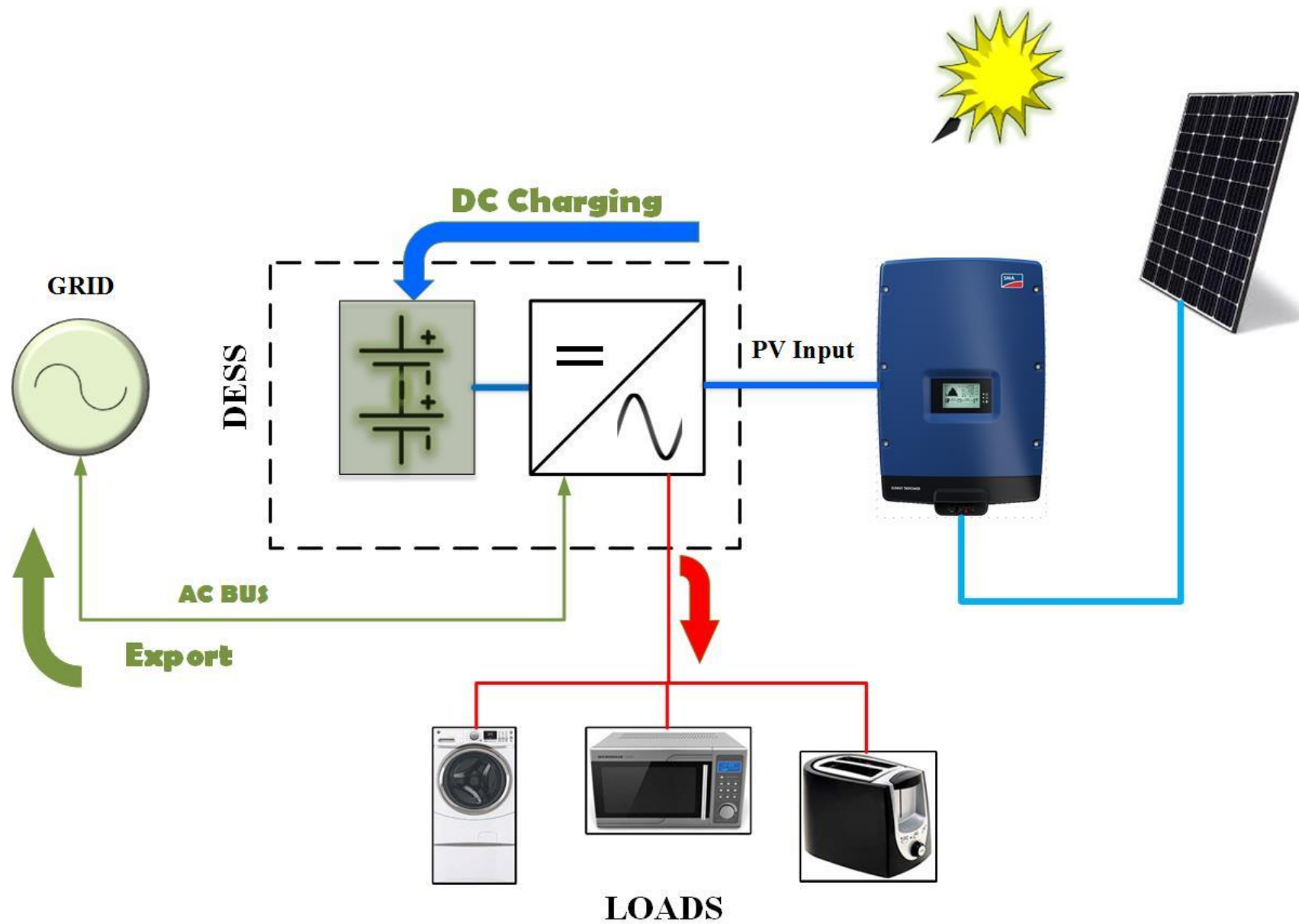


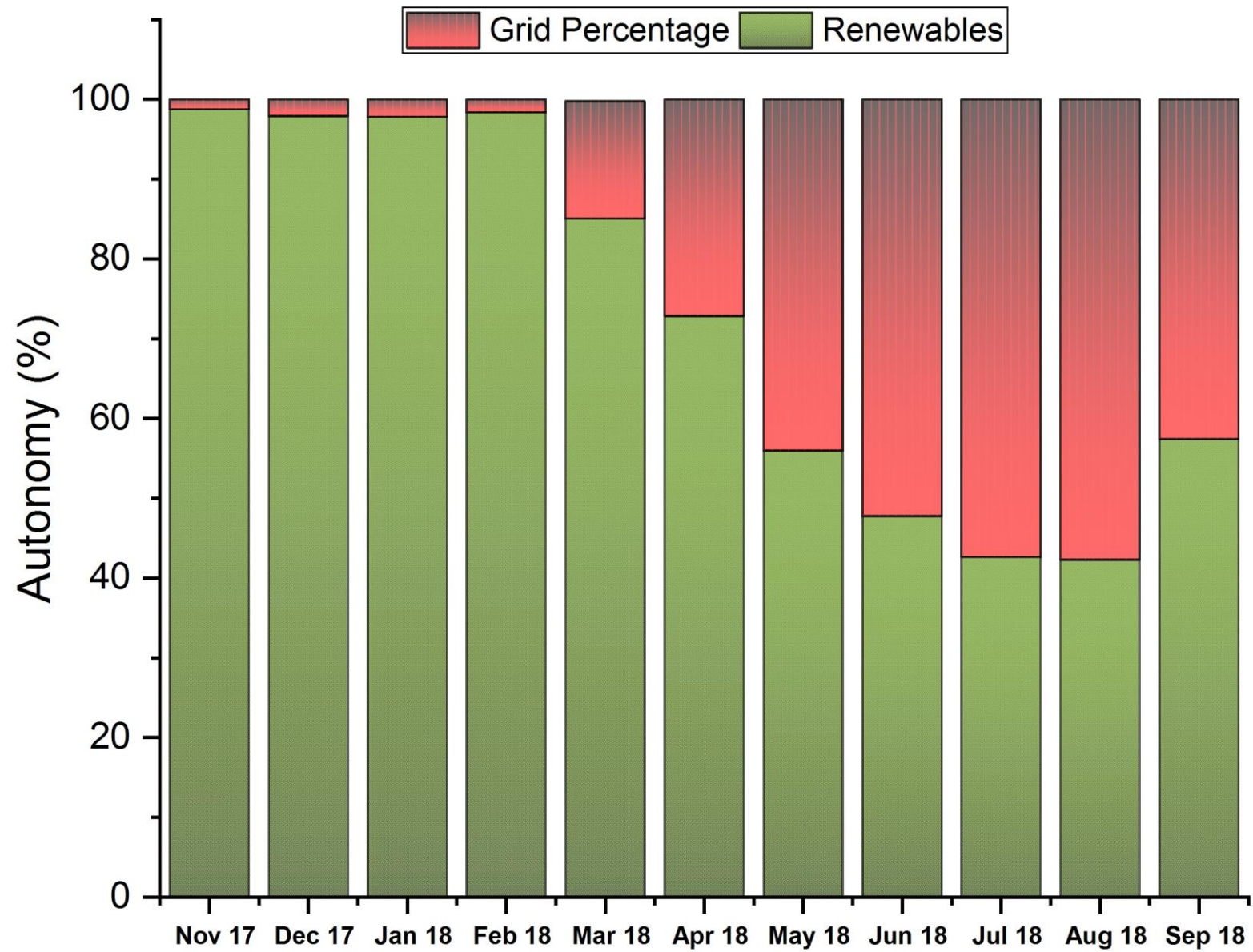
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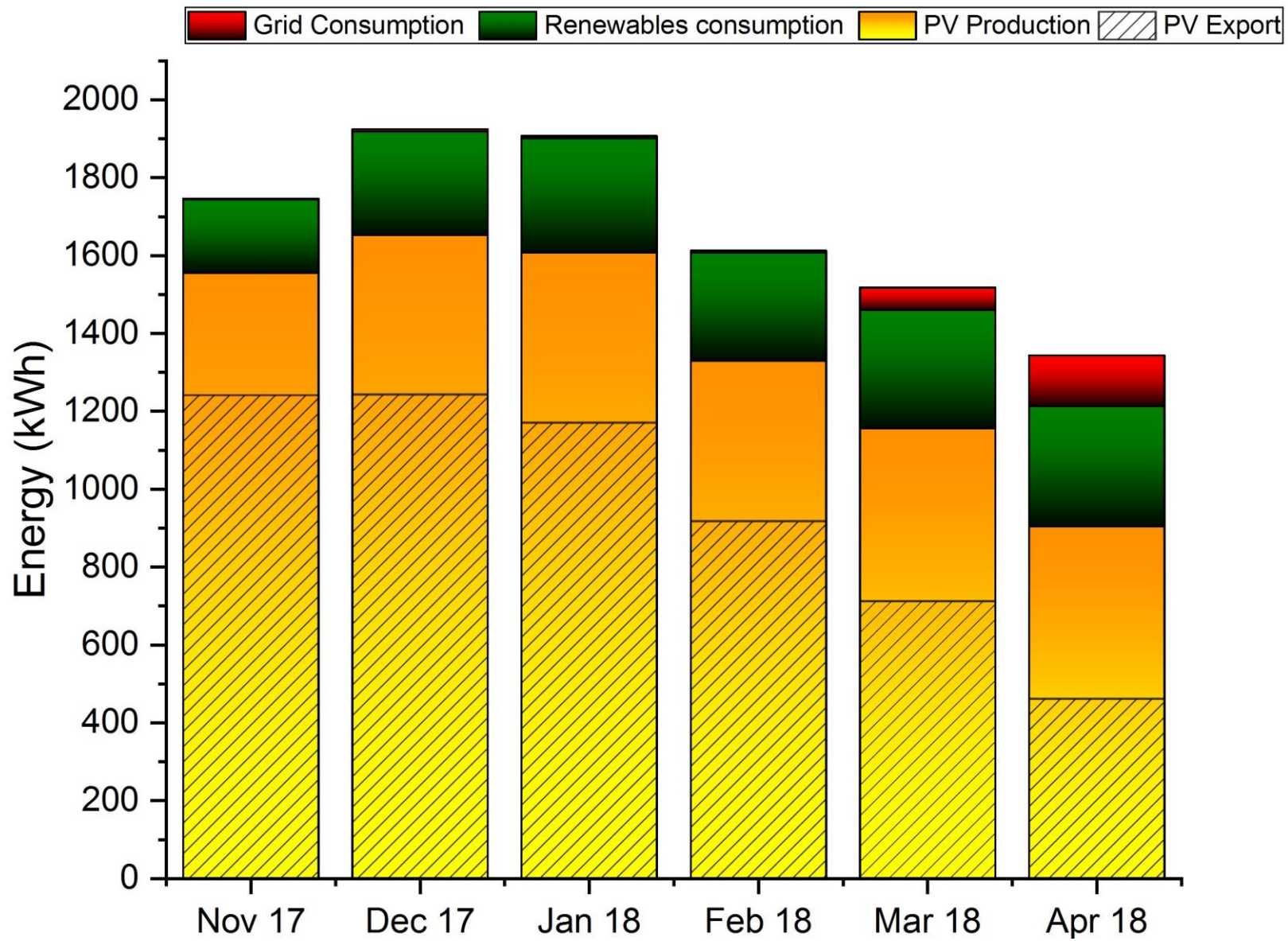
Technological Niches

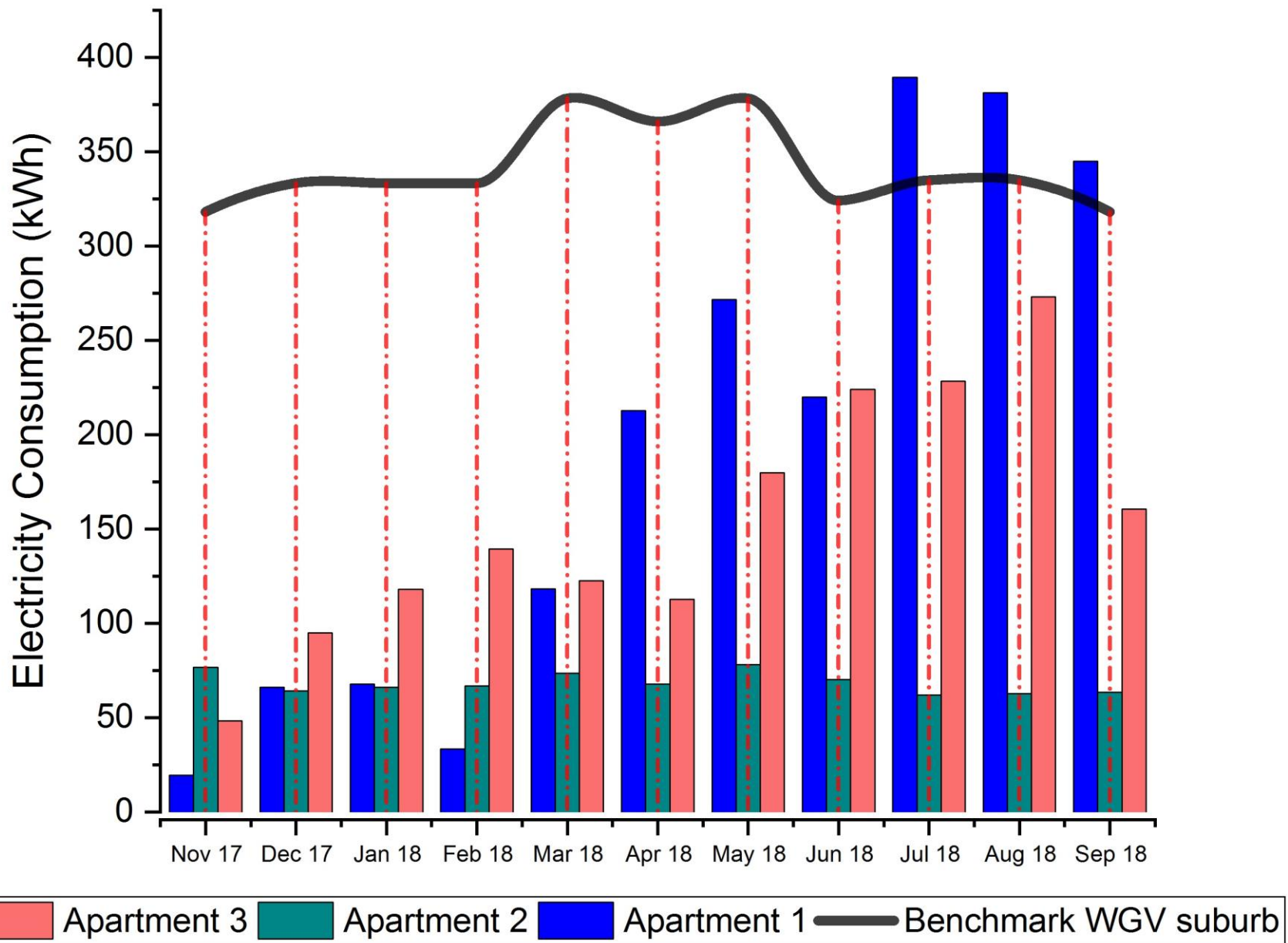


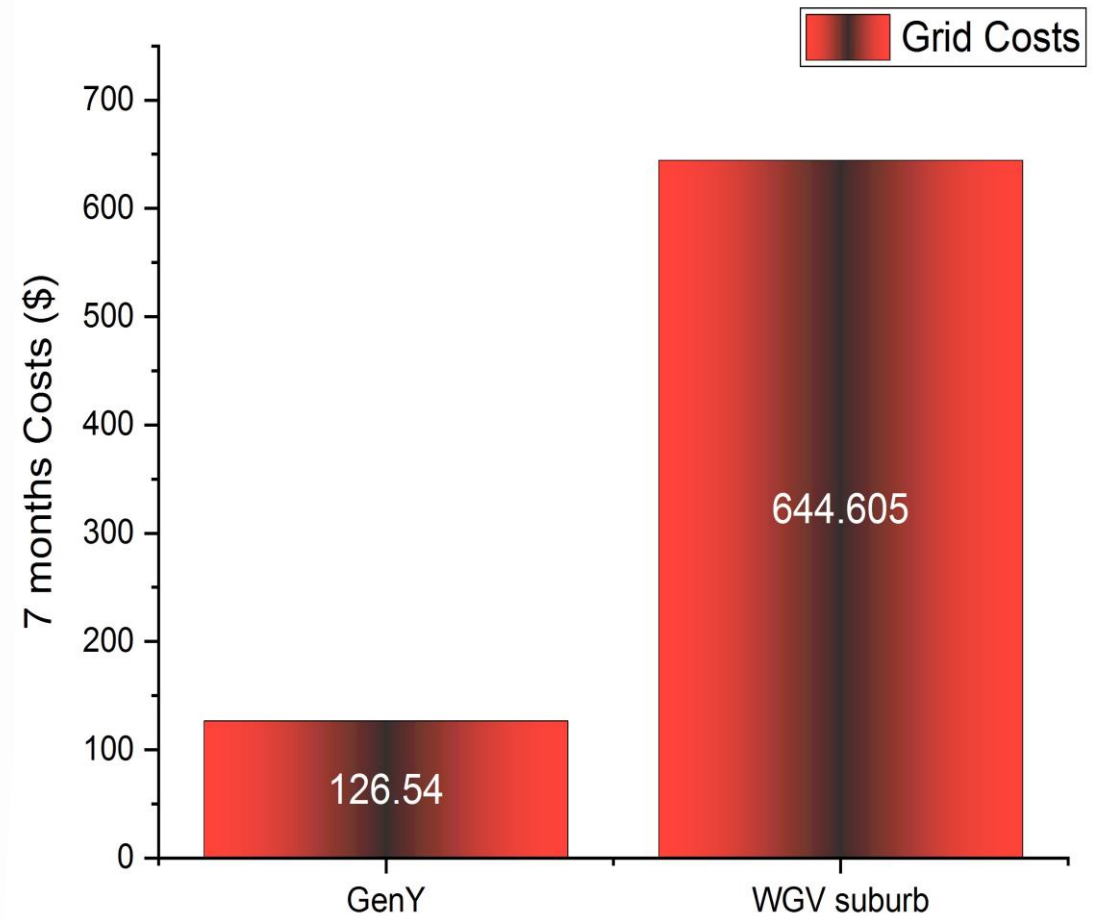
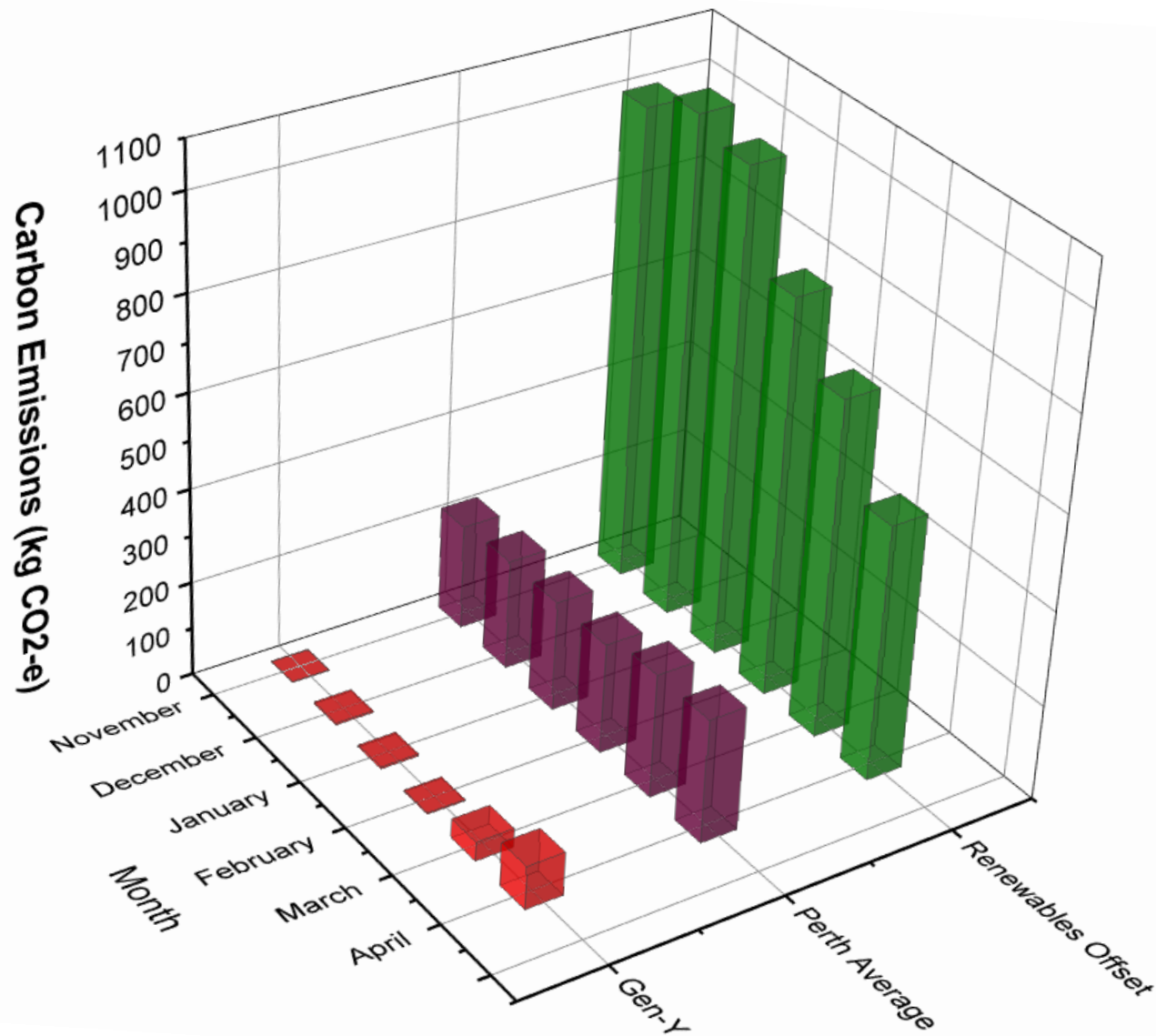






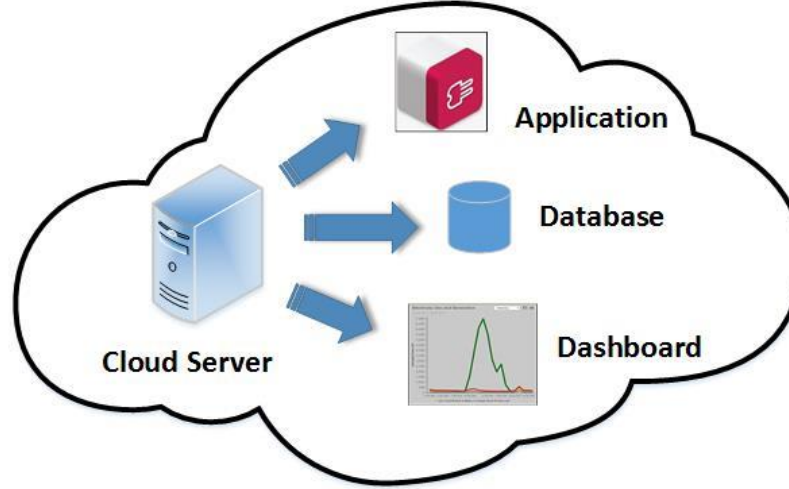
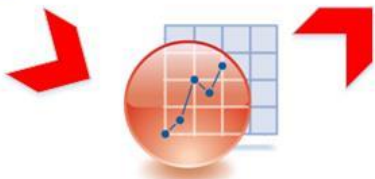




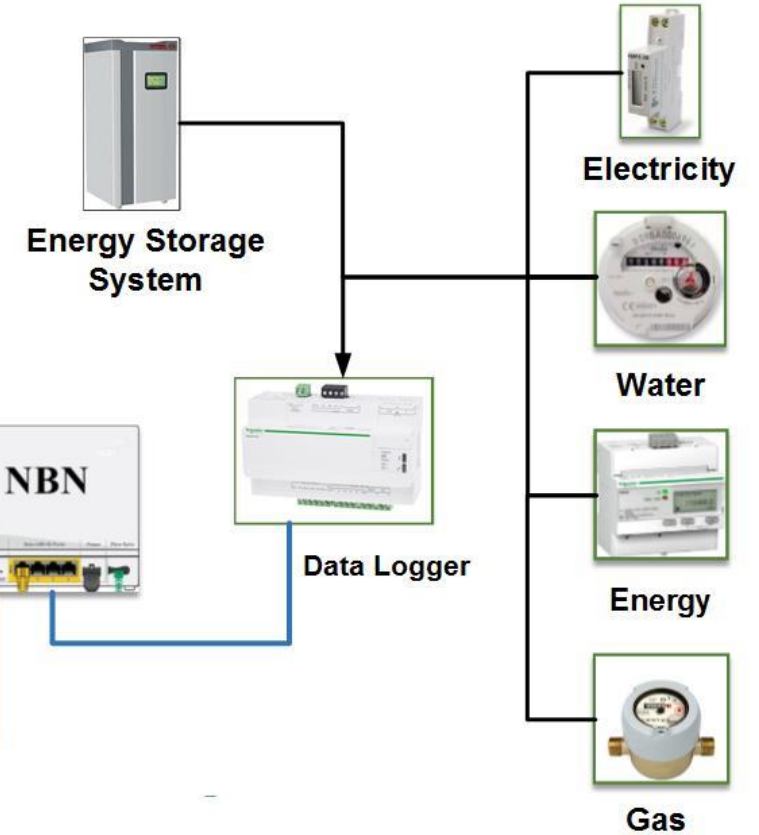


WGV cloud

Data collection and processing

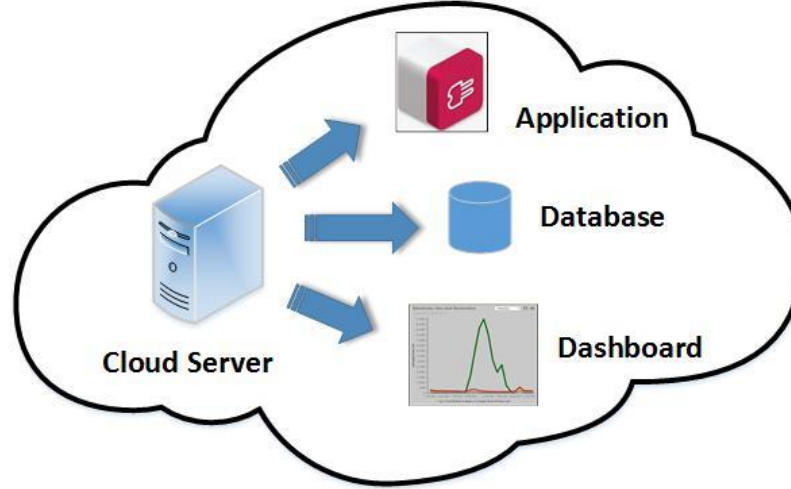
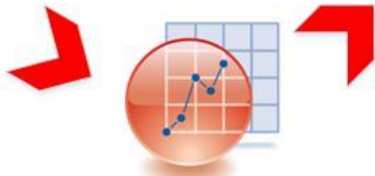


Onsite devices

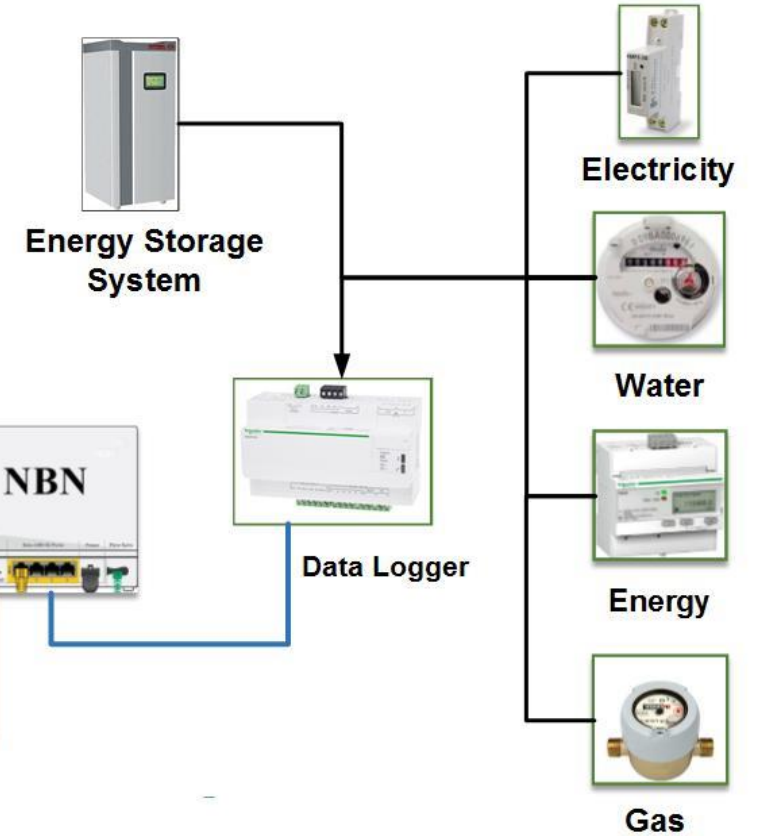


WGV cloud

Data collection and processing



Onsite devices



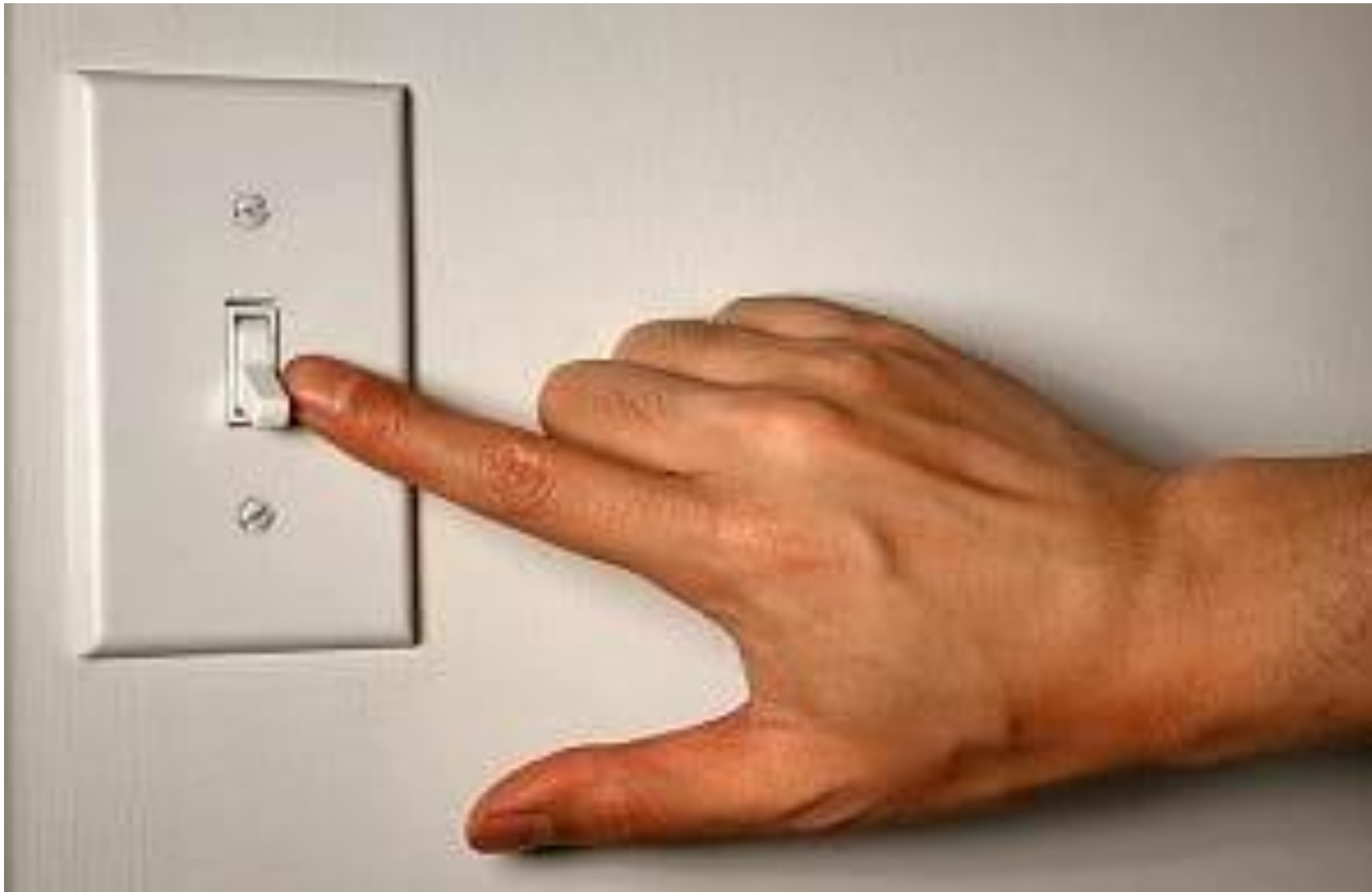


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Credit: <https://pptrns.com/?scid=23>
<https://www.telegraph.co.uk/education/stem-awards/digital/importance-of-data-visualisation/>



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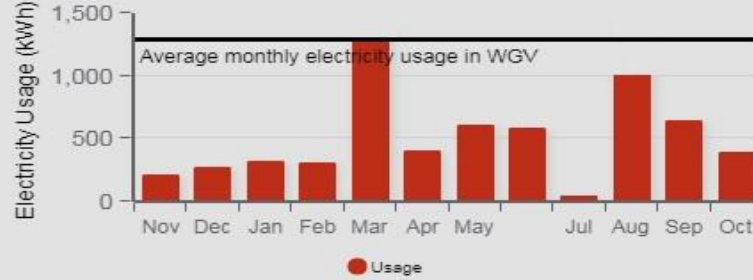


Electricity Usage

Last 12 Months ▾



1/11/2017 - 25/10/2018



Gas Usage

Last 12 Months ▾

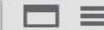


1/11/2017 - 25/10/2018

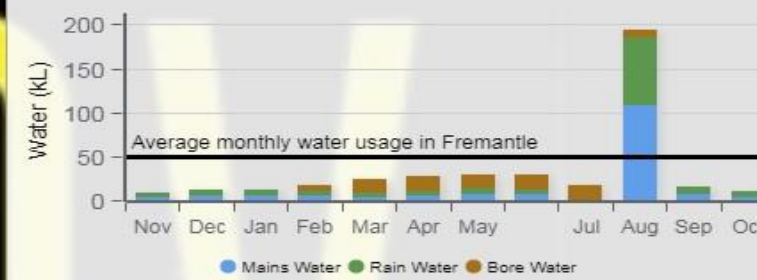


Water Usage

Last 12 Months ▾



1/11/2017 - 25/10/2018

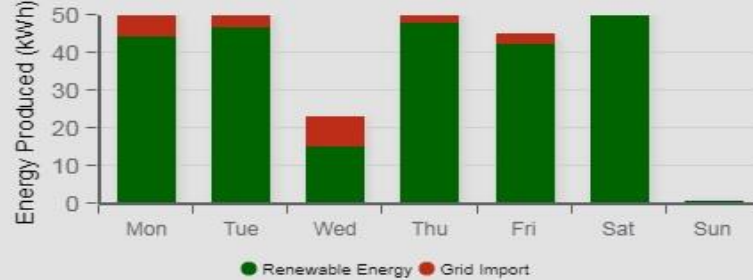


Electricity Supply

Last 7 Days ▾



22/10/2018 - 28/10/2018

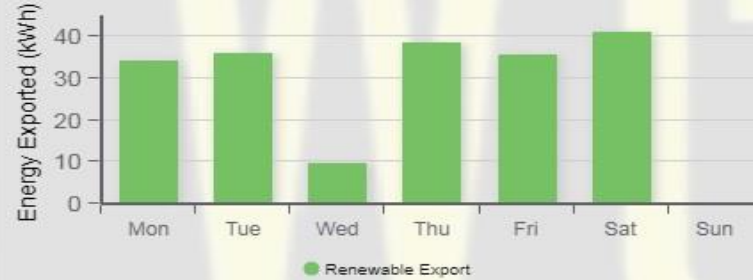


Electricity Export

Last 7 Days ▾



22/10/2018 - 28/10/2018



Solar Battery Charging

Last 24 Hours ▾



27/10/2018 2:00 AM - 28/10/2018 1:28 AM

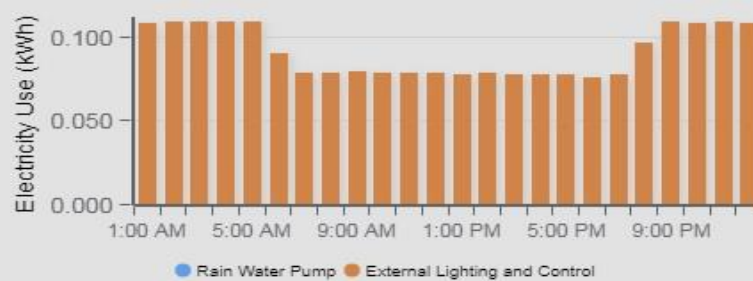


House Services Load

Yesterday ▾



27/10/2018 - 27/10/2018

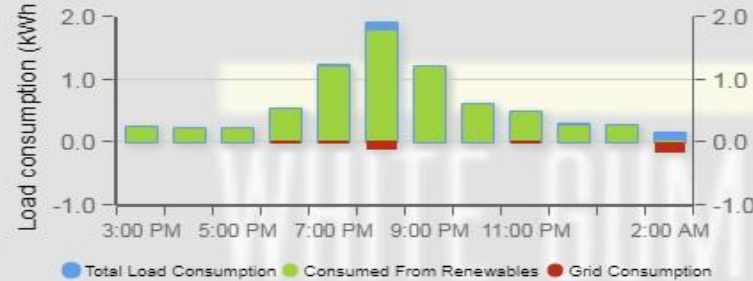


Load Comparison

Last 12 Hours ▾



27/10/2018 2:00 PM - 28/10/2018 1:28 AM

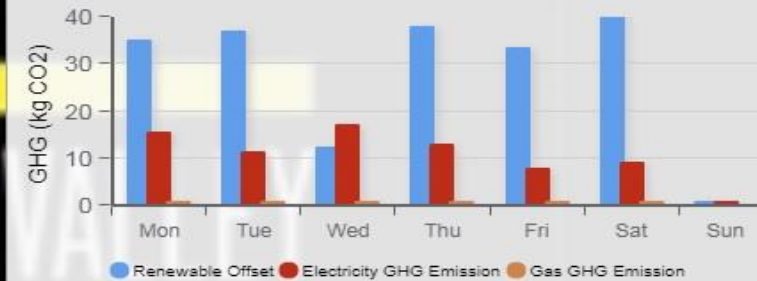


GHG Production

Last 7 Days ▾



22/10/2018 - 28/10/2018



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Thank you



[linkedin.com/in/moizmasood](https://www.linkedin.com/in/moizmasood)



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moiz@balgroup.com.au



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Credit: <https://www.greenpeace.org.au>



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Next presenter:
Jessica Breadsell

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>



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People and practices in low carbon developments

Jessica Breadsell

jessica.k.breadsell@postgrad.curtin.edu.au



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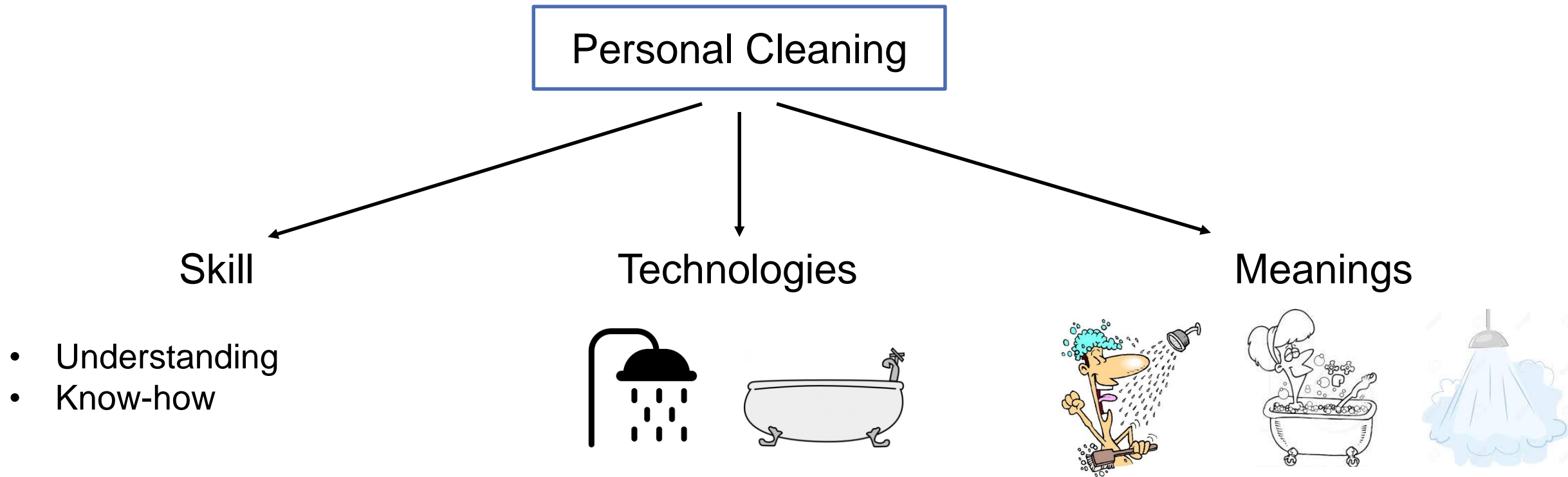
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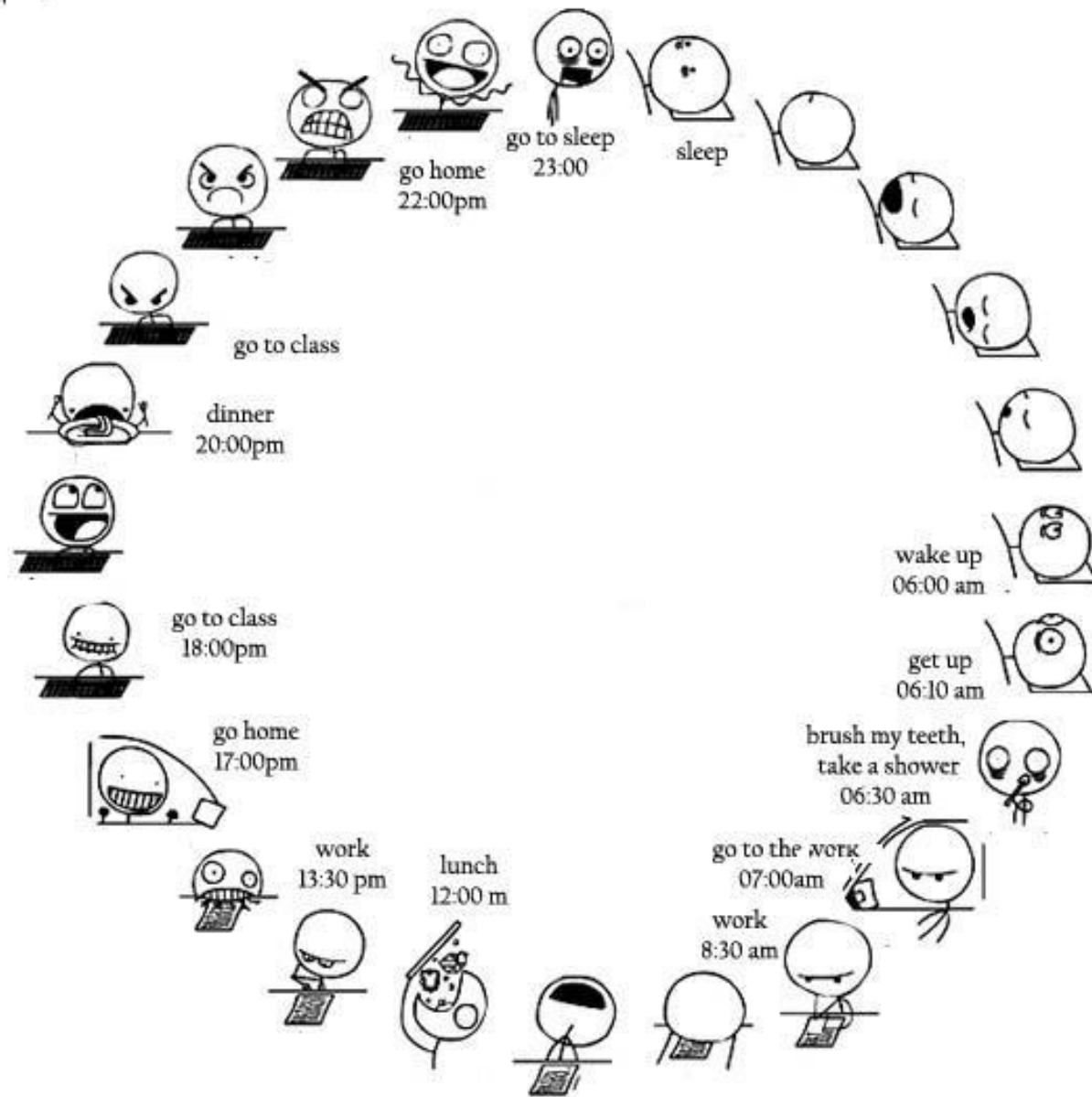
Credit: <https://thinktransition.com/oh-no-dont-yo-yo-three-actions-for-creating-sustainable-change/>

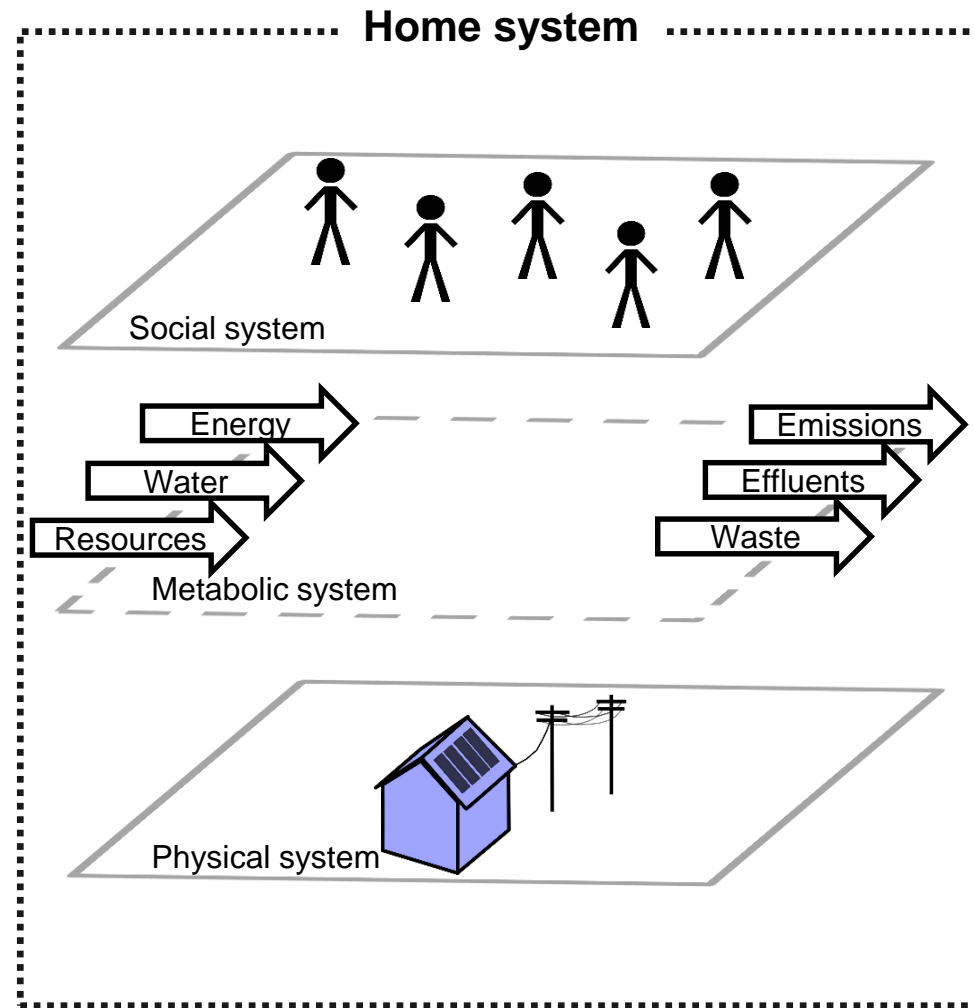


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Practices are influenced by skills, meaning and technology







WGV by LandCorp



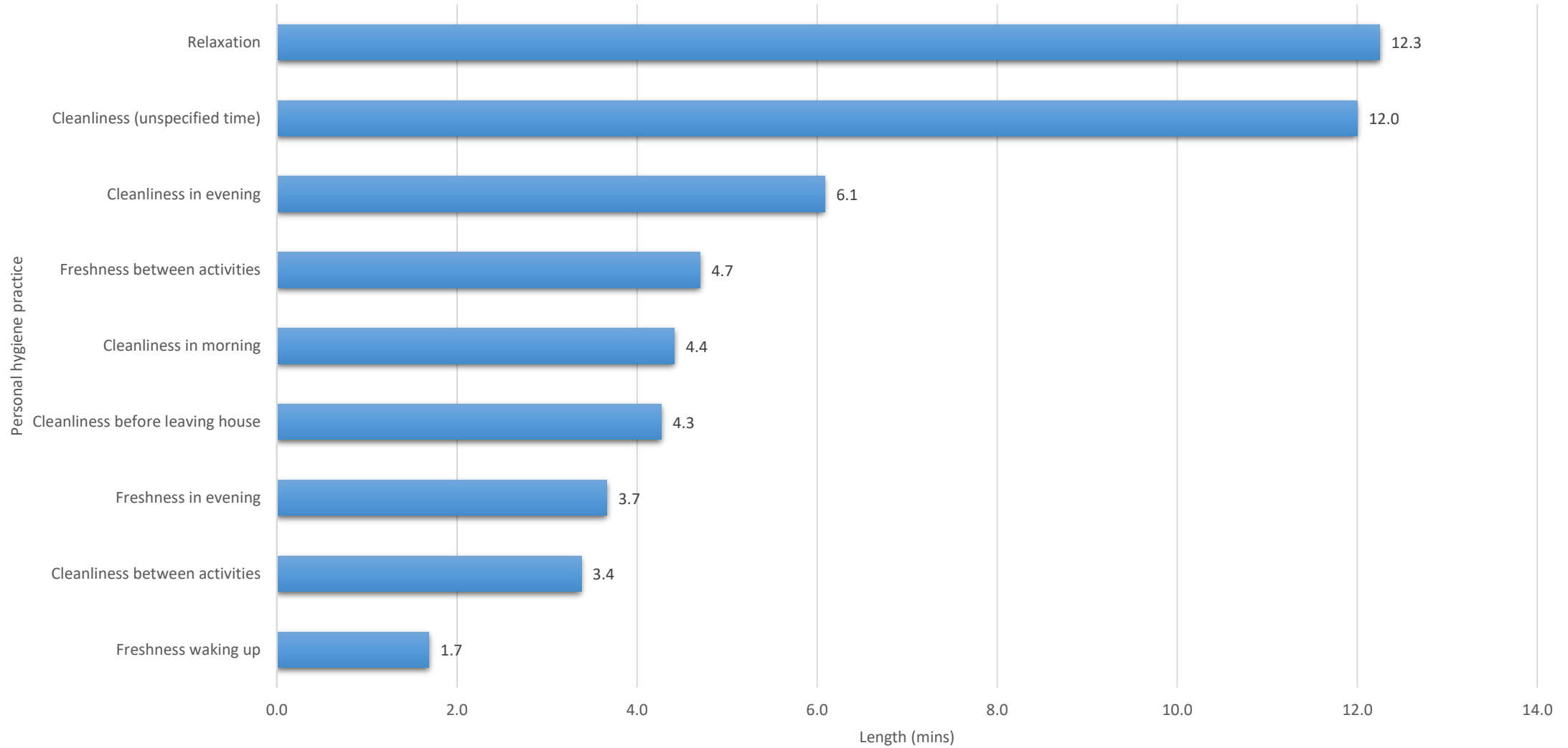
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Credit: Josh Byrne & Associate JBA

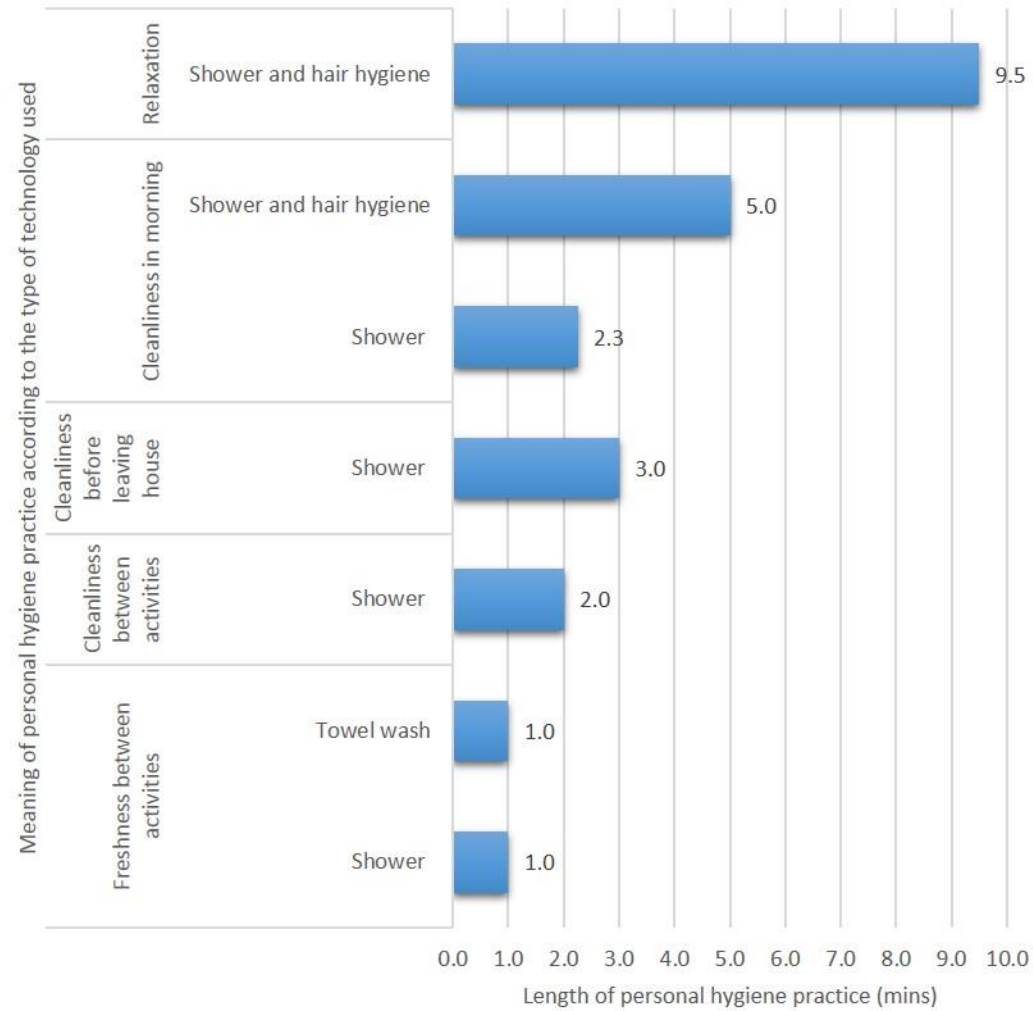


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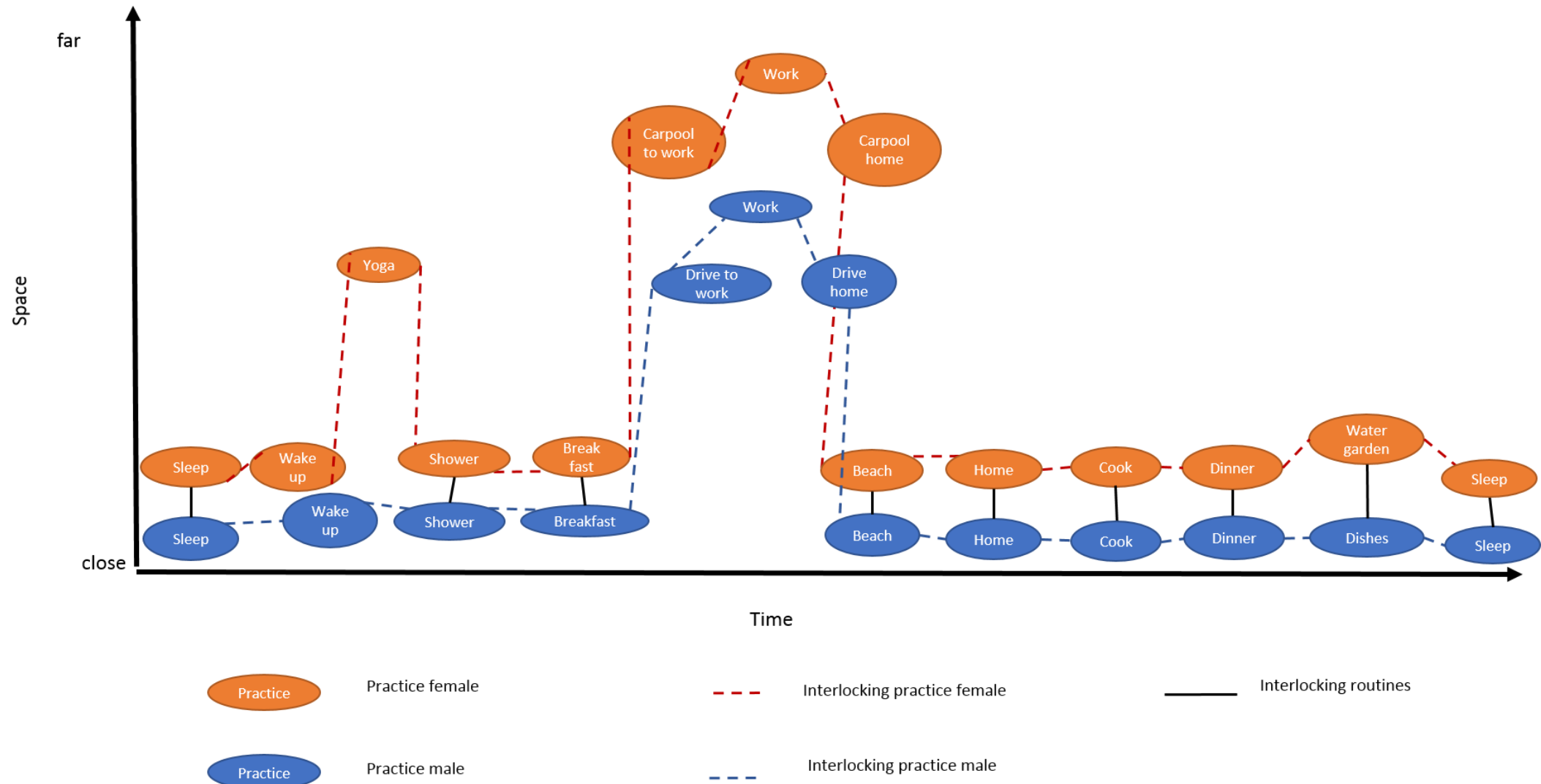
Personal hygiene practices and their length

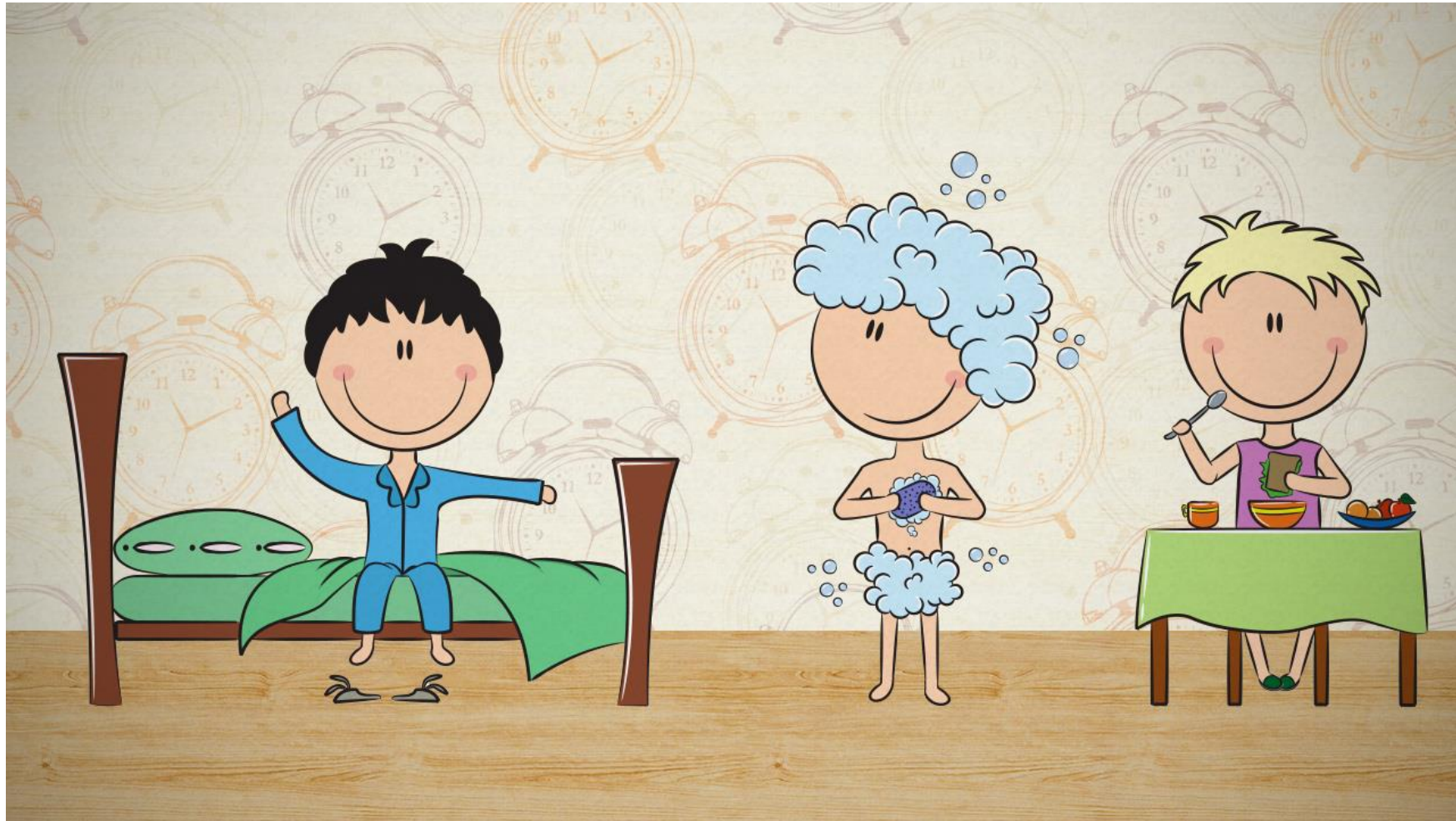


House J's various personal hygiene practices, their length, meaning and technologies.



A Home System of Practice across time and space









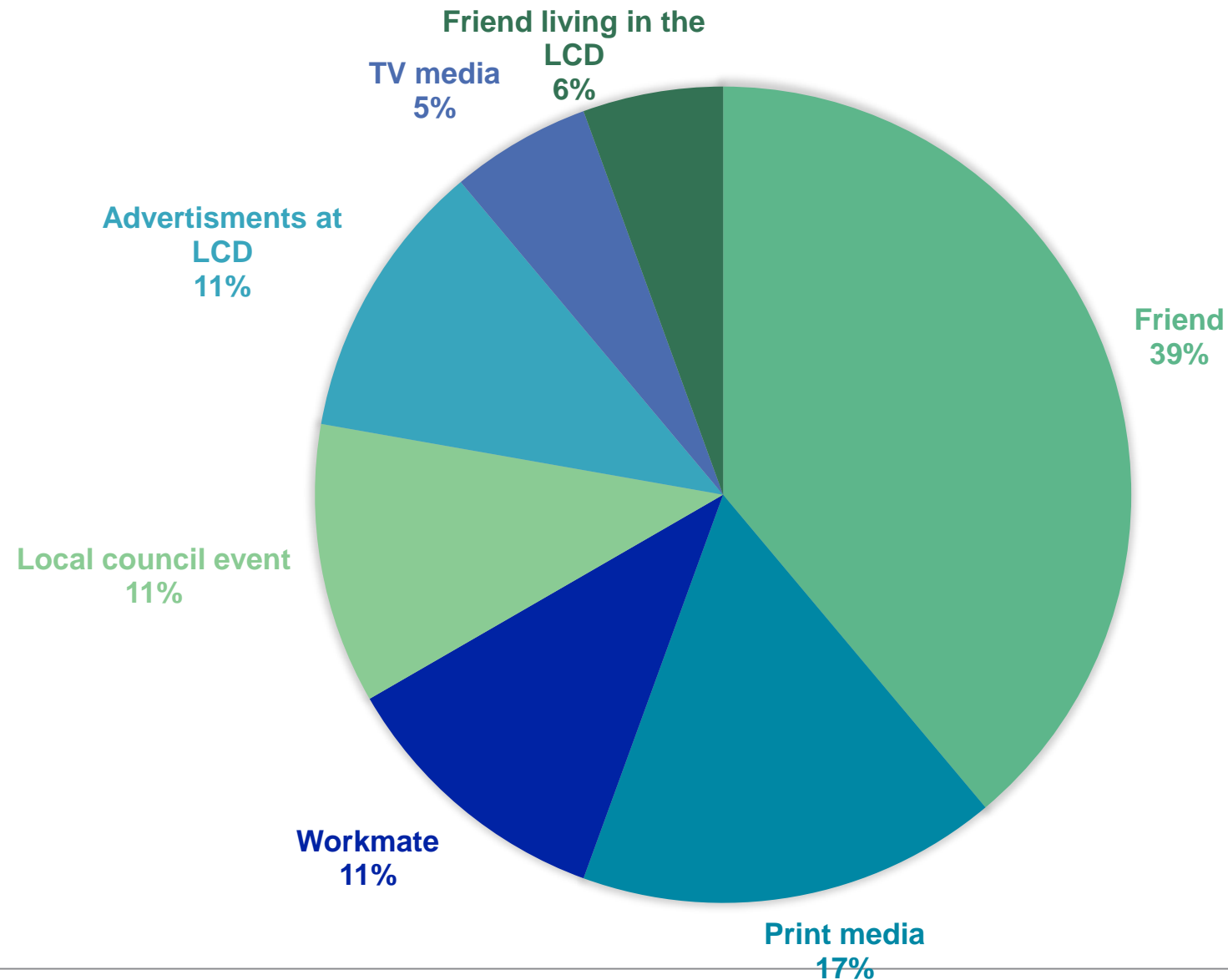
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Credit: <http://www.hornsby.nsw.gov.au>

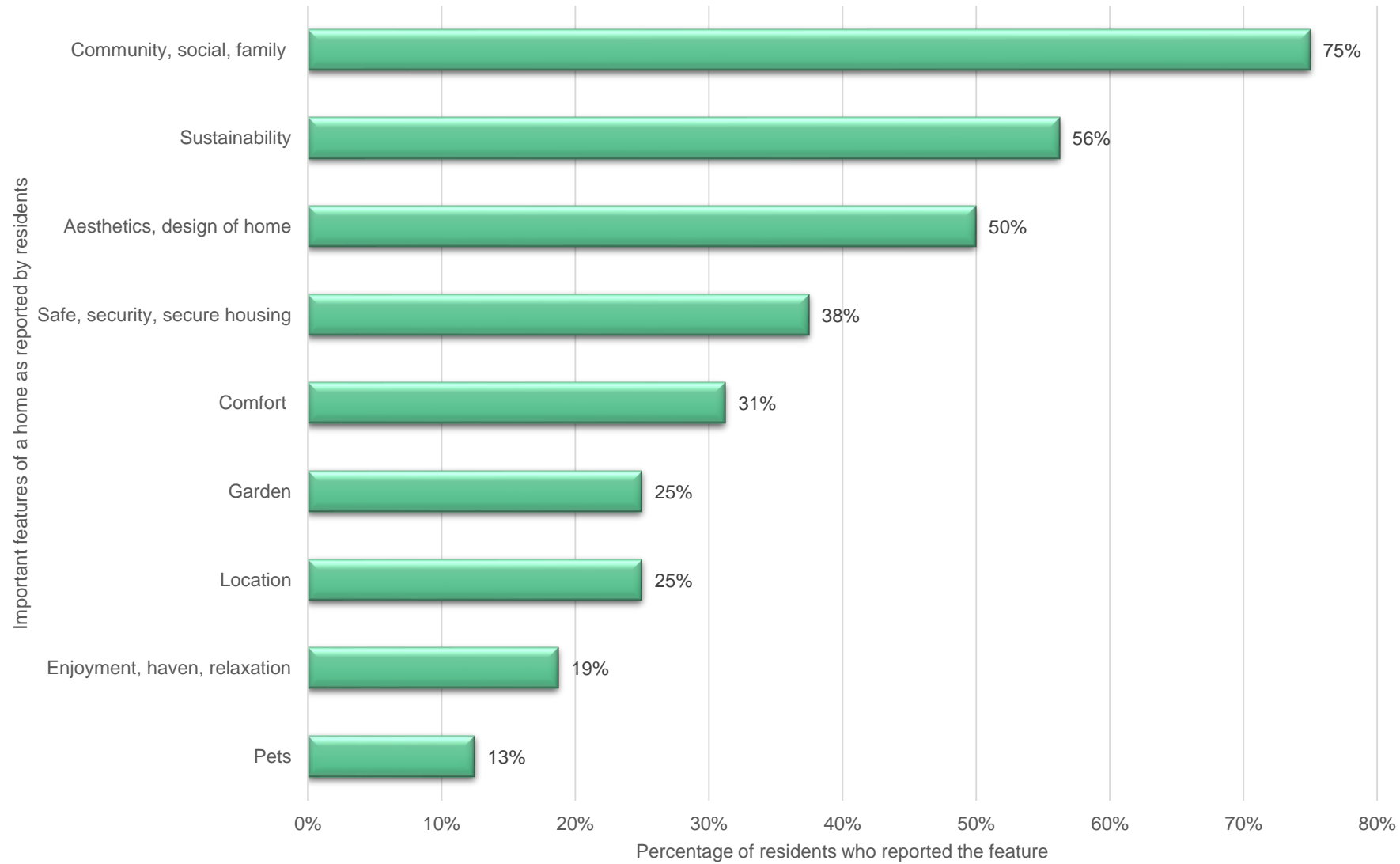


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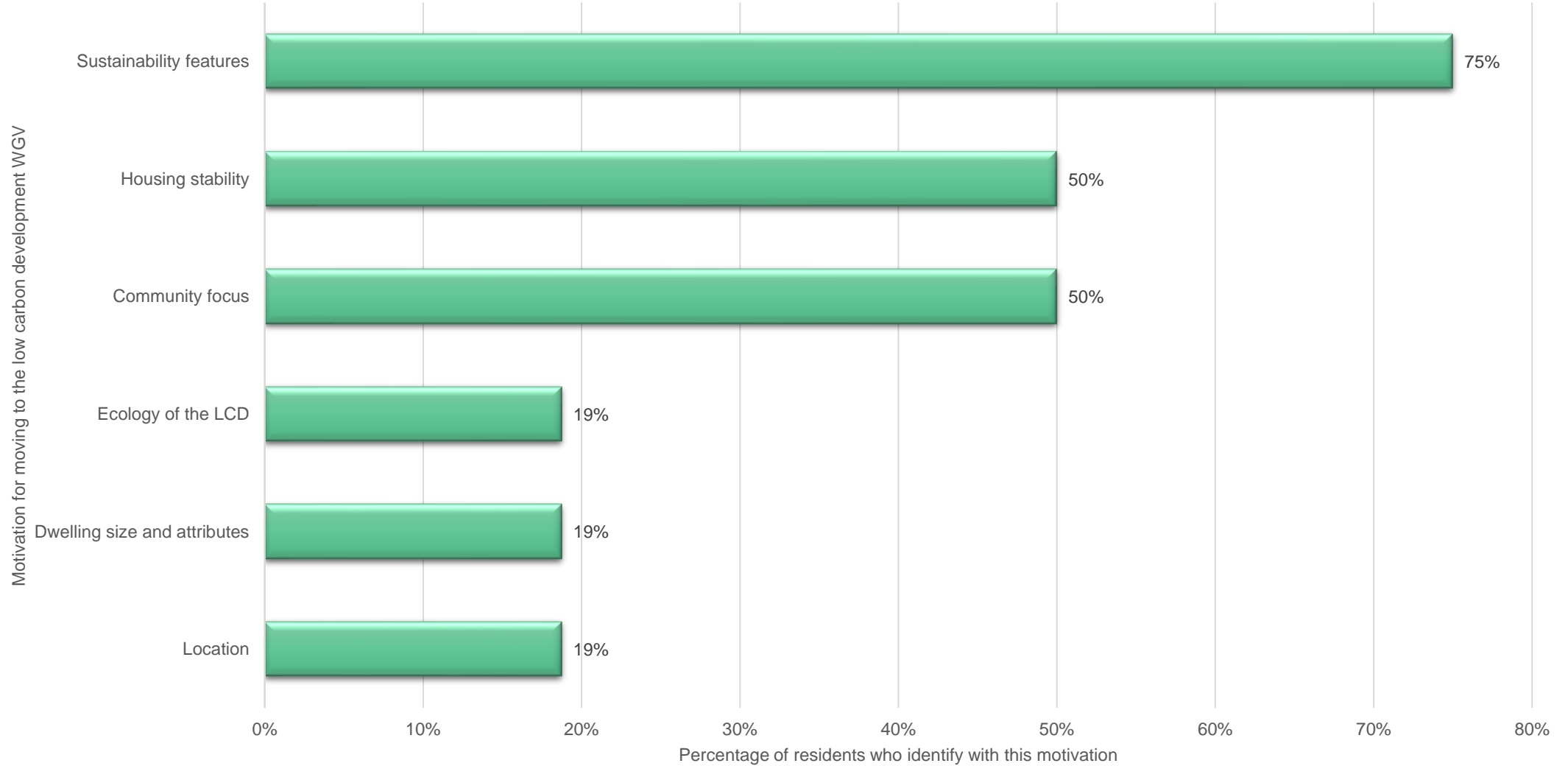
Residents reported responses to how they originally heard about WGV



The most important features of a home as reported by residents



Motivations of residents for moving into WGV

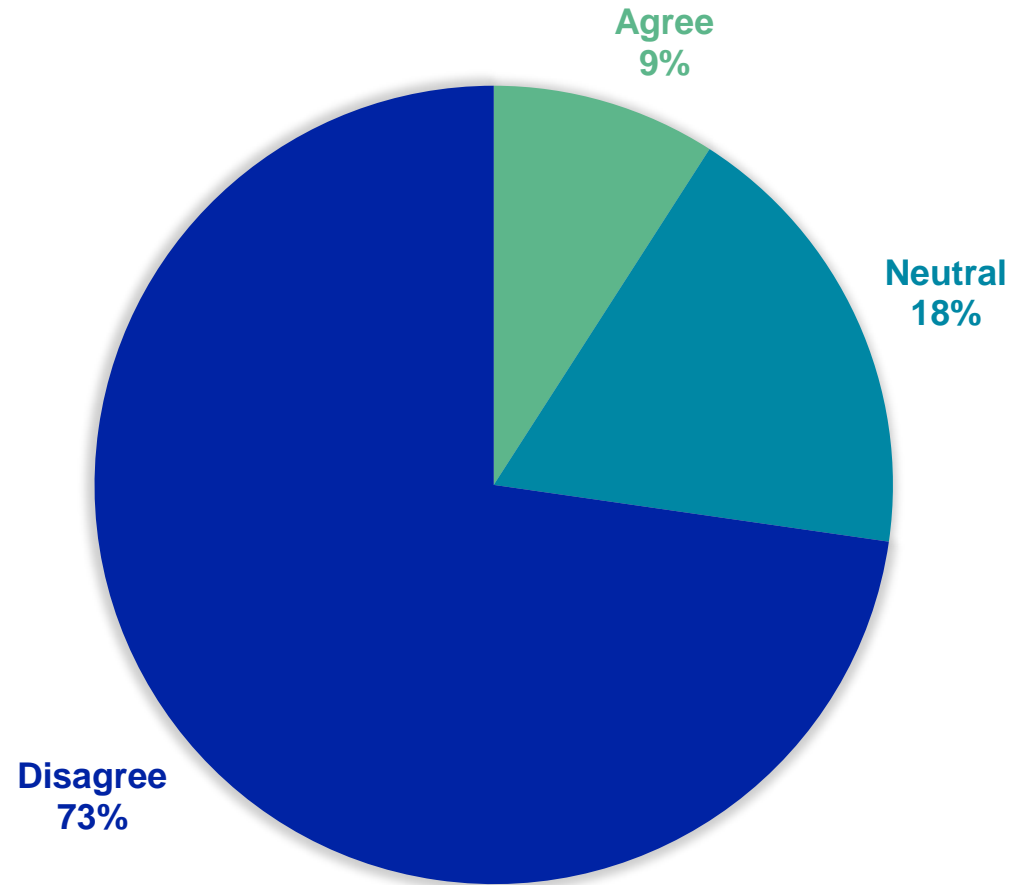


*"Moving to a low carbon precinct I believe will improve
my quality of life and motivate me to make better
consumer and environmental choices."*

(Resident of WGV)



I AM CONCERNED ABOUT HOW EASY IT WILL BE TO MAINTAIN MY LOW CARBON HOUSE



Utilisation



Utilisation





Next presenter:
Paula Hansen

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>



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A systematic literature review of agent-based modelling & energy transitions

Paula Hansen

paula.hansen@postgrad.curtin.edu.au



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Credit: <https://www.smart-energy.com/wp-content/uploads/2018/09/renewable.jpg>



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Credit: <https://i0.wp.com/www.takechargeamerica.org/wp-content/uploads/2018/02/general-data-protection-regulation.png>



Credit: <https://www.elegantthemes.com/blog/wp-content/uploads/2018/02/general-data-protection-regulation.png>



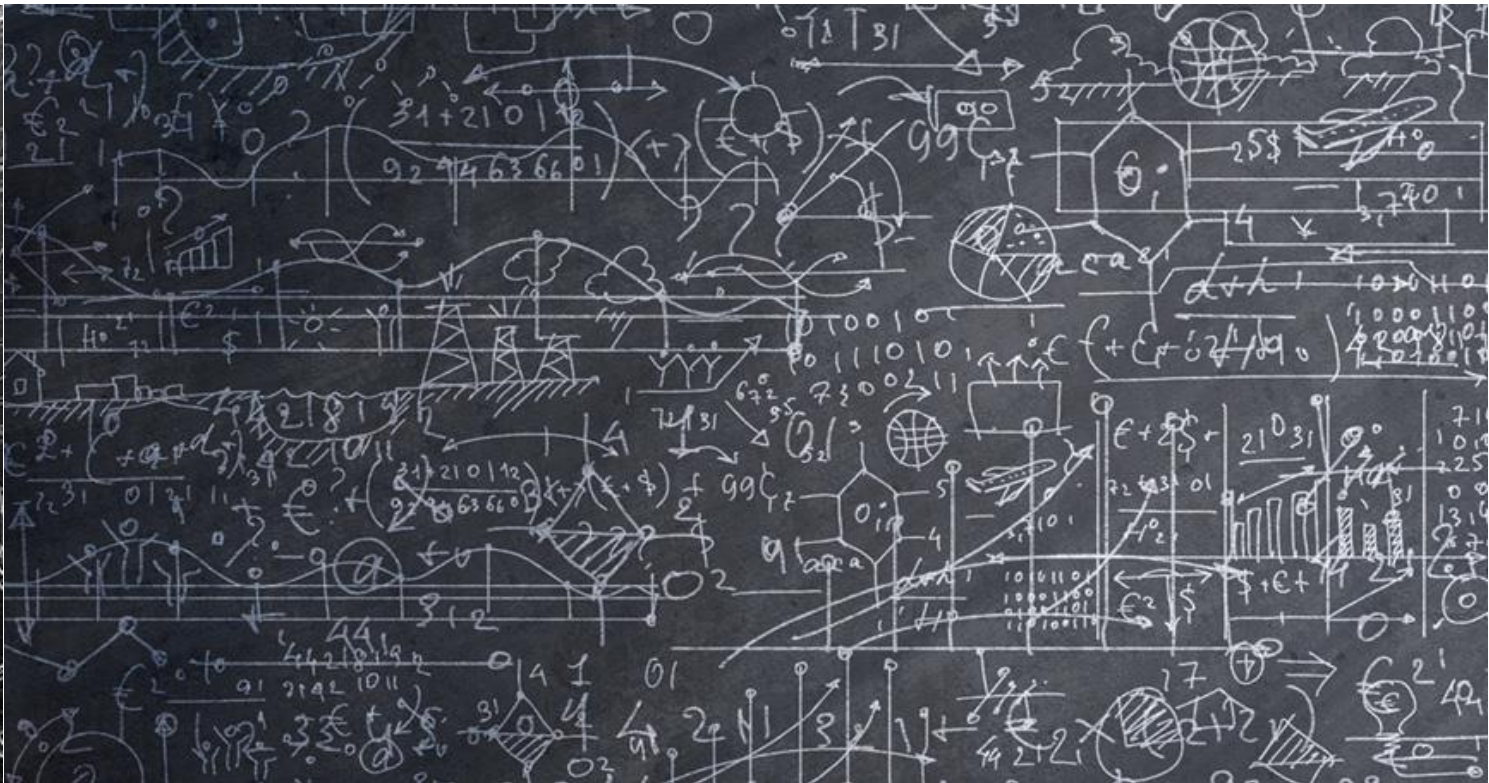
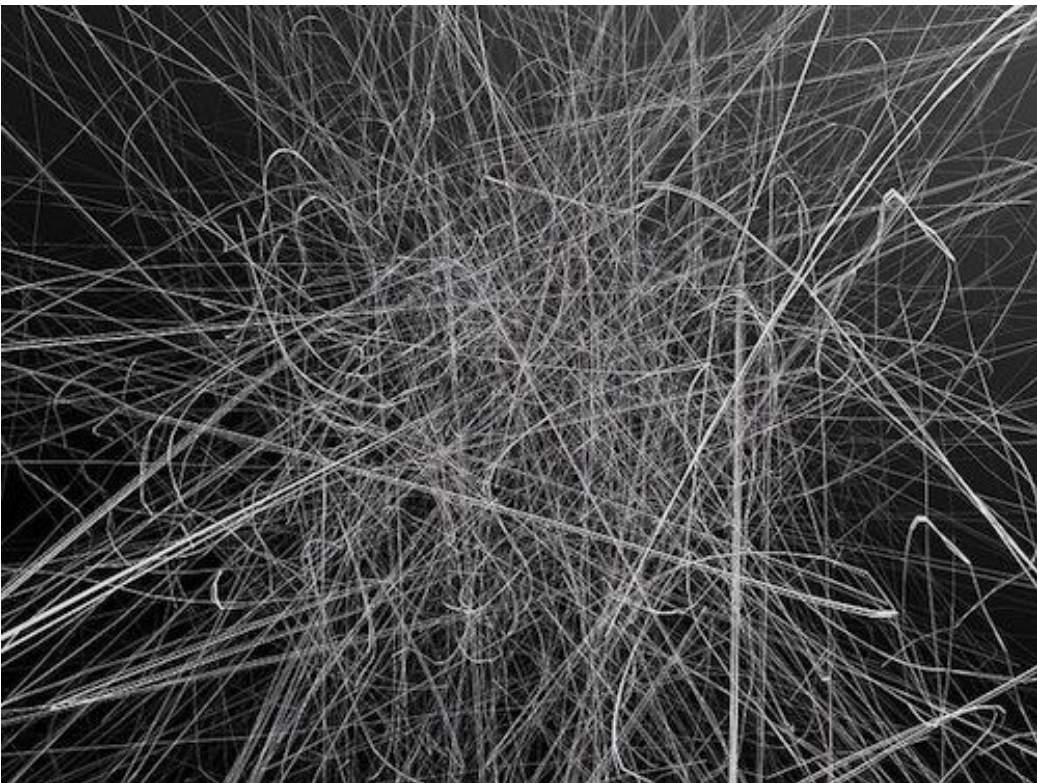
Credit: https://d2r9nfii89r0l.cloudfront.net/article/images/740x500/dimg/innovation-lightbulb-idea_25.jpg



Credit: <http://watt-logic.com/wp-content/uploads/2016/10/timing.jpg>



Credit: https://inta-avn.org/images/inta/news/2014/CC_news/Energy.jpg



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Credit: <https://ericbrown.com/wp-content/uploads/2015/03/complexity.jpg>
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AGENT BASED MODELLING



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Credit:

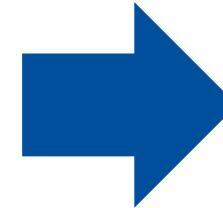
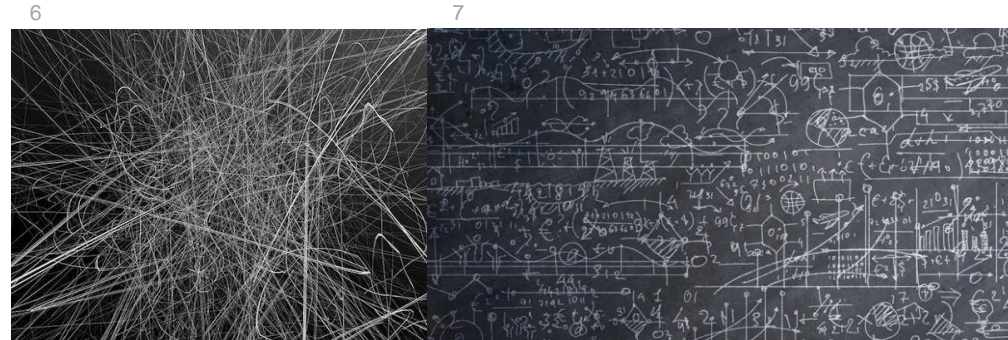
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- 1 <https://i0.wp.com/www.takechargeamerica.org/wp-content/uploads/iStock-547533236.jpg?fit=796%2C439&ssl=1>
- 2 <https://www.elegantthemes.com/blog/wp-content/uploads/2018/02/general-data-protection-regulation.png>
- 3 https://inta-aivn.org/images/inta/news/2014/CC_news/Energy.jpg
- 4 <http://watt-logic.com/wp-content/uploads/2016/10/timing.jpg>
- 5 https://d2r9nfiii89r0l.cloudfront.net/article/images/740x500/dimg/innovation-lightbulb-idea_25.jpg
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- 7 <http://blog.nextit.com/wp-content/uploads/2016/06/defending-complexity.jpg>
- 8 Warner Bros./ Village Roadshow Pictures/ Groucho Film Partnership/ Silver Pictures via <http://www.daleunavuelta.org/wp-content/uploads/2016/11/matrix.jpg>
- 9 Warner Bros./ Village Roadshow Pictures/ Groucho Film Partnership/ Silver Pictures via https://ksassets.timeincuk.net/wp/uploads/sites/55/2017/03/matrix_reboot_1000-630x400-1.jpg



REPRODUCIBLE
REDUCE BIAS
SYSTEMATIC



("agent-based model*" OR "agent-based simulation") AND (energy OR electricity)

Credit: Screenshot from 'Advanced Search' feature on ProQuest 2018 LCC via Curtin University library

Appendix A: Testing search string robustness

To verify the representativeness of the selected sample of literature and evaluate search string effectiveness, three additional queries were run in ProQuest and Scopus (as the original search showed that GoogleScholar did not generate any results not already contained in the other two databases it was not used again). While the focus of this review is on energy (transitions), the word electricity was included to account for inconsistent and varied usage across the literature. A majority of studies containing the term electricity in the title are in the Electricity Market topic area. However, the term also appears in the Policy and Planning and Consumption Dynamics/Consumption topic areas. This illustrates that while the term is pre-dominantly used in market-centric not always the case. Inclusion of the term therefore proved sensible.

Table 3: Alternative search query evaluation.

(agent-based OR multi-agent) AND (energy OR electricity)		
Results in	ProQuest	Scopus
Anywhere	23,612	34,15
Abstract only	2,701; peer-reviewed: 1,191	3,332; article, review: 1
Title only	645; peer-reviewed: 265	657; article, review: 1
Of these 265 results, 10 were published between 1999-2007.		
/P This query was run to test the robustness of the search string applied in this study. The first more flexible compared to the original ("agent-based model*" OR "agent-based simulation"). through titles within in the "titles only" search, results generally show little potential relevance under investigation; many seem highly technically focussed or centred on electricity markets.		
Limiting the date range to studies published before 2007 showed that the large majority of studies published after 2007. This suggests that the date distribution observed in the present study is not and not due to search string design.		
(agent-based OR multi-agent) AND (energy OR electricity) AND (transition OR adoption OR analysis OR micro*)		
Results in	ProQuest	Scopus
Anywhere	10,963; peer-reviewed: 2,861	4,141; limit to article in press
Abstract only	86; peer-reviewed: 46	110; limit to article in press
Title only	5; 4 peer-reviewed; 2 of these results is an article that is included in this review (duplicate); the	5; 1 article, 1 conference papers

other 2 are not included and are relevant to the topic, however, 1 proofed to have been published in 2018	is included here, 1 is not but could be relevant
Date range of results: 2010-2017	Date range of results: 2008-2017

→ This query was run to test the robustness of the search string applied in this study. The first expression is much more flexible compared to the original ("agent-based model*" OR "agent-based simulation"). On the other hand, and in contrast to the above, a third expression, "transition", was added. Unsurprisingly, the addition of the expression led to a smaller number of results in "anywhere" compared with above; and a drastic decrease in results when restricting the search to abstracts only (and even more when limited to titles only). 1 article was identified within the title search that suggests potentially high relevance to the topic under investigation. Within the abstract search, a few articles could be relevant based on their titles. However, none appeared to address a new topic area not covered here. In fact, a large portion of articles appeared market centric.

The representativeness of the date range observed in the selected set of literature was verified with a majority of studies in the much broader search having been published after 2007.

("agent-based computational" OR "agent-based spatial" OR "agent-based diffusion" OR "agent-based adoption" OR "agent-based analysis" OR "agent-based micro*") AND (energy OR electricity)		
Results in	ProQuest	Scopus
Title only	30; peer-reviewed: 21; duplicates eliminated, remaining: 8 results	16; article, article in press: 10; 5 of these 10 contain the phrase "agent-based analysis" in the title;
Abstract only	Of these 8, 5 contain the phrase "agent-based analysis" in the title; the other 3 are: "agent-based spatial", "multi-agent based microgrid energy management", "agent-based computational modelling"; 5 of 8 contain the word market in the title	"agent based computational economics", "agent-based spatial simulation", "agent-based computational economics simulation", "Agent-based microsimulation", "multi-agent based microgrid energy management"; 6 of the 10 contain the word "market" in the title

→ This query was applied to test whether a significant number of potentially relevant articles was lost by including only the restrictive phrases "agent-based model*" and "agent-based simulation" in the search string. The results suggest that this was not the case. Firstly, the majority of articles contained the term "agent-based analysis" rather than the more specific terms of diffusion or adoption. In ProQuest only 3 of the peer-reviewed articles contained other terms; these were "multi-agent based microgrid energy management", "agent-based computational modelling", and "agent-based spatial". In Scopus, in addition to "agent-based analysis", the terms "agent based computational economics", "agent-based spatial computational economics simulation", "Agent-based microsimulation", "multi-agent management" appeared. This shows that no articles containing the terms agent-based simulation or agent-based model were lost due to search string construction.

Secondly, the majority of these articles appeared to be market-centric or technical studies; across ProQuest and Scopus, 11 of 18 results even included the word market in the title. They are therefore unlikely to have added insights to the present study, particularly given the focus on social components of the energy transition in this analysis.



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Credit: Author



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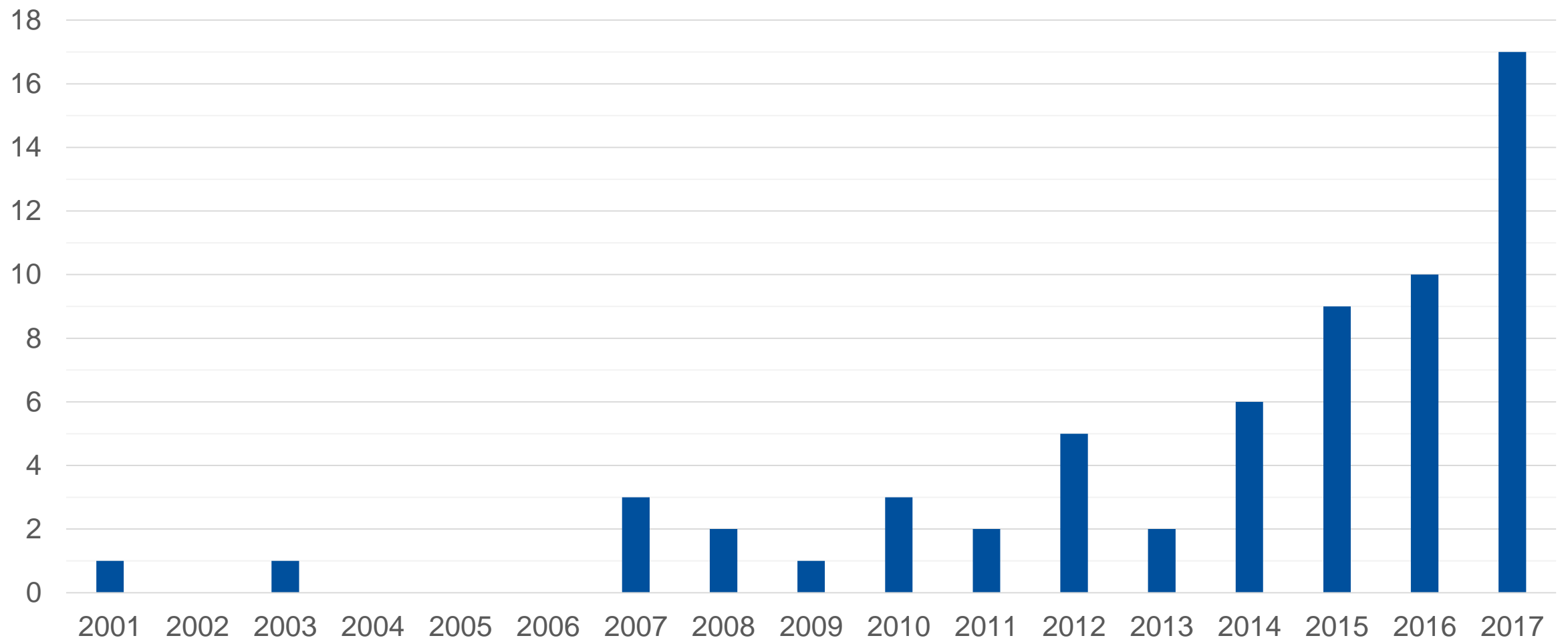


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Credit: https://cdn-images-1.medium.com/max/1200/1*C9fLwET5OfP4H3GuN0f-SQ.jpeg



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Credit: Hansen et al 2018 (in press)

12



Credit:

<https://i0.wp.com/www.takechargeamerica.org/wp-content/uploads/iStock-547533236.jpg?fit=796%2C439&ssl=1>

7



Credit: https://d2r9nfiii89r0l.cloudfront.net/article/images/740x500/dimg/innovation-lightbulb-idea_25.jpg

25



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9



Credit: <https://www.elegantthemes.com/blog/wp-content/uploads/2018/02/general-data-protection-regulation.png>

3



Credit: <https://www.smart-energy.com/wp-content/uploads/2018/09/renewable.jpg>

6



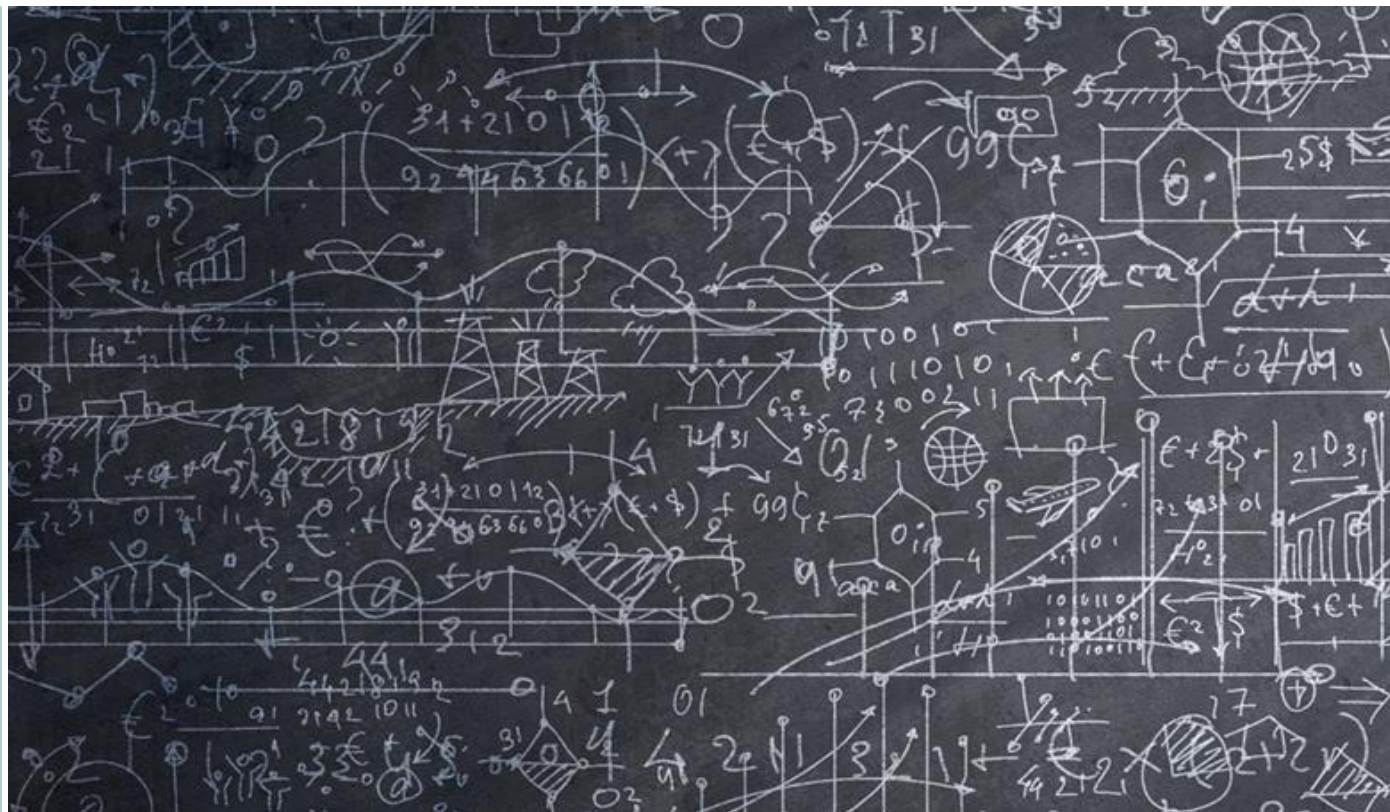
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POLICY AND DECISION MAKING



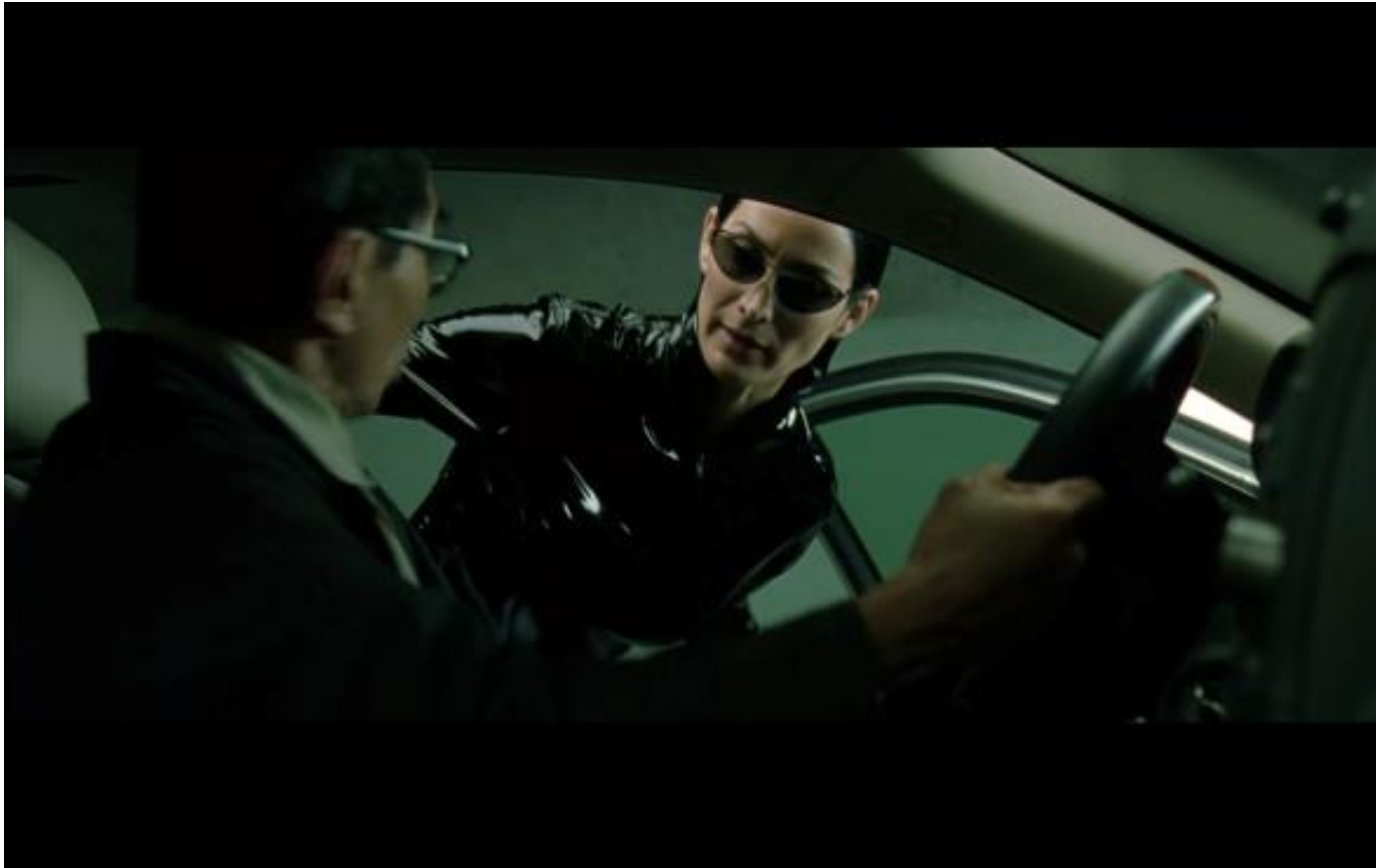
Curtin University

Credit: <http://www.daleunavuelta.org/wp-content/uploads/2016/11/matrix.jpg>
<https://www.elegantthemes.com/blog/wp-content/uploads/2018/02/general-data-protection-regulation.png>



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DRIVING TRANSITIONS PRACTICALLY



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Credit: <https://bplustmovieblog.files.wordpress.com/2014/10/the-matrix-reloaded-1244.png?w=590>
<https://www.smart-energy.com/wp-content/uploads/2018/09/renewable.jpg>



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THANK YOU



Paula Hansen | paula.hansen@postgrad.curtin.edu.au



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Credit: https://ksassets.timeincuk.net/wp/uploads/sites/55/2017/03/matrix_reboot_1000-630x400-1.jpg



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Next presenter:
Lio Hebert

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>

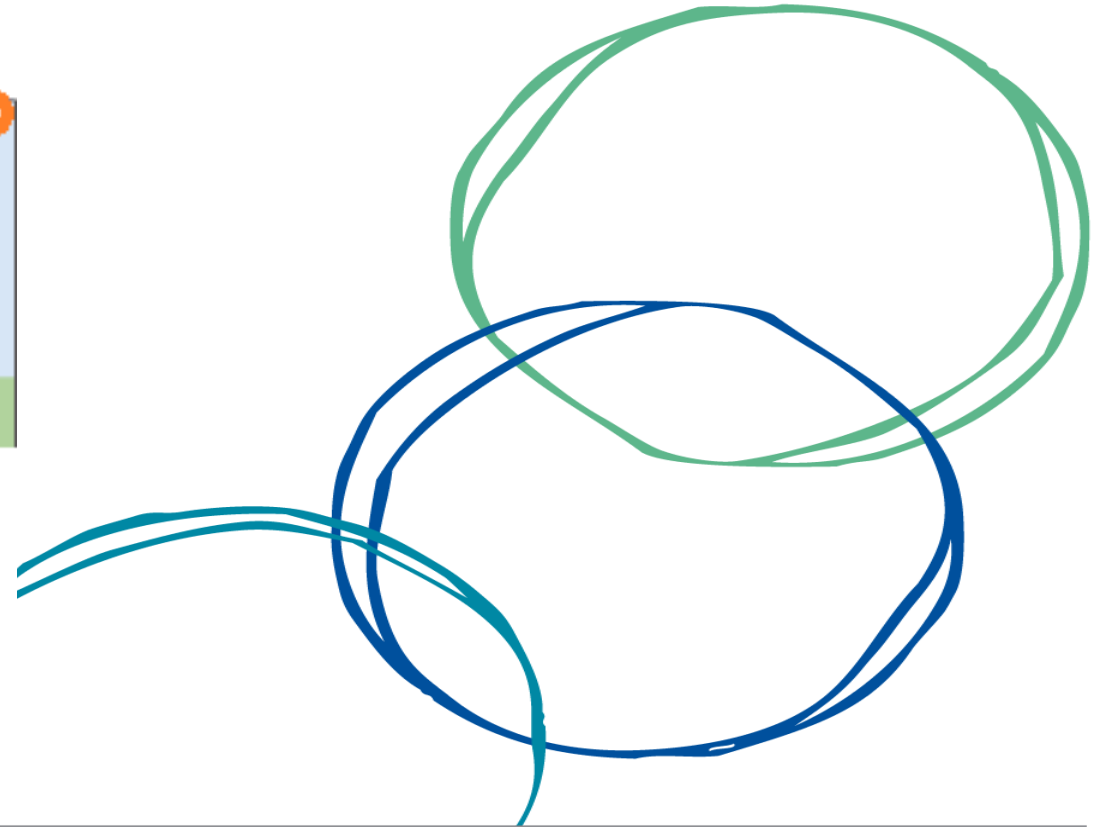
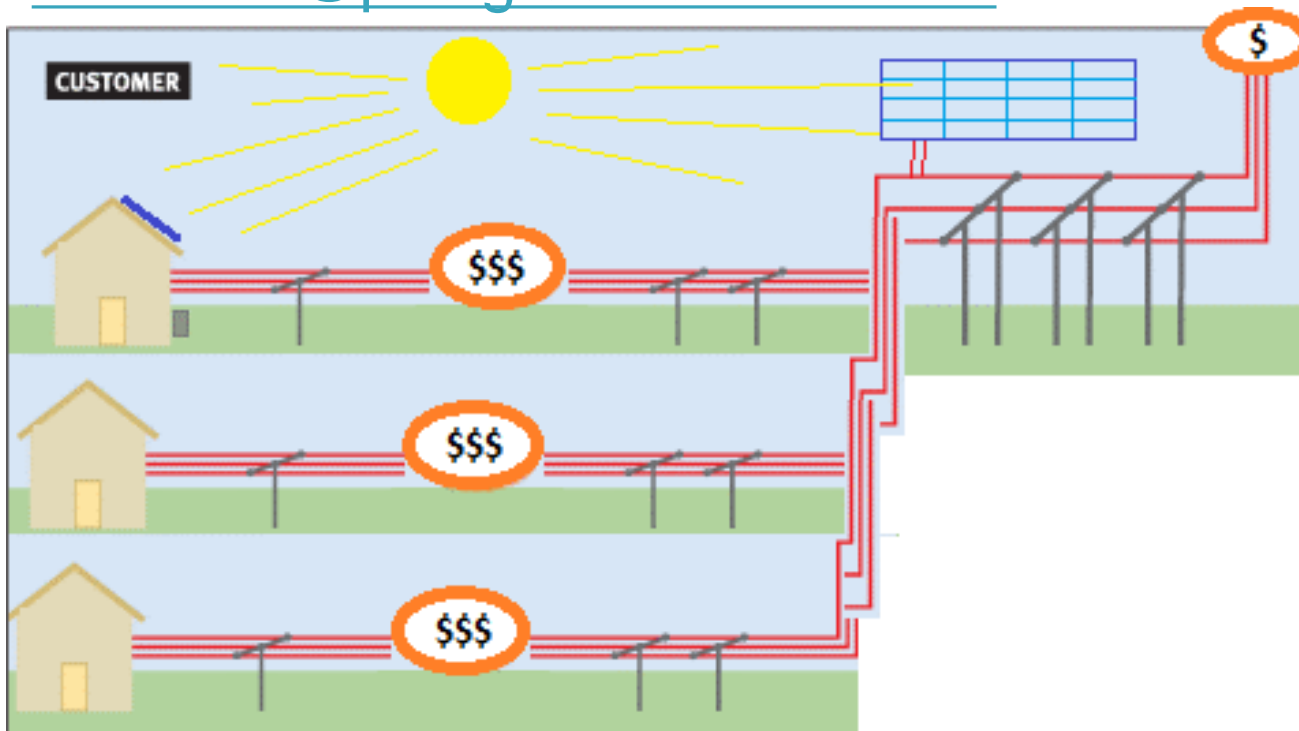


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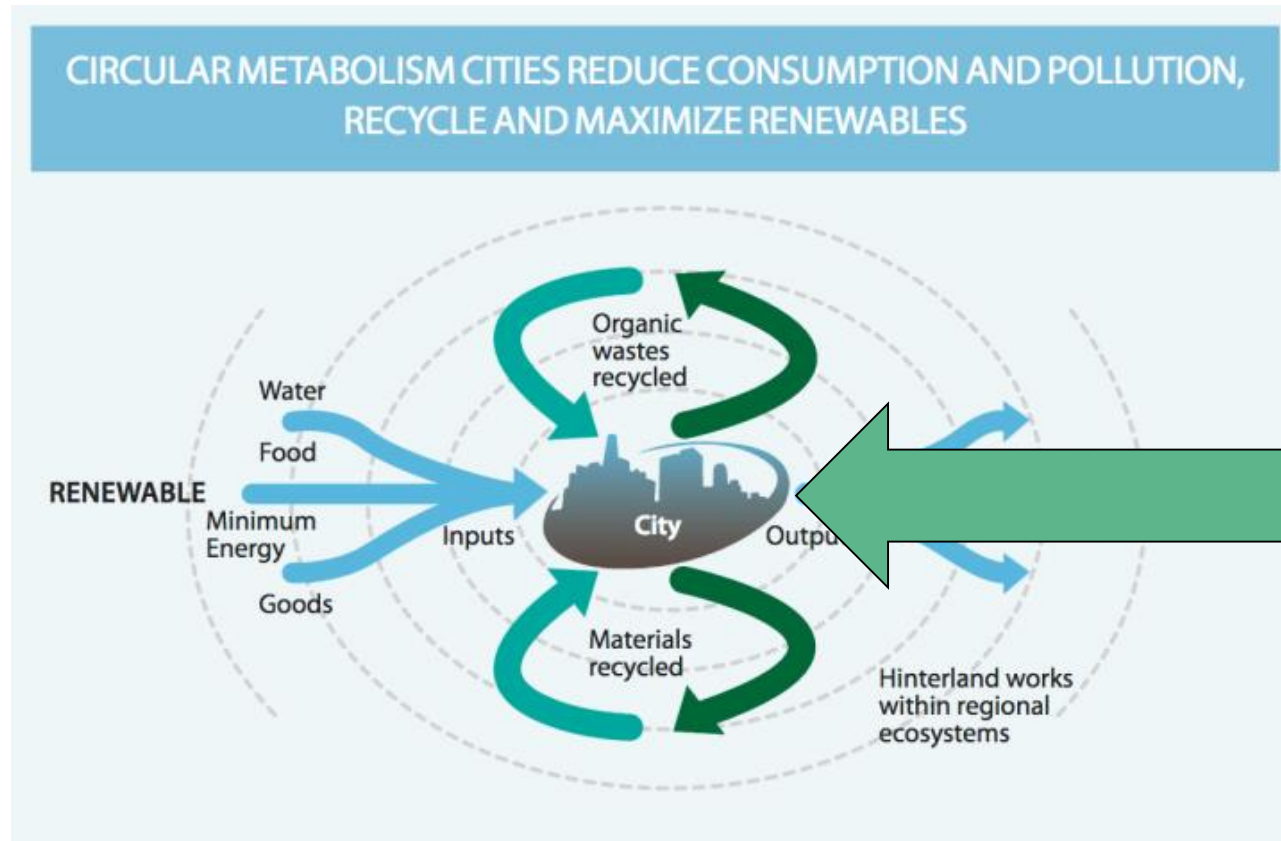
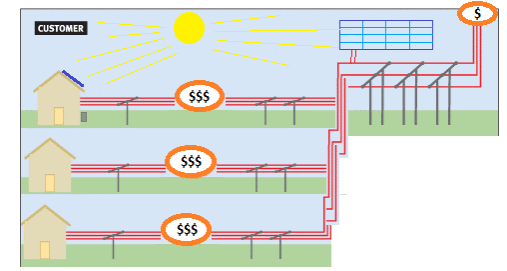
Industrial precinct transition to solar: A new economic approach

Lio Hebert

lio.hebert@postgrad.curtin.edu.au



Why talk about industrial precincts?



Non-residential precincts
are
major contributors
to Cities'
carbon footprint

Examples of r

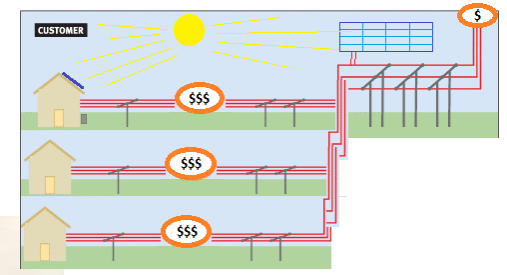


www.spse

<https://www.advisian.com/en/case->



<http://www.lastpixel.com.au/project/perth-airports-vision/>

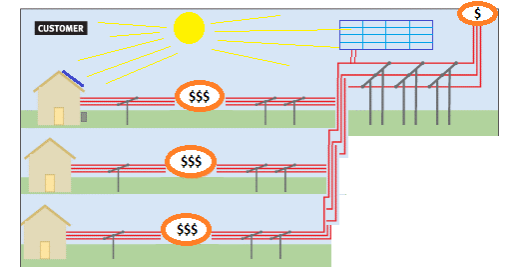
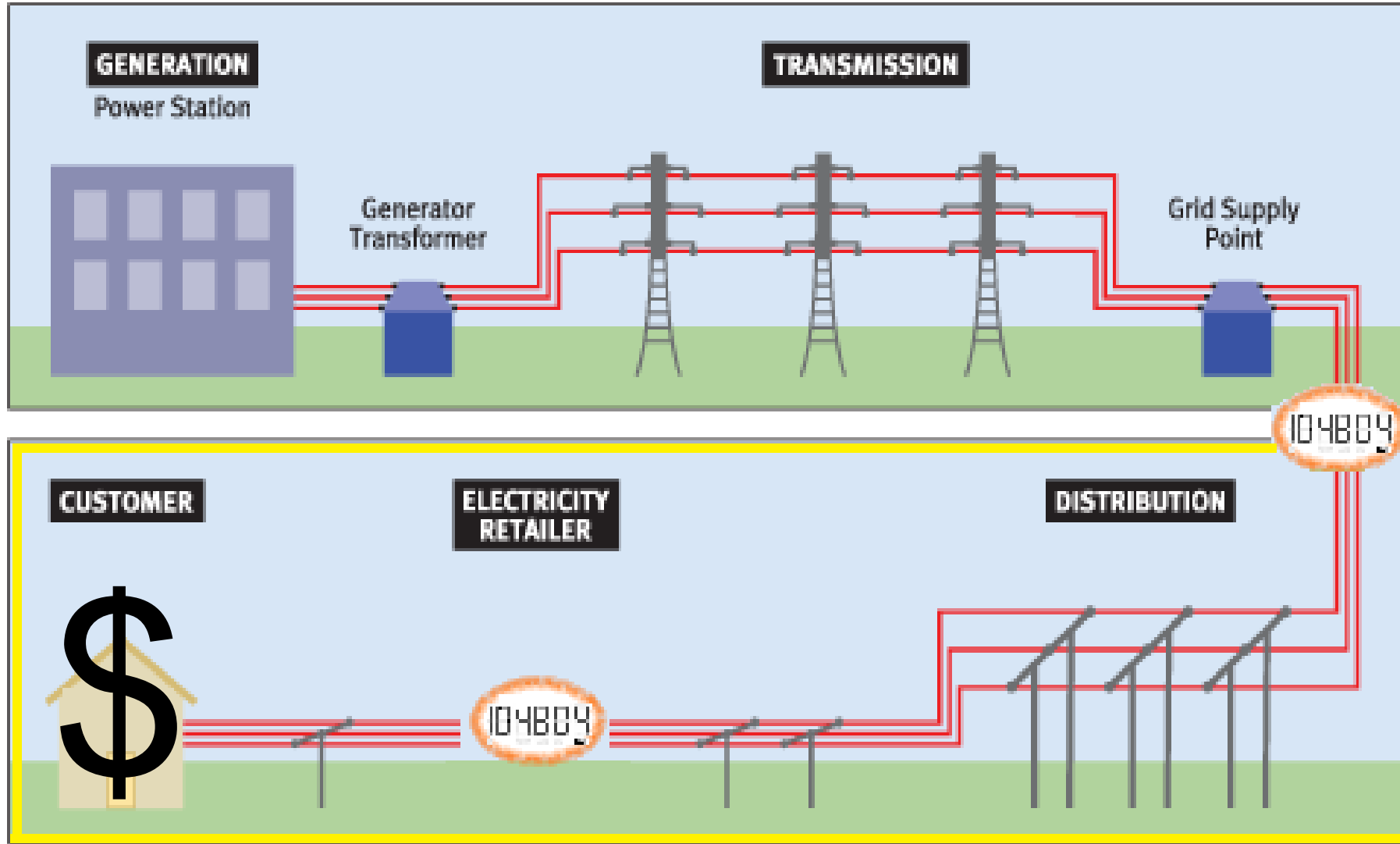


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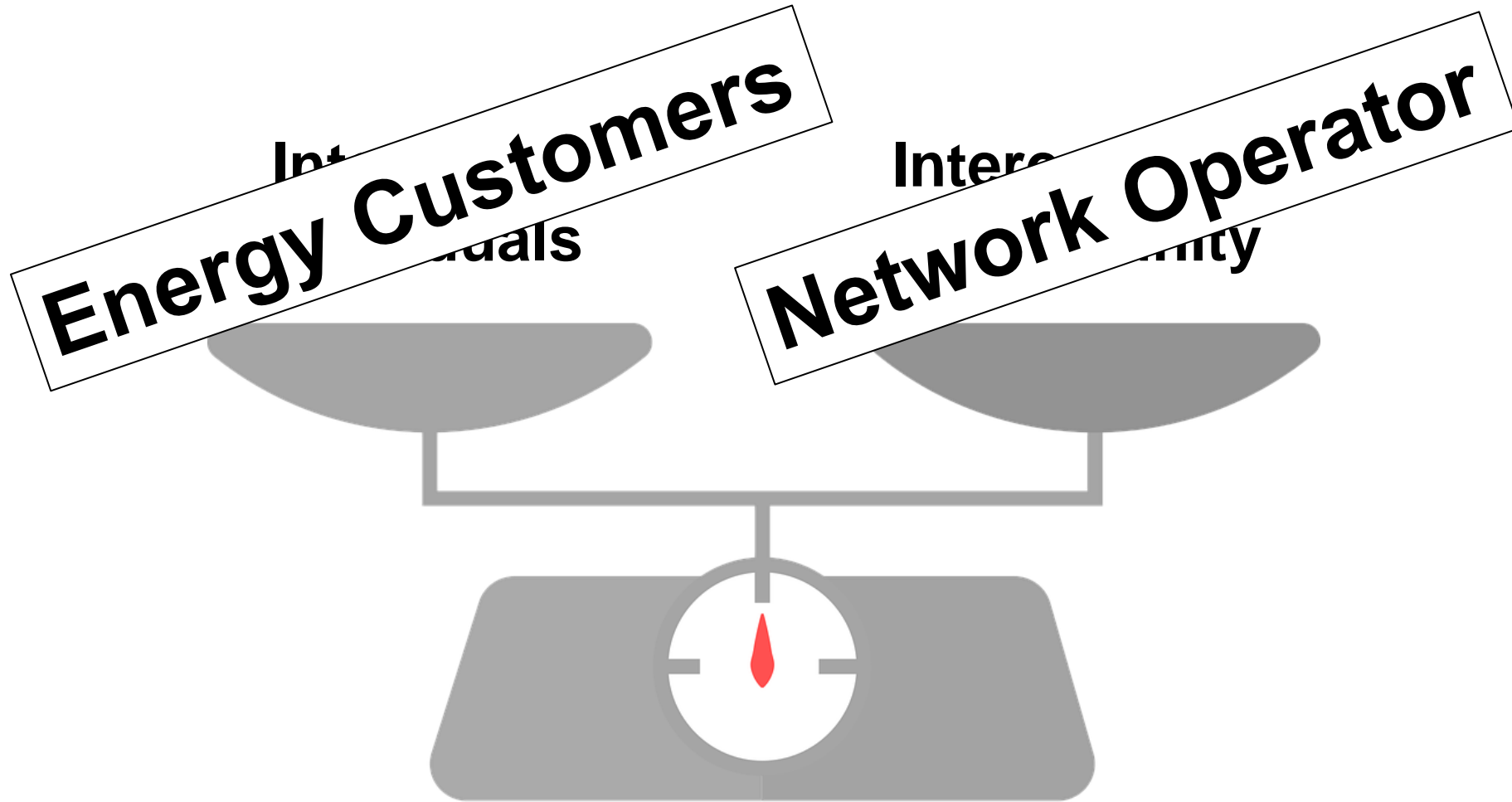
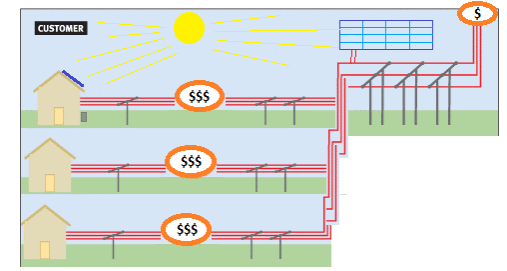


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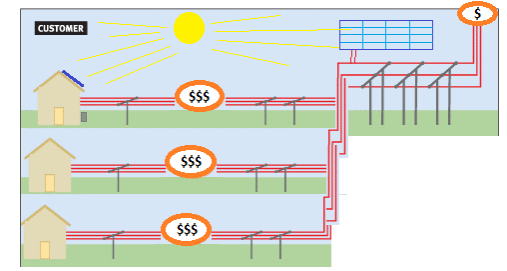
What is motivation to transition to solar?



What makes a precinct **durably** attractive?



What part of the energy supply makes an industrial precinct attractive?



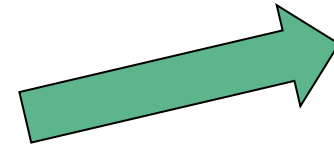
COST-EFFECTIVE with **PREDICTABLE** electricity bills

RELIABLE

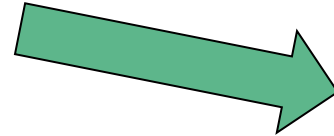
ADAPTABLE and **EV ready** (delivery fleets & captive vehicles)

ETHICAL (low-carbon, environment friendly)

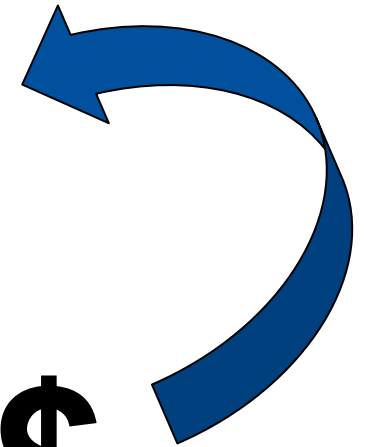
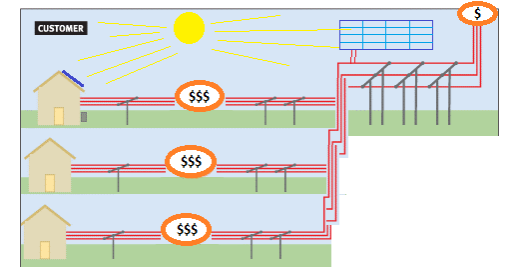
What's a cost-effective LC energy supply?



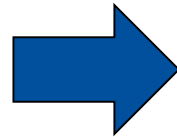
Energy (generation
& balancing)



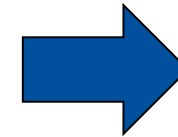
Network (distribution
& control)



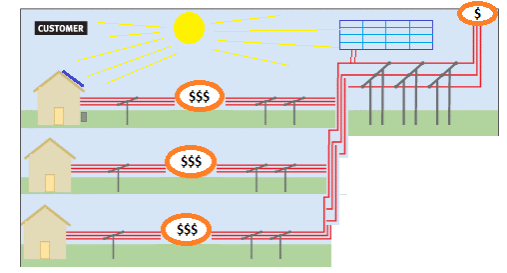
Adding more
Renewables



Increase the
COMPLEXITY



Objective of the research



To develop an

INNOVATIVE APPROACH to ENERGY BUSINESS

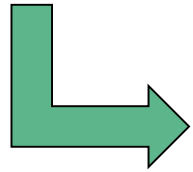
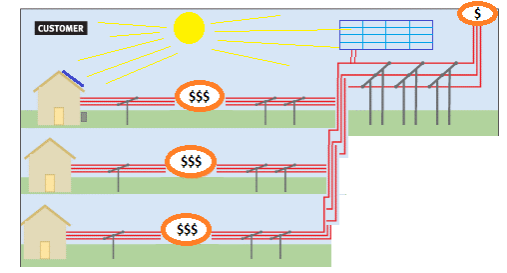
to help

INDUSTRIAL PRECINCTS TRANSITION TO SOLAR

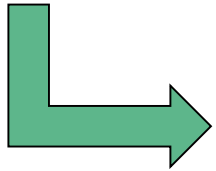
And become more ATTRACTIVE to businesses

Methodology of the research

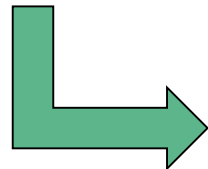
Analyse how the transition to solar is happening on the Public Grid and on other Embedded Electricity Networks



Find the weak points, the **BARRIERS** and propose alternatives

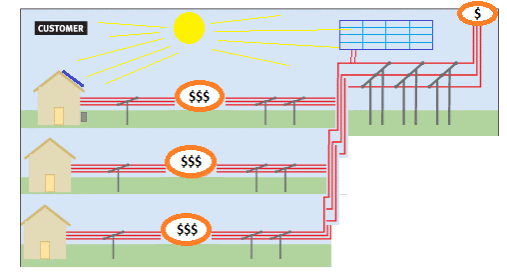


Define an **innovative approach** to better introduce PV



Test and calibrate the new business model on a case study

Scenarios considered in the research



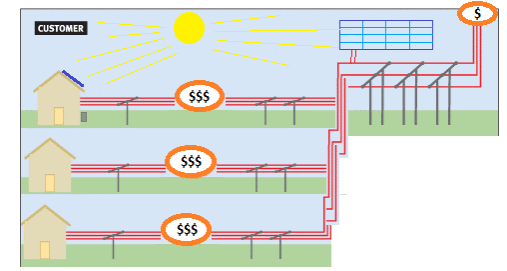
0. Do-Nothing: No transition to solar.

1. Public Utility: Let customers install rooftop solar but with no requirement to get involved in the energy supply.

2. Other EEN: ENO owns and control all the on-site renewables and storage, but no customer participation

3. Innovative BM: ...

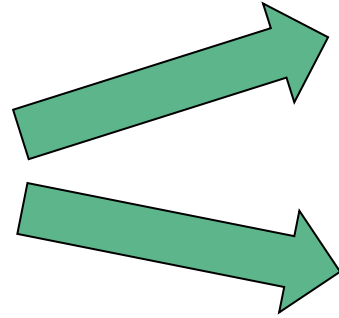
The Innovative Business Model:



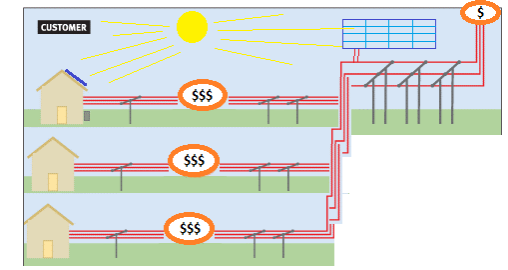
1. **Primary profit centre = Property** → Energy supply = Enabler
2. **Concept of the *Energy Village*:** to insure balance of interests
3. **Network Operator = Major of the Village:** ENO ensures homogeneous integration of the RE and storage
4. **Customer involvement:** Customers can install rooftop solar and battery but they must get involved in the energy stability and cost-effectiveness

Metric to assess cost-effectiveness

Levelised Cost of Energy
(LCOE)



\$



Energy generated x n years



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Credit: <https://www.citipower.com.au/media/1953/how-electricity-is-delivered-in-victoria.jpg>; mbtskoudsalg.com; ficardo-weddings.com; <http://knowledge.wharton.upenn.edu>

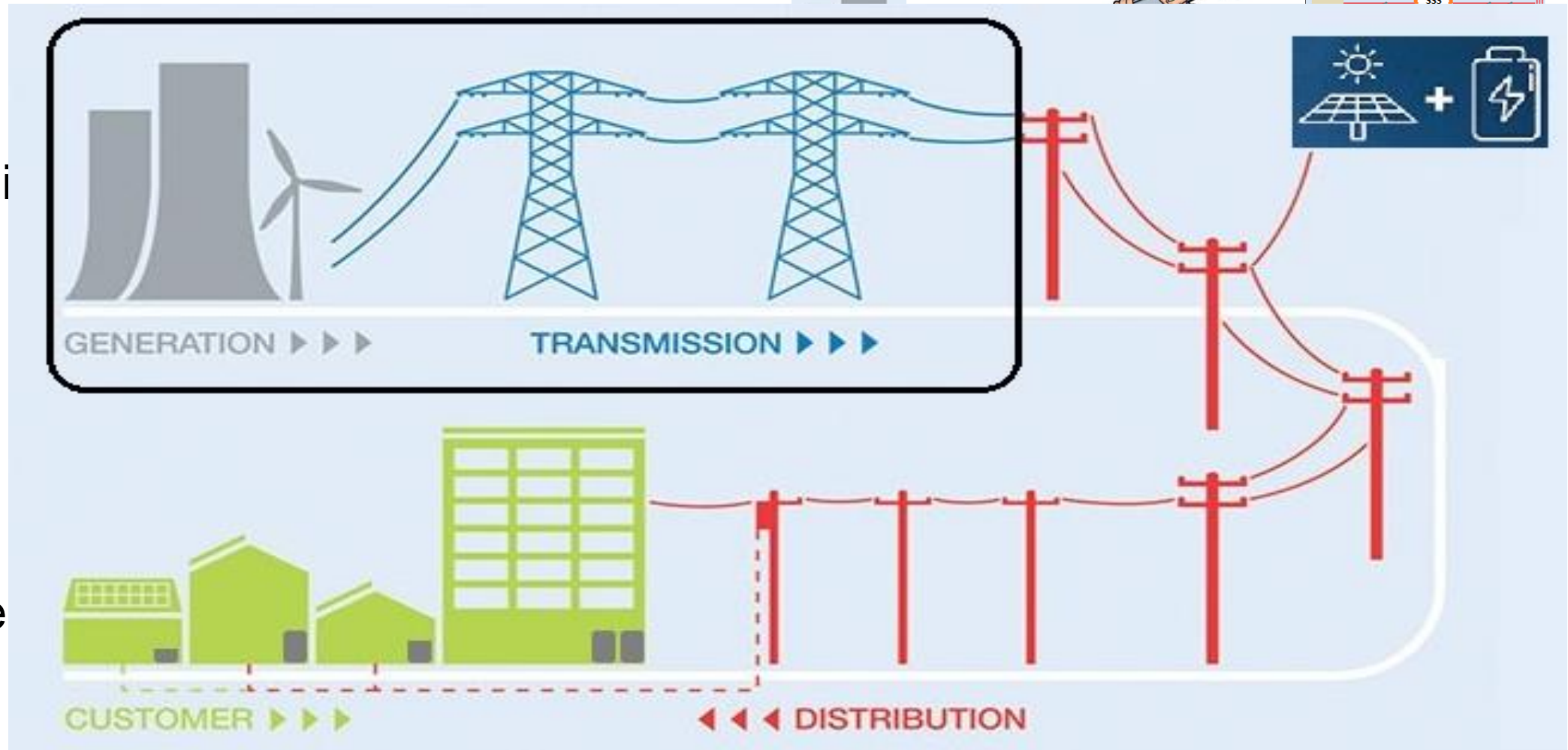


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New metric to assess cost-effectiveness

Level 1

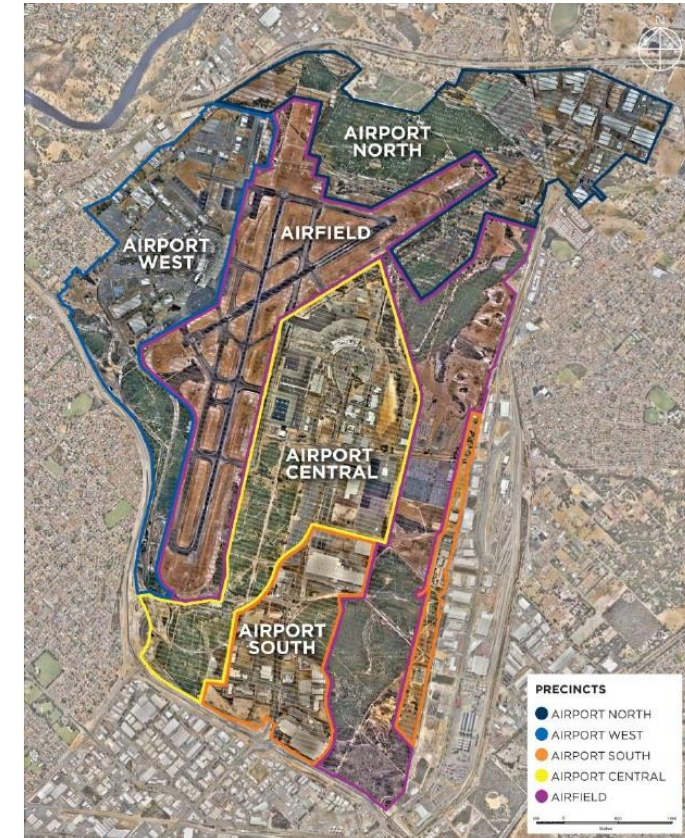
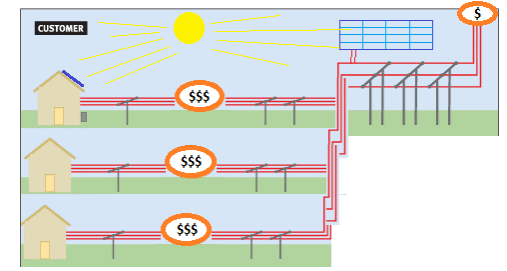
Level 2



➤ Energy delivered x 11 years

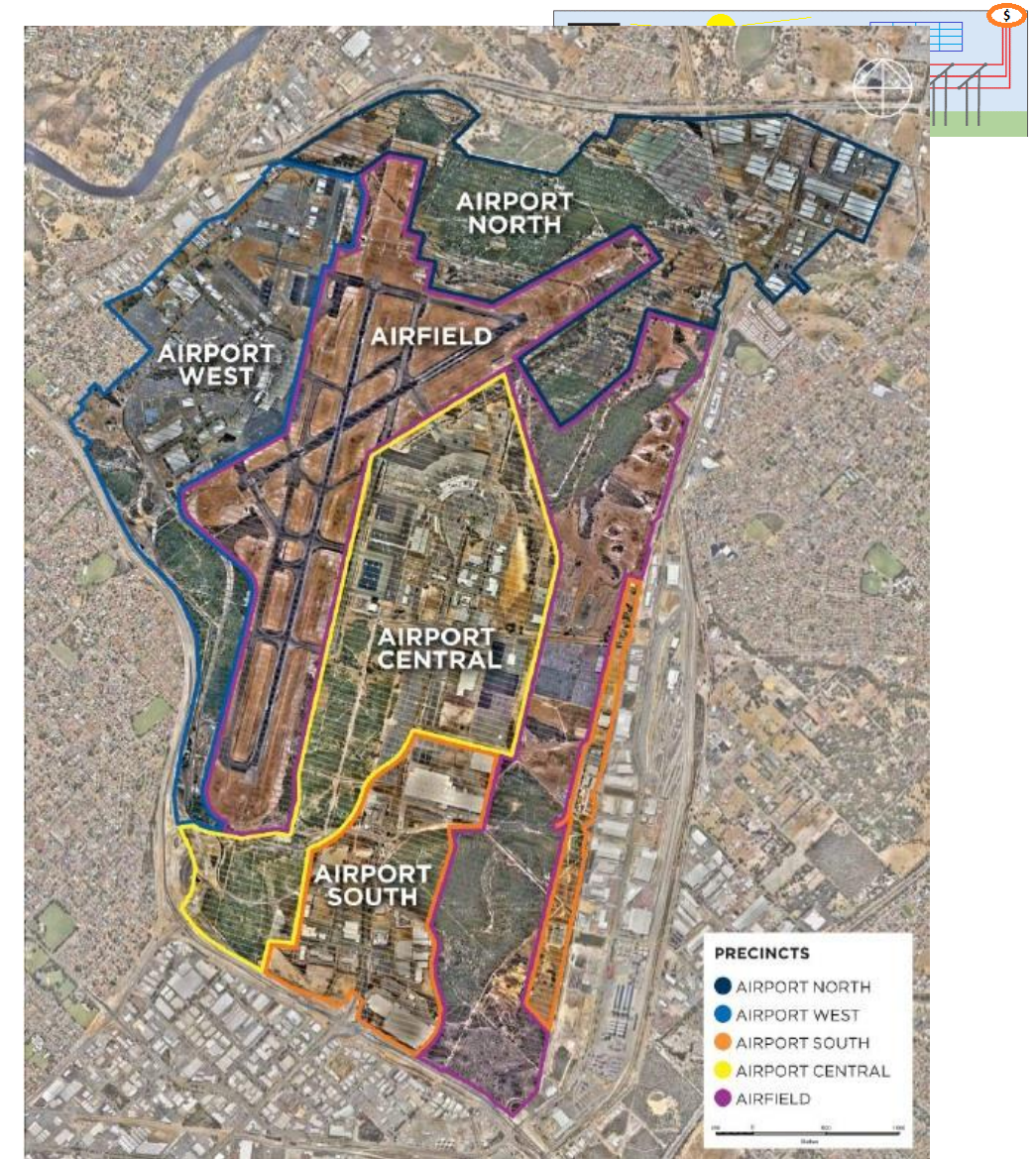
Case Study

What if the
Perth Airport
industrial precinct
transitioned to solar?

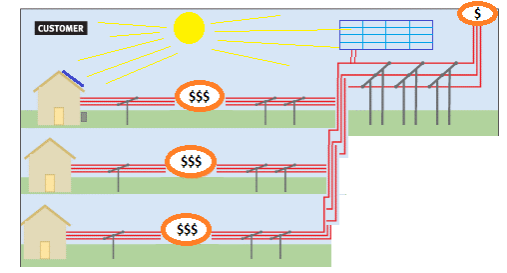


Perth Airport Estate and Embedded Network

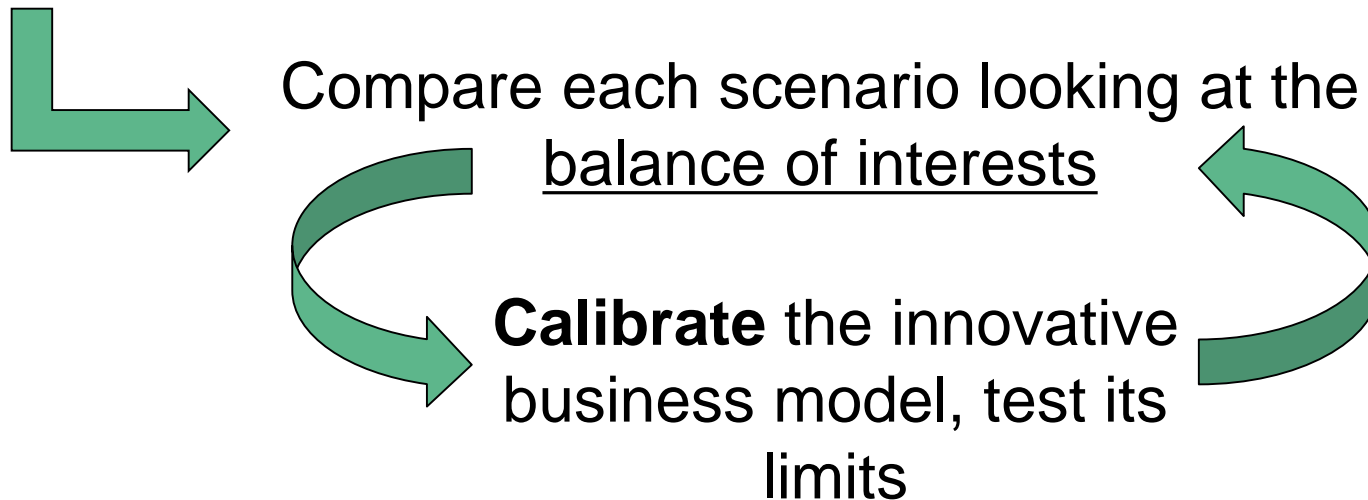
- ✓ Runways
 - ✓ Terminals
 - ✓ Hangars
 - ✓ Aircrafts maintenance facilities
 - ✓ ...
-
- ✓ Commercial tenants in terminals
 - ✓ Office buildings
 - ✓ Hotels
 - ✓ Industrial tenants of all sizes
- ➔ ENERGY CUSTOMERS



Methodology of the case study

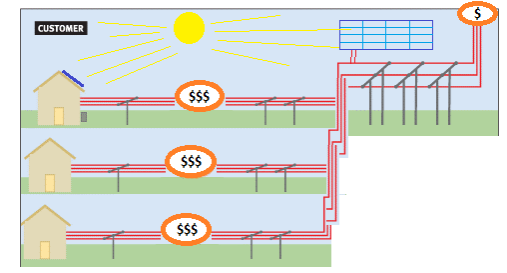


➡ Model and run simulations of each scenario

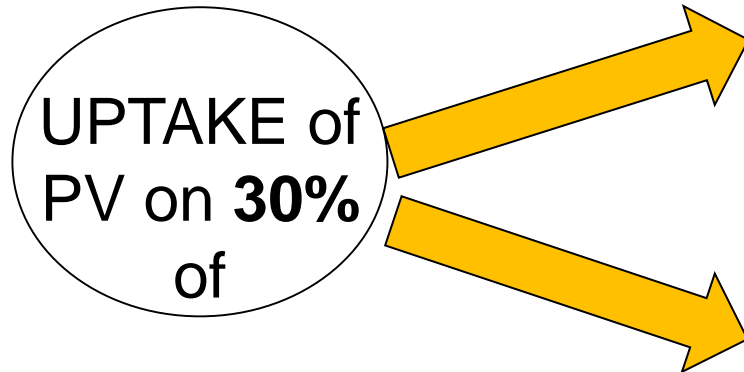


➡ Deliver an industry-ready model

Expected impact :



Assuming nationwide:



7 int'l Airports and 12
largest industrial sites



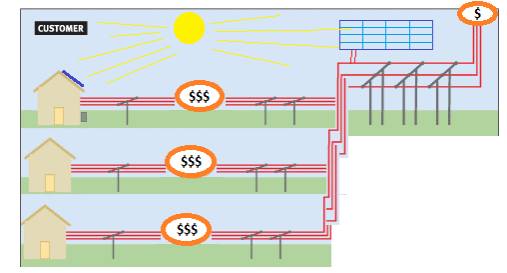
Installing an
average of
5MW

100 largest Business
Parks and 43
Universities



Installing an
average of
1MW

Potential carbon savings by 2030:



Assuming:

30% of 7 int'l Airports and of 12 industrial sites install an average of **5MW**



6 EEN x 7500MWh/y x
 $0.81\text{tCO}_2\text{e/MWh} = 36,400\text{tCO}_2\text{e/y}$

30% of 100 largest Business Parks and 43 universities install an average of **1MW**



30 EEN x 1500MWh/y x
 $0.81\text{tCO}_2\text{e/MWh} = 52,200\text{tCO}_2\text{e/y}$

TOTAL : 88,600tCO₂e saved per year

And more competitive industrial precincts!

Next presenter:
Sebastian Davies-Slate

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>



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Integrating Land Values and Transit

Credit: PTAWA

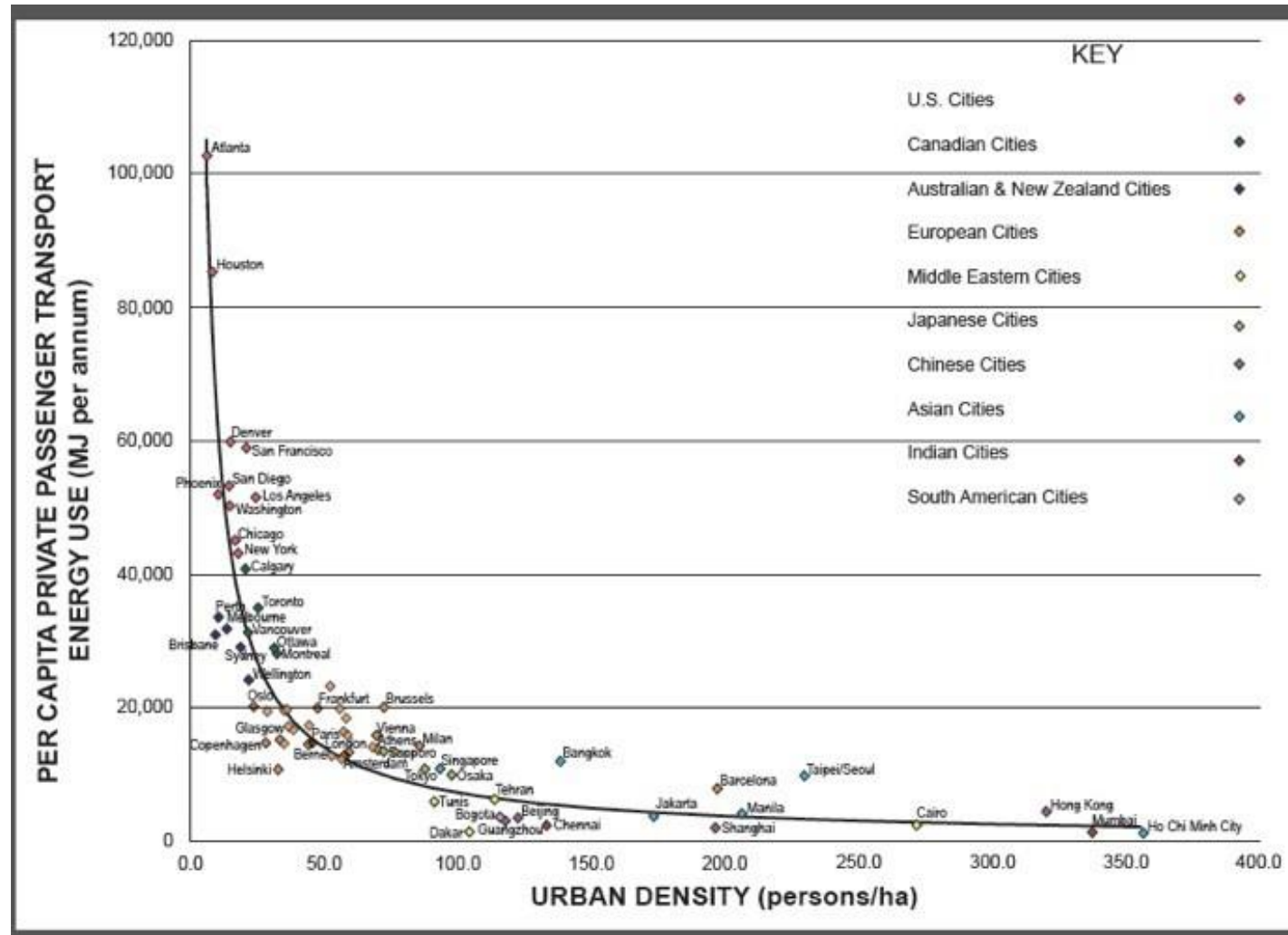
Sebastian Davies-Slate
[sebastian.davies-slate@
postgrad.curtin.edu.au](mailto:sebastian.davies-slate@postgrad.curtin.edu.au)



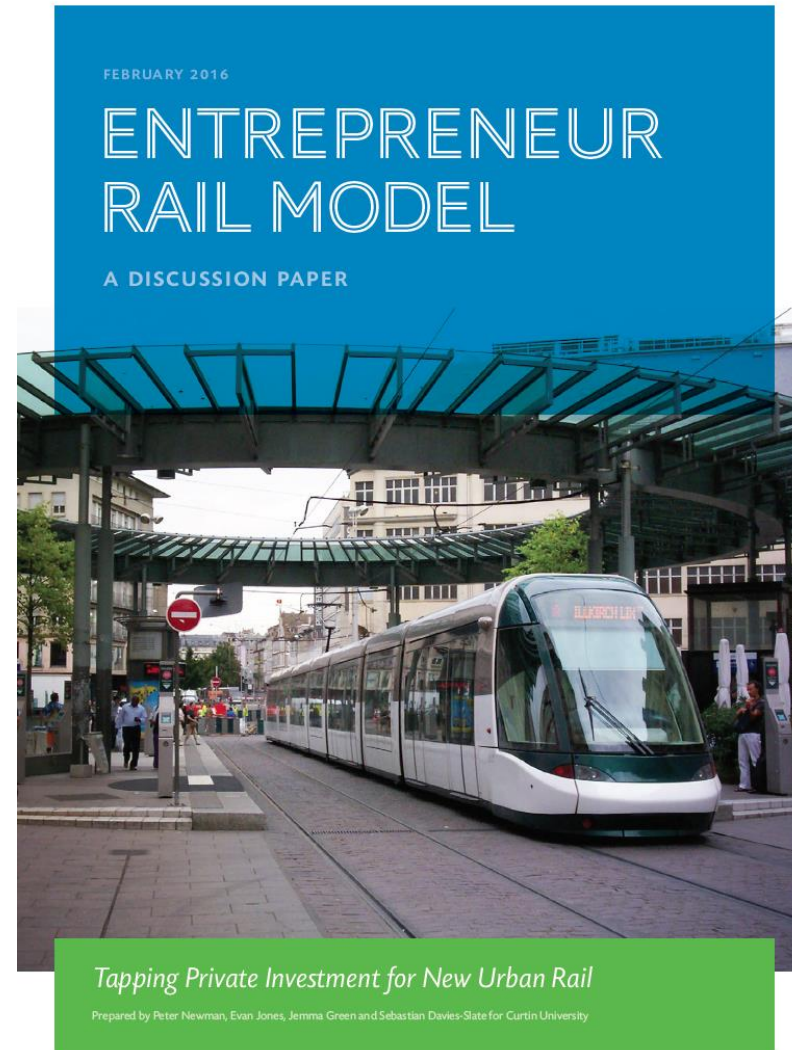
The Problem: Car Dependency and Limited Public Finances



The problem: energy use and GHG emissions



The entrepreneur rail model: private funds and innovation



The entrepreneur rail model: private funds and innovation



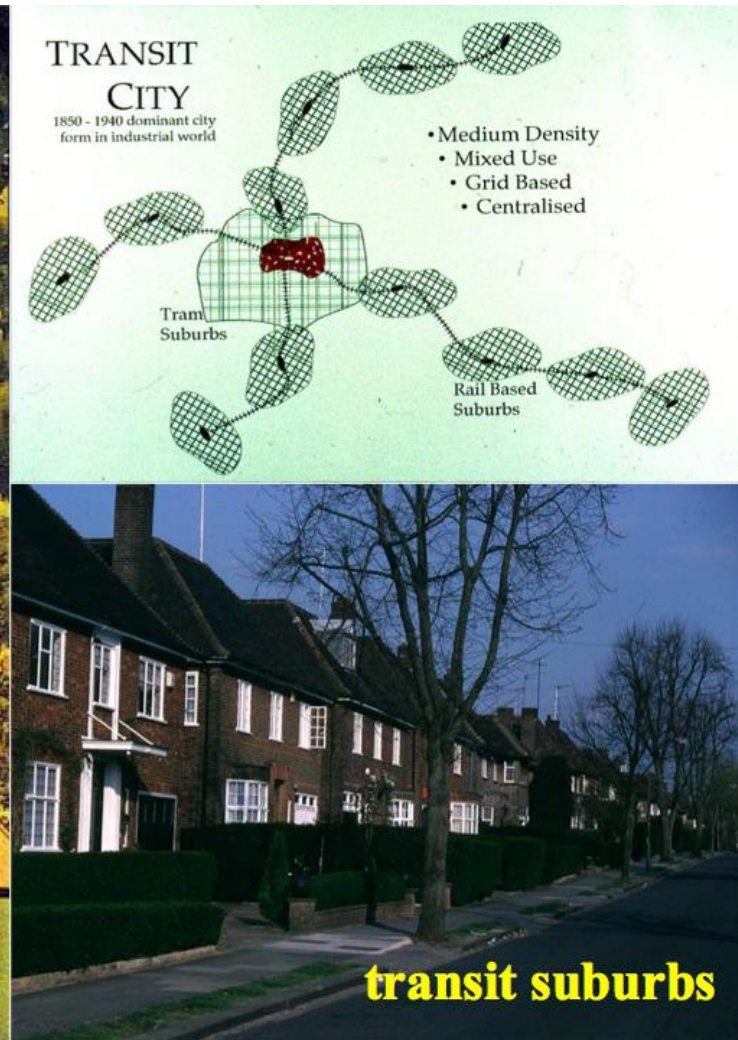
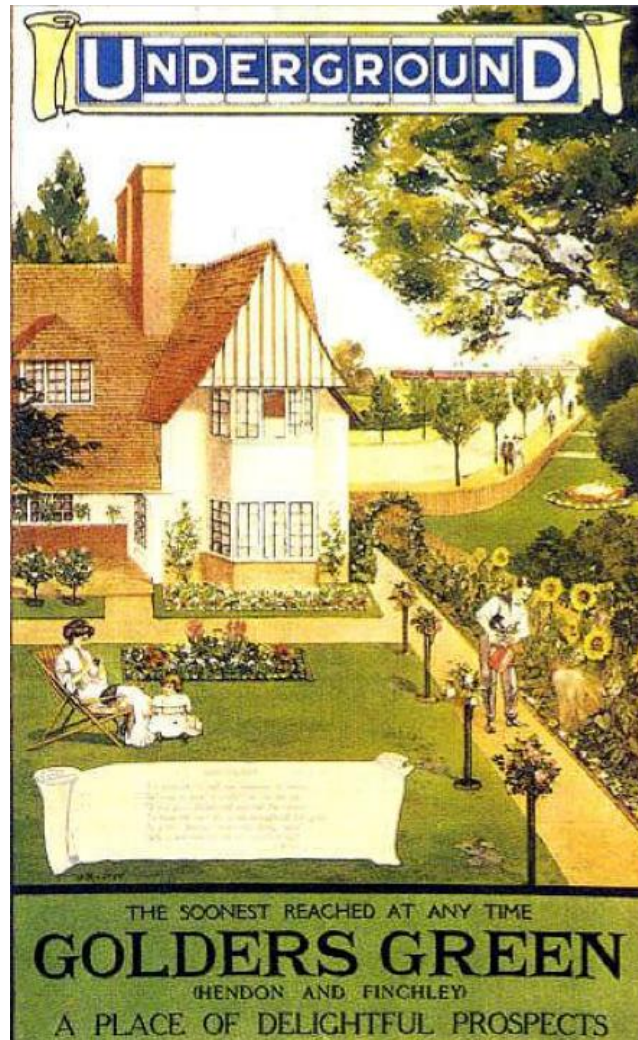
Conventional rail planning model



Entrepreneurial rail planning model



London Underground and “Metroland”



Case study: Miami Brightline



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Credit: All Aboard Florida (2017)



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Case study: Miami Brightline



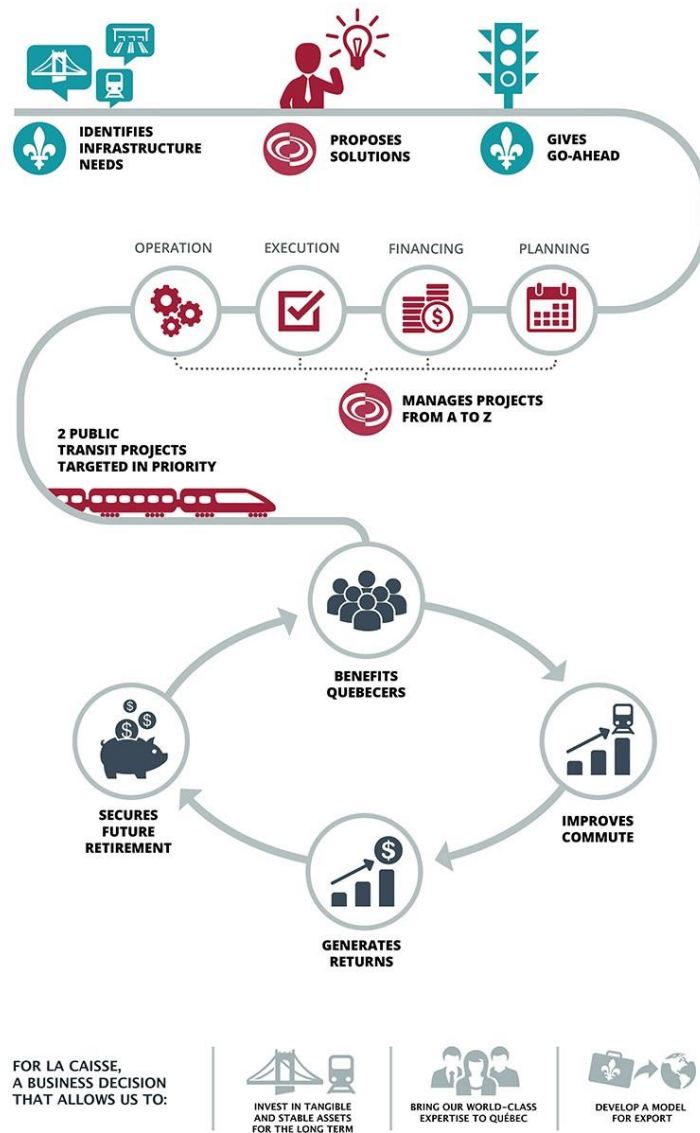
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Credit: USA Today



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Case study: Montreal and Auckland



Credit: CDPQ Infra

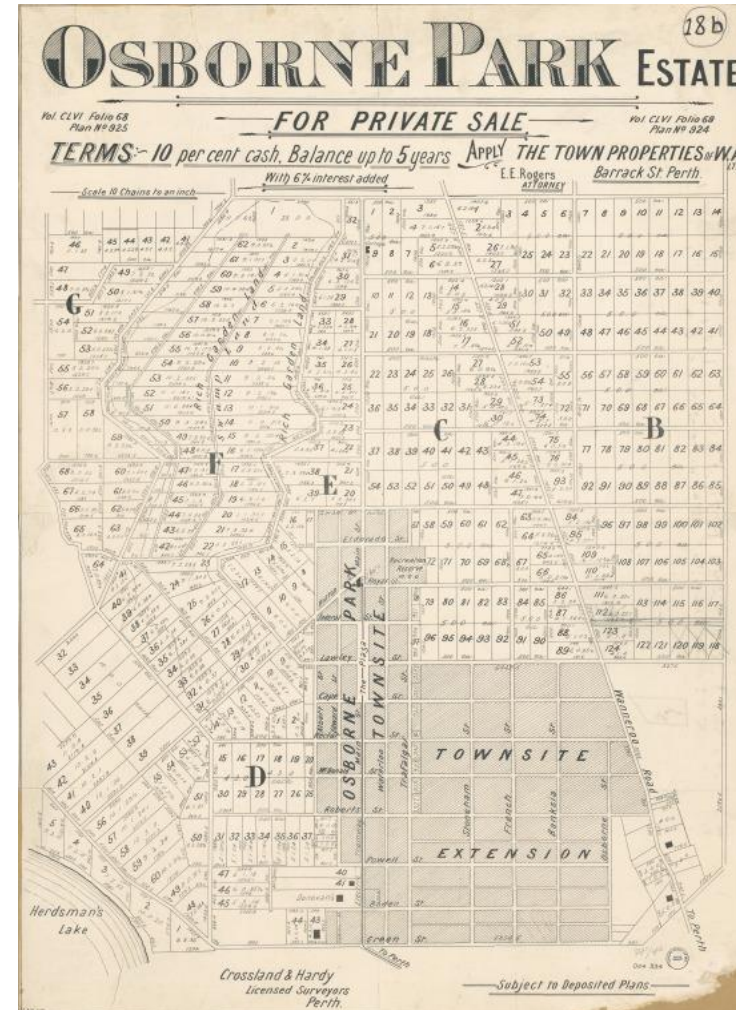


Credit: NZ Herald

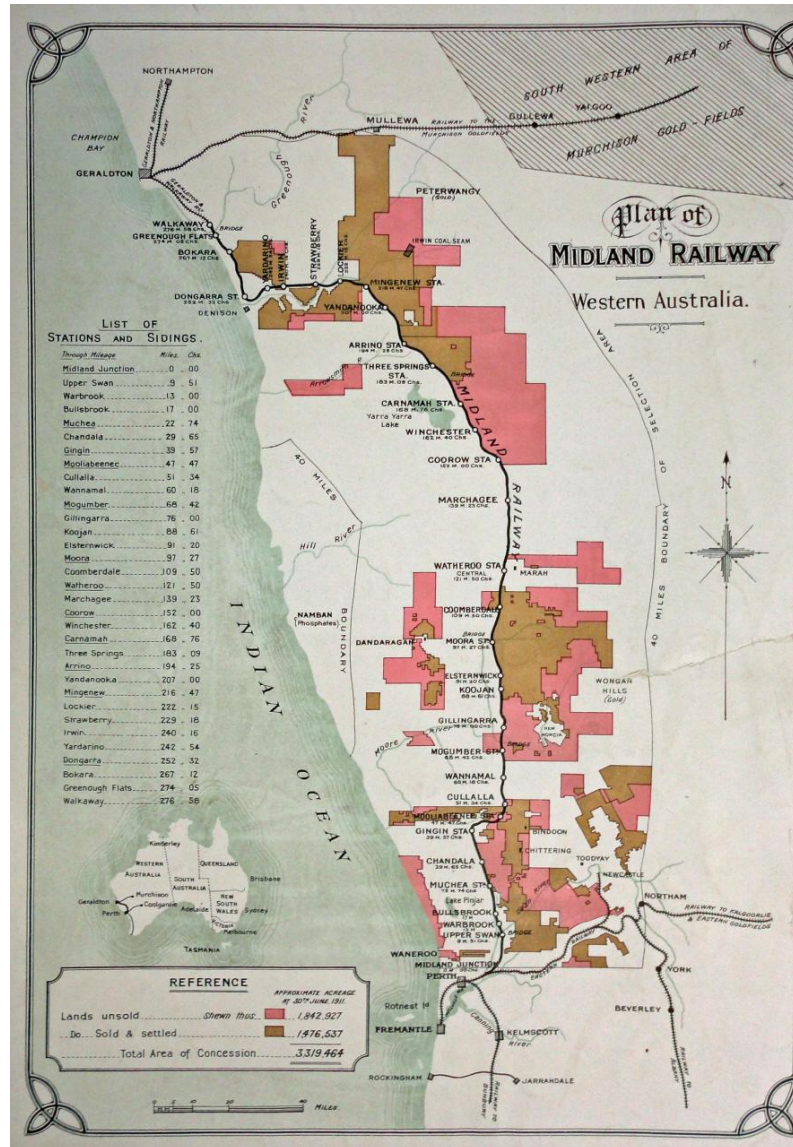
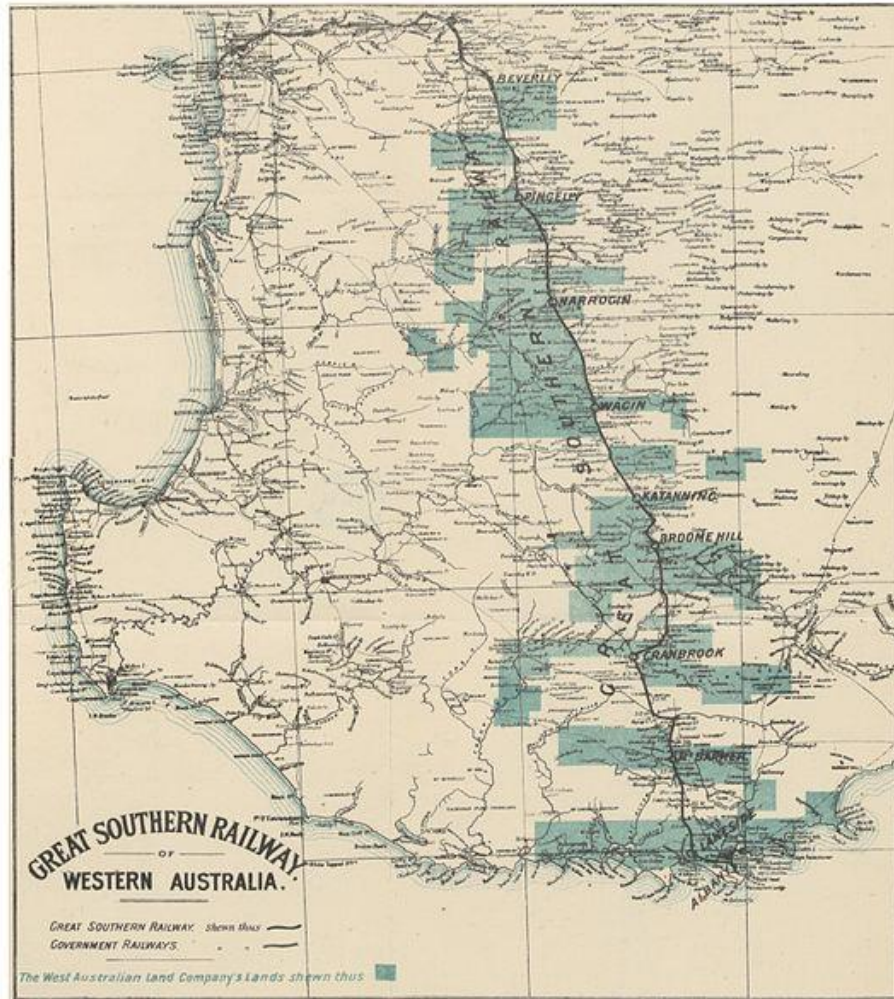
CLARA - Consolidated Land and Rail Australia



The Tramways Companies



Land Grant Railways



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Credit: Mennell (1894); Carnamah Historical Society



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urban science



Article

Partnerships for Private Transit Investment—The History and Practice of Private Transit Infrastructure with a Case Study in Perth, Australia

Sebastian Davies-Slate and Peter Newman * 

Curtin University Sustainability Policy Institute, GPO Box U1987, Perth, WA 6845, Australia;
sebastian.davies-slate@curtin.edu.au

* Correspondence: p.newman@curtin.edu.au; Tel.: +61-426-677-944

Received: 25 July 2018; Accepted: 28 August 2018; Published: 3 September 2018



Abstract: Urban transit planning is going through a transition to greater private investment in many parts of the world and is now on the agenda in Australia. After showing examples of private investment in transit globally, the paper focuses on historical case studies of private rail investment in Western Australia. These case studies mirror the historical experience in rapidly growing railway cities in Europe, North America, and Asia (particularly Japan), and also the land grant railways that facilitated settlement in North America. The Western Australian experience is noteworthy for the small but rapidly growing populations of the settlements involved, suggesting that growth, rather than size, is the key to successfully raising funding for railways through land development. The paper shows through the history of transport, with particular reference to Perth, that the practice of private infrastructure provision can provide lessons for how to enable this again. It suggests that



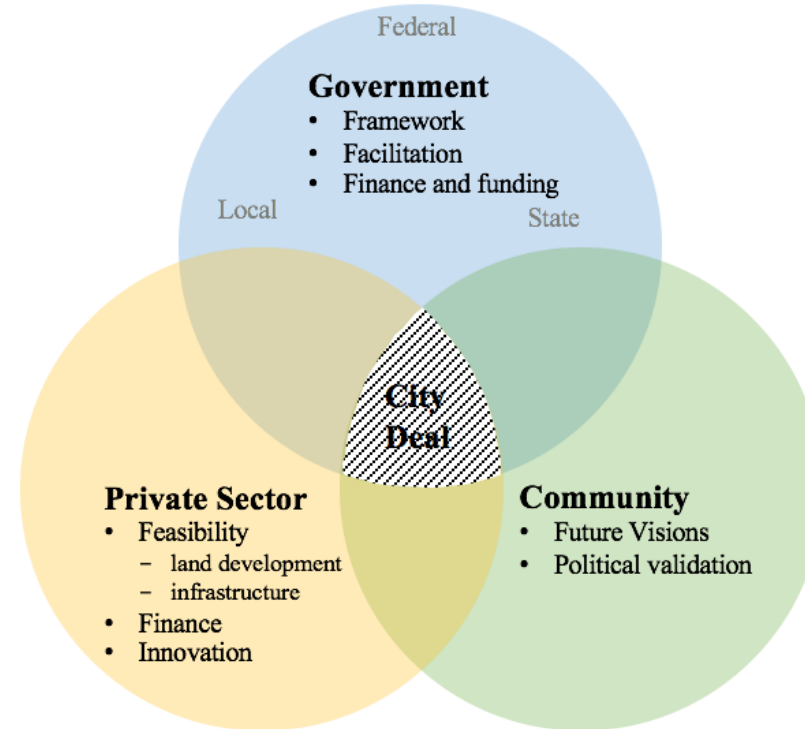
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City Deal

A new way of Building Australian cities for their long term based on partnerships...



Transit-activated corridors



Curtin University

Credit: melbournesnorth.com.au



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Investigative trip in Japan



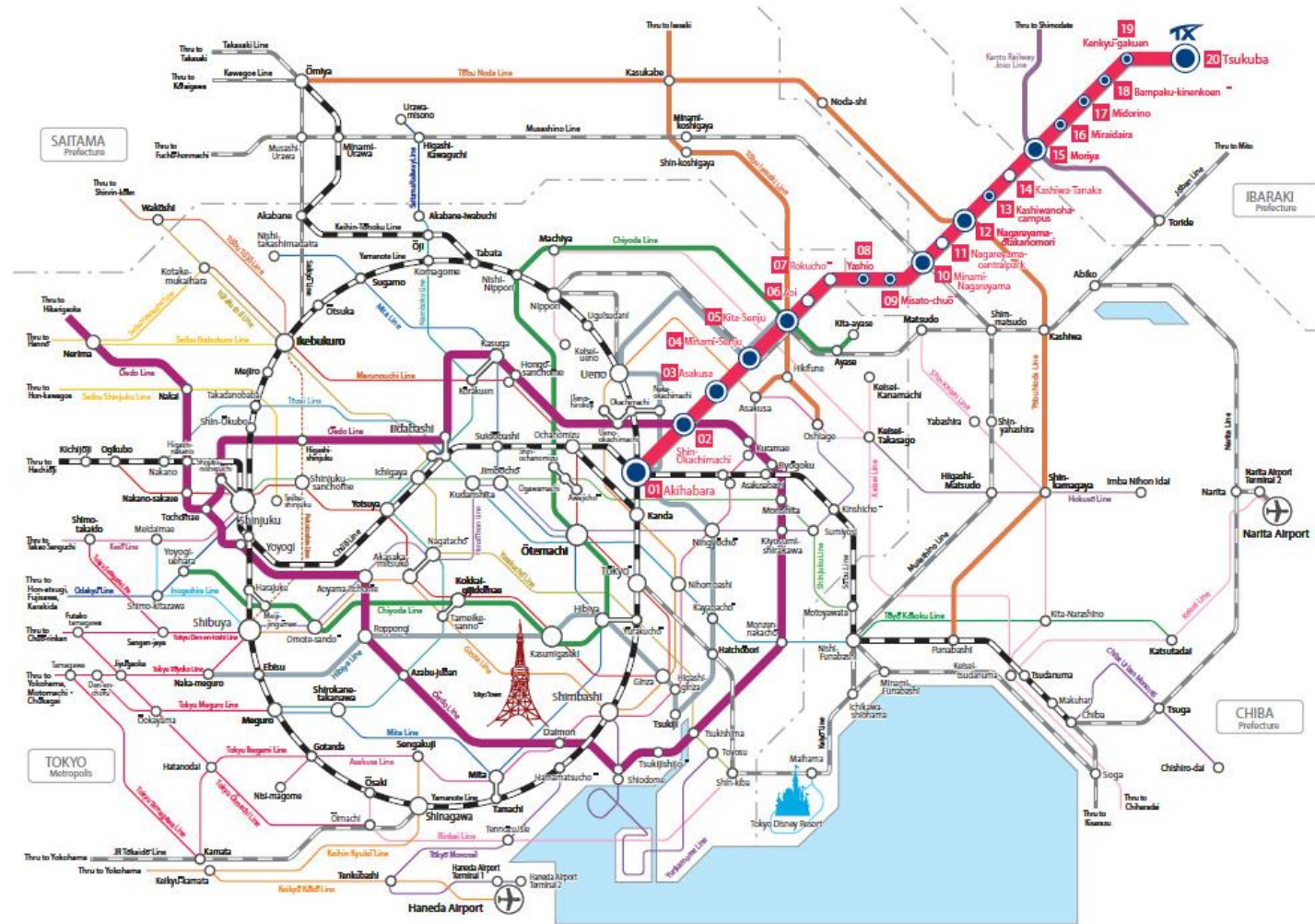
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Credit: author



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A new case study: Tsukuba Express



The Trackless Tram



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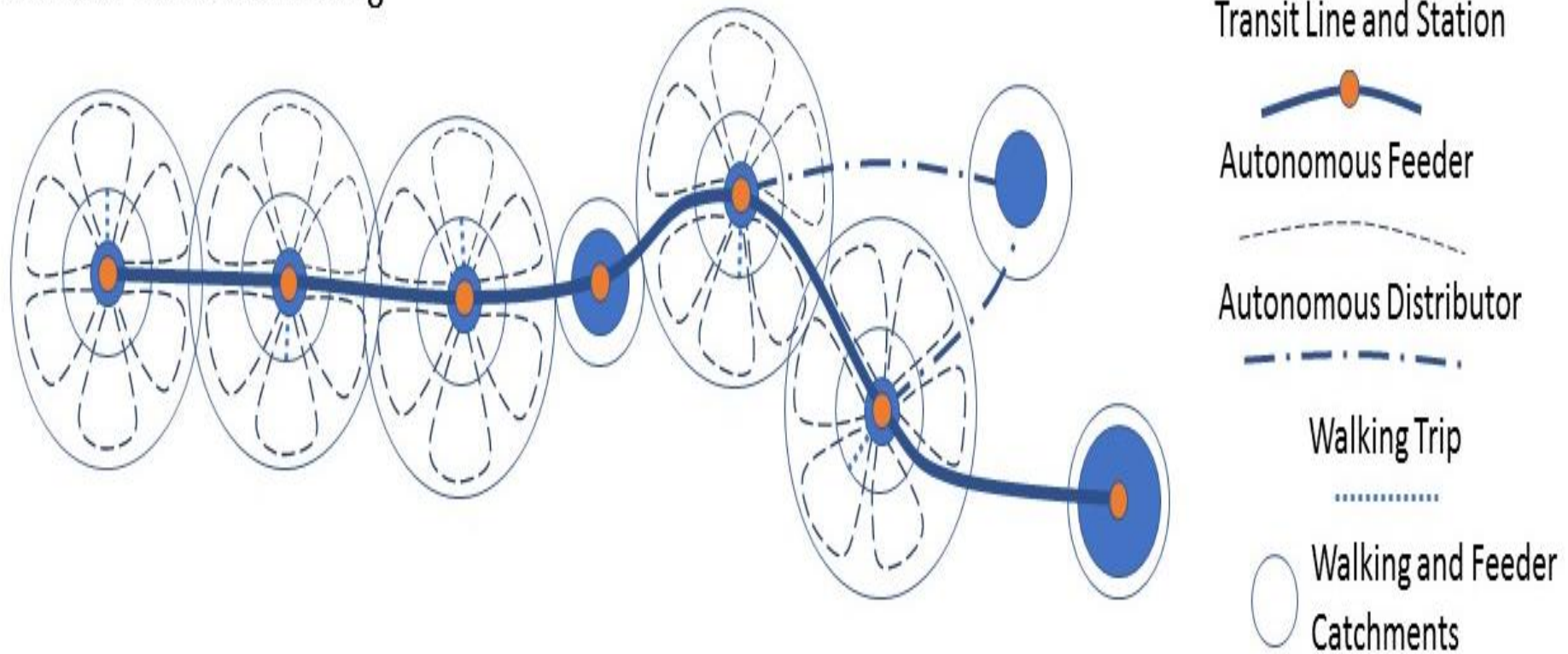
Credit: CRRC



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The Trackless Tram

Corridor Transit Commuting



Thank You



Curtin University

Credit: Place Match



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Next presenter:
Portia Odell

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>



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Influencing change through a low carbon schools community program

Portia Odell

Portia.odell@postgrad.curtin.edu.au



John Curtin College of the Arts.
Credit: <https://horrephotography.com/>



Curtin University

Low carbon schools pilot program ran from 2015 to 2017 with 15 Perth schools



Low Carbon Schools Program Launch.
Credit: <https://horrephotography.com/>

simply
CARBON



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City of
Fremantle



City of
Melville



Bendigo Bank



City of
Cockburn



Sustainable Schools WA



synergy



THE GOVERNMENT OF
WESTERN AUSTRALIA



WASTE
AUTHORITY
WA...TOO GOOD TO WASTE



TRANSPORTATION TO SCHOOL



life
cycle



moore moore



Ellenby Tree Farm
Growing tomorrows trees today



FlowLess



WATER EDUCATION



BENARA
NURSERIES



solaranalytics



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Schools program aimed to empower and help schools reduce their carbon footprint

Carbon Footprint

Workshops



First LCSP Workshop.
Credit: SimplyCarbon

[illegible]

Action Plan

Lance Holt School Action Plan

Please scroll down to see tables for Water, Wastewater, Transportation and Other Activities.

In the table "Other," you can add things such as existing water conservation, tree planting, single garbage, creating a school landscape page for maintenanceability of any community outreach activities etc.

ENERGY Action Item (Short Description)	Description	Business Investment (\$/K)	Approx Cost	Who/Name (if not school resources)	Due Date (plenty lead time)	Status (update from 2017 survey)
1. Electricity tariff	Assess whether our current tariff is the most appropriate (i.e. lowest rate)		None	Garcia	Aug 17	Application to change to 2- or 3- tier summer rates 2018. Paper work was re-submitted in April 2017 as change did not include the original paperwork. The reason was that there is a problem with us changing tariffs.
2. Power usage	Determine our total electricity consumption, separating the amount of solar and grid electricity consumed		None	Patte & Garcia	Dec 17	Make Tiers applied for additional costs from Western Power. Unfortunately, only electricity meter read data was available. He identified that we will receive an audit.

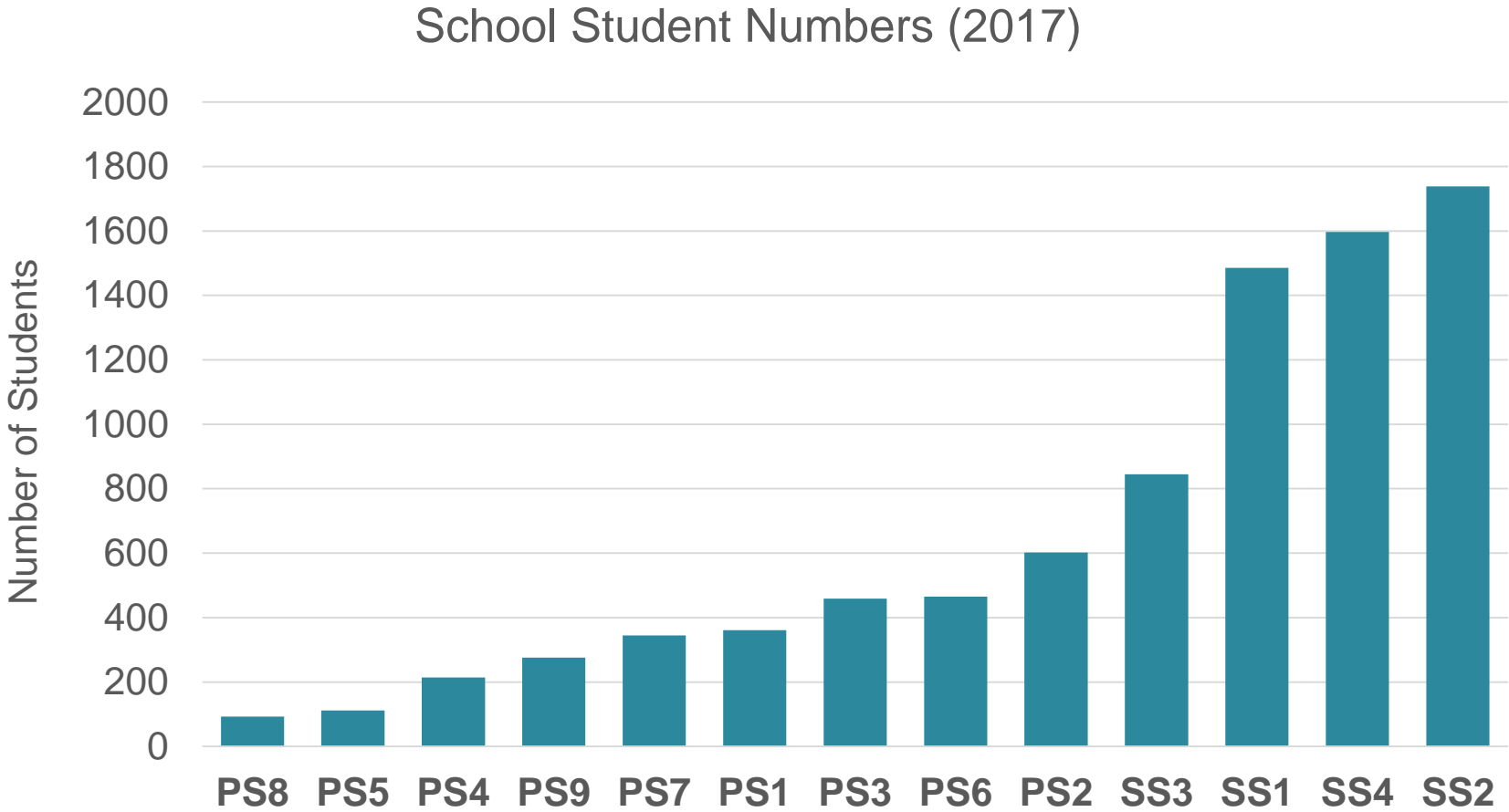
Meet-ups



Meet-up.
Credit: SimplyCarbon

15 schools participated in the schools program with student numbers ranging from 60 to 1600

# of Schools	Council Area
1	City of Belmont
1	City of Canning
2	City of Cockburn
6	City of Fremantle
3	City of Melville
1	City of Rockingham
1	City of Swan



Research Question: How can schools contribute to the reduction of carbon emissions within the community?

- 1. What are the barriers and enablers for school carbon reduction?**
- 2. What effective strategies are used to decarbonise schools?**
- 3. How can schools influence community attitudes and behaviour around low carbon living?**



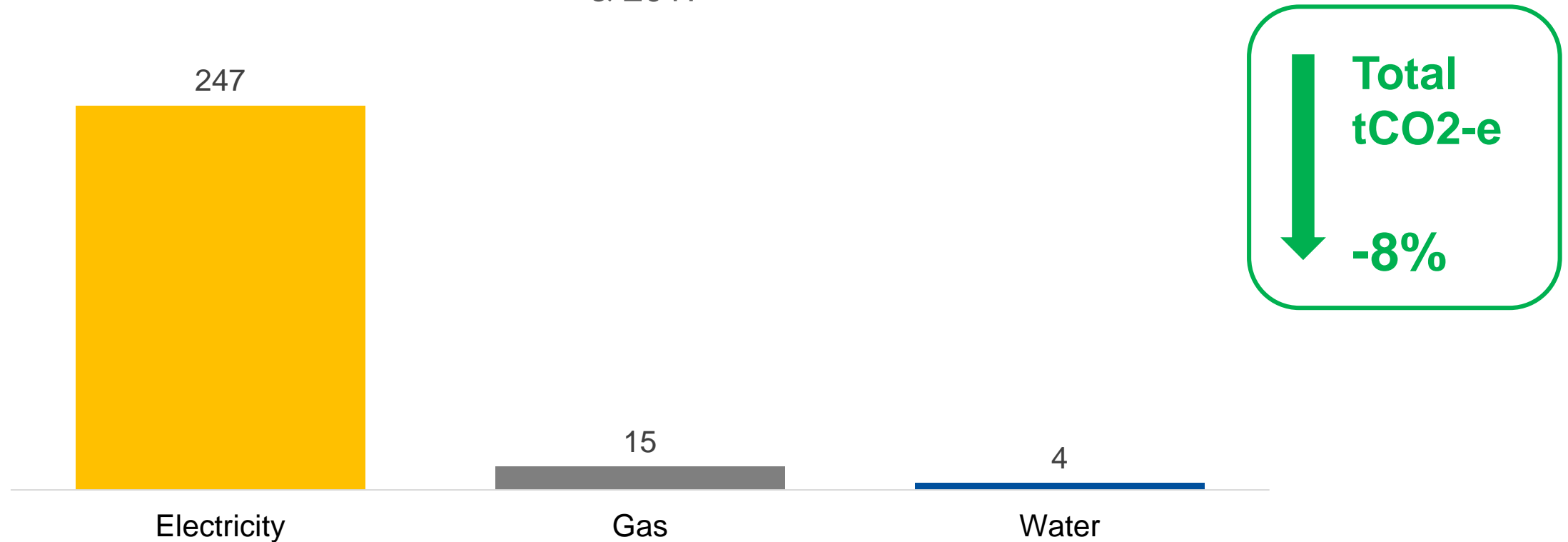
Research Question: How can schools contribute to the reduction of carbon emissions within the community?

- 1. What are the barriers and enablers for school carbon reduction?**
- 2. What effective strategies are used to decarbonise schools?**
- 3. How can schools influence community attitudes and behaviour around low carbon living?**




Total of 266 tco2-e saved across all 13 schools with largest reduction from electricity

Total Tonnes Carbon Emissions Saved by Utility Between 2015
& 2017




Average carbon emissions per student and average utility savings per student decreased between 2015 and 2017



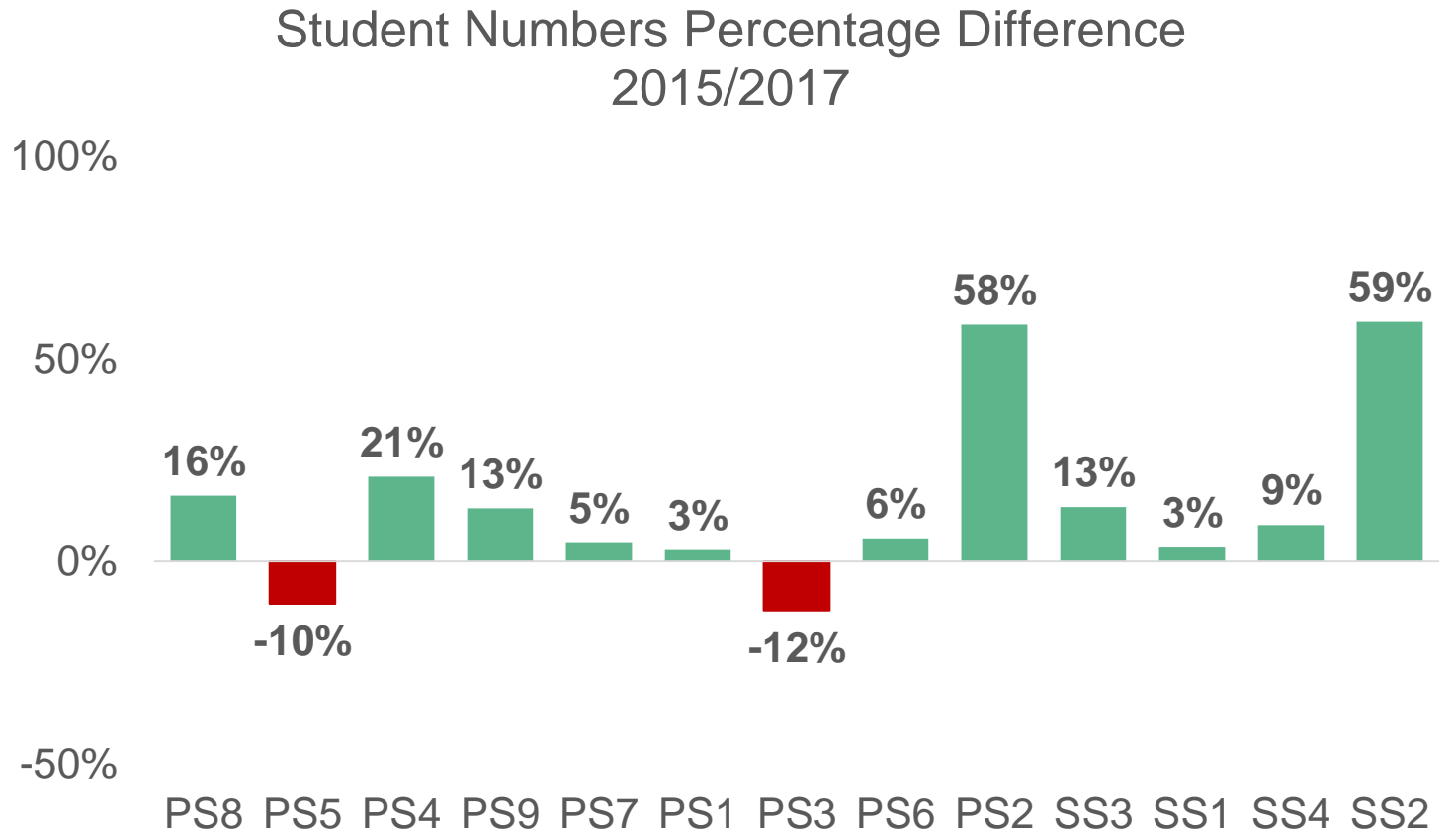
Average
tCO2-e
Per Student

-20%




Average Utility
Savings (2015 to
2017)

\$-16.71
Per Student




Average carbon emissions per student and average utility savings per student decreased between 2015 and 2017



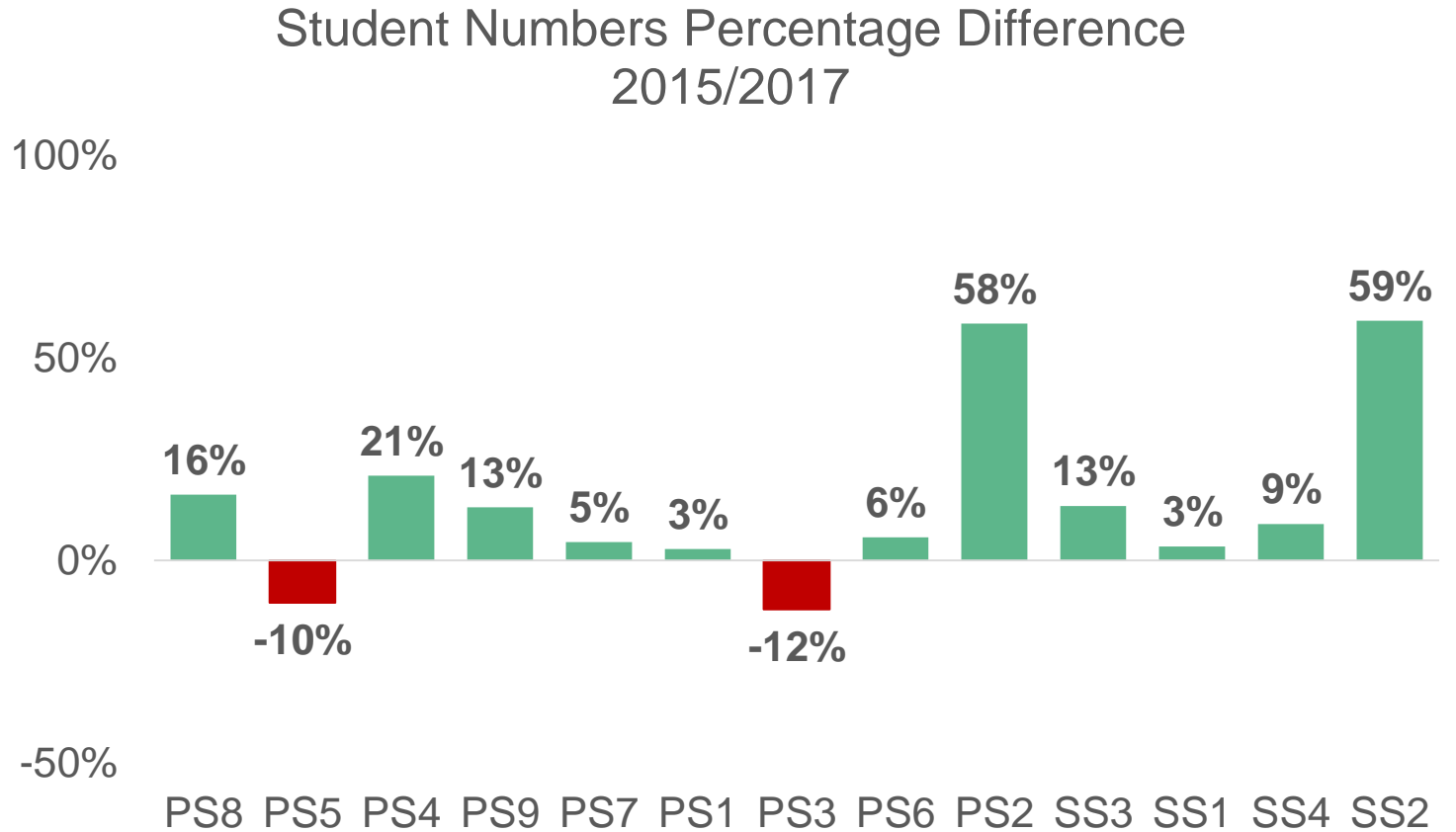
Average
tCO2-e
Per Student

-20%



Average Utility
Savings (2015 to
2017)

\$-16.71
Per Student

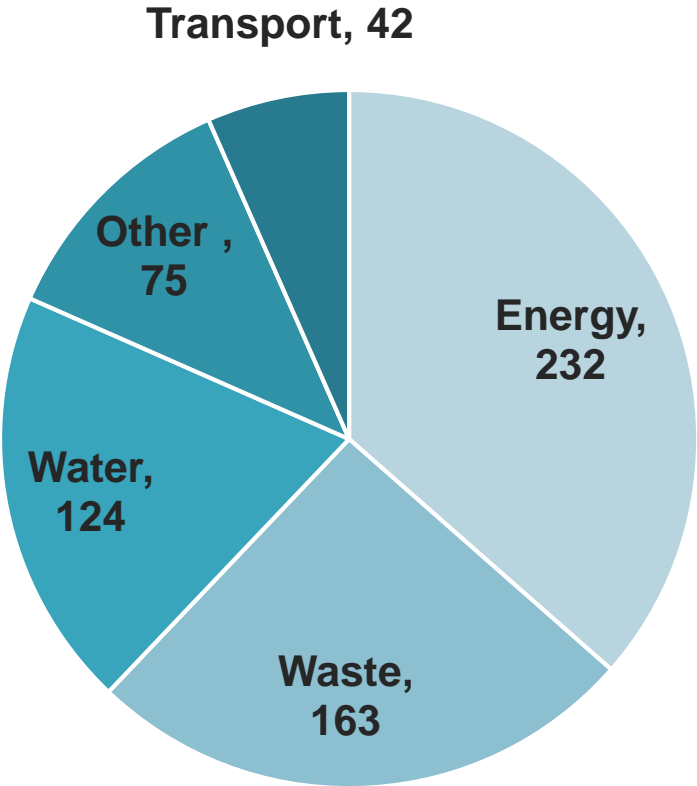


Schools pursued over 600 initiatives with over half involving no cost

636 Low Carbon Initiatives



60% initiatives no cost



Lance Holt School Action Plan

Please scroll down to see tables for Water, Waste, Transport and 'Other Activities'

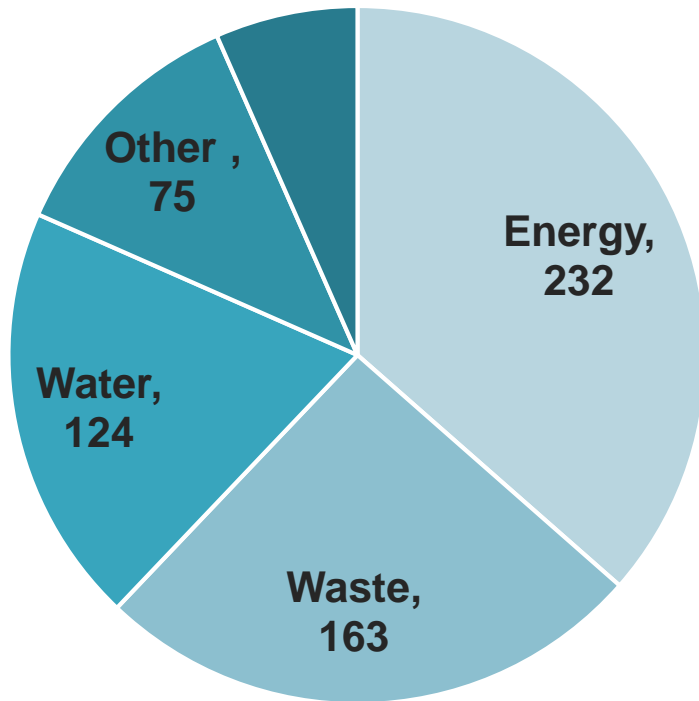
In the table 'Other', you can add things such as: creating student committees, tree planting, yoga gardens, creating a school feedback page for the sustainability of any community outreach activities etc.

	ENERGY Action Item (Short Description)	Description	Student involvement (Y/N)	Approve Cost	Who/Name (List specific person responsible)	Due Date (Month/Year)	Status (Include any progress reports)
1	Electricity audit	Assess whether and current audit is the most appropriate i.e. lowest rate		Paid	Gertraud	Aug 17	Application to change to 20 tariff submitted Dec 2016. Paperwork was re-submitted in April 2017 as Synergy did not receive the original paperwork. The response was that there is a problem with us changing tariffs. Old Synergy account closed under City of Perth/other has been closed. Close new account & establish, we should be able to get the 20 tariff.
2	Power usage	Determine our total electricity consumption, reporting the amount of solar and grid electricity consumed.		Paid	Pathe & Gertraud	Dec 17	Mark Tynopce applied for additional data from Western Power. Unfortunately only <u>monthly</u> meter read data was available. He clarified that we will need to invest in a sub-meter for solar. Detailed energy use and production data.

Schools pursued over 600 initiatives with over half involving no cost

636 Low Carbon Initiatives

Transport, 42



60% initiatives no cost



Curtin University

Credit: <https://www.allclearid.com/personal/services/identity-repair/icon-nocost-gray/>
<http://chittagongit.com/icon/light-switch-icon-21.html>
https://www.clipartmax.com/middle/m2K9A0b1b1i8H7G6_faucet-water-tap-clip-art/



**LOW CARBON LIVING
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Most schools pursued actions with the largest carbon savings potential



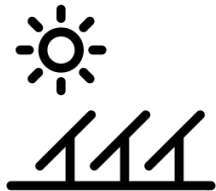
11 schools initiated a Switch Off Protocol



9 schools did a Type 1 energy audit



9 schools have plans for LEDs



8 schools have plans for Solar



RQ #1: barriers to school carbon reduction include lack of time, lack of money & knowledge



- No upfront funds for retrofits
- No access to alternative funding



- No or limited knowledge
- Limited access to experts



- Lack of staff time
- Inconsistent volunteers

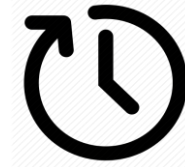
Enablers to school carbon reduction are a whole-school approach, community engagement



- Integration of low carbon initiatives across all areas



- Support of principal and business manager



- Time given to staff for initiatives
- Engaged community and parents



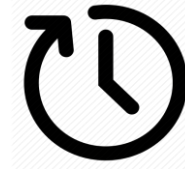
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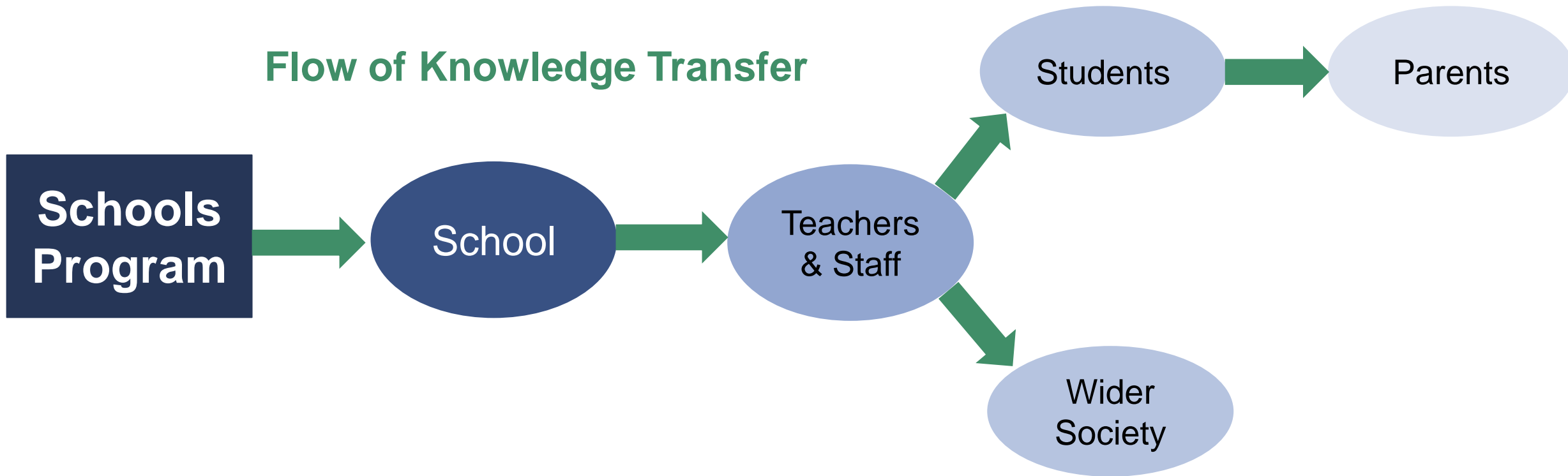
- Support of principal and business manager



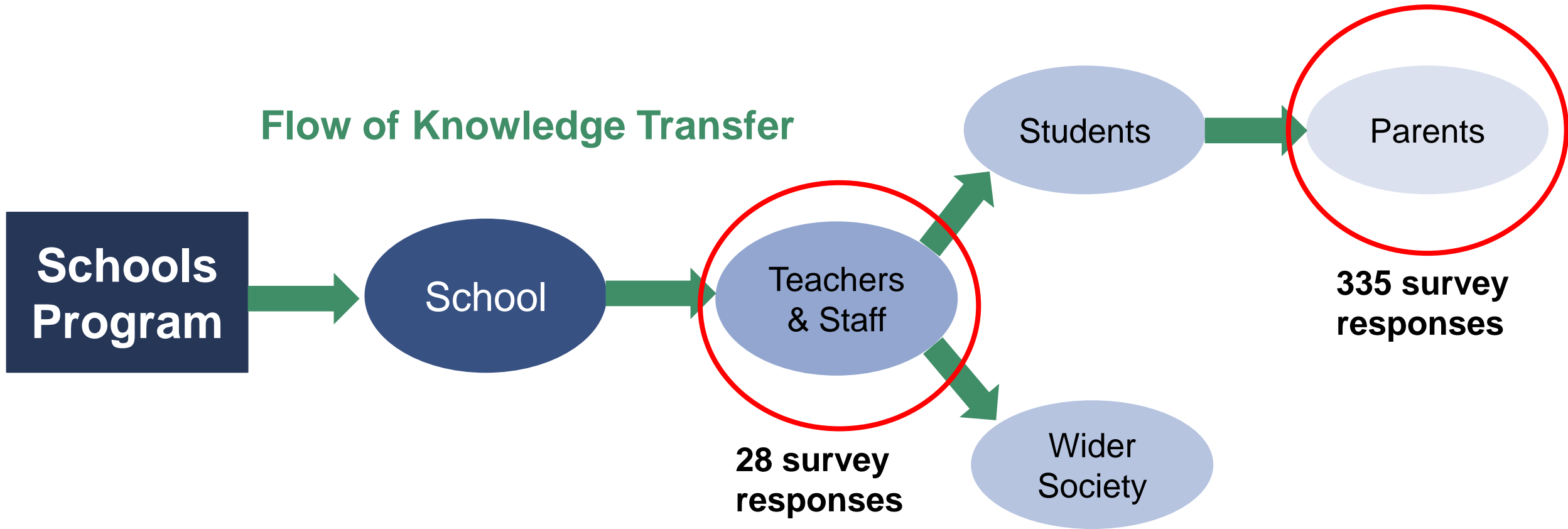
- Time given to staff for initiatives
- Engaged community and parents



RQ 3: how can schools influence community attitudes and behaviour around low carbon living?



Parent & committee member surveys were used to measure transfer of low carbon knowledge



Using program feedback and research findings, climateclever launched nationally in 2018



HORIZON
POWER



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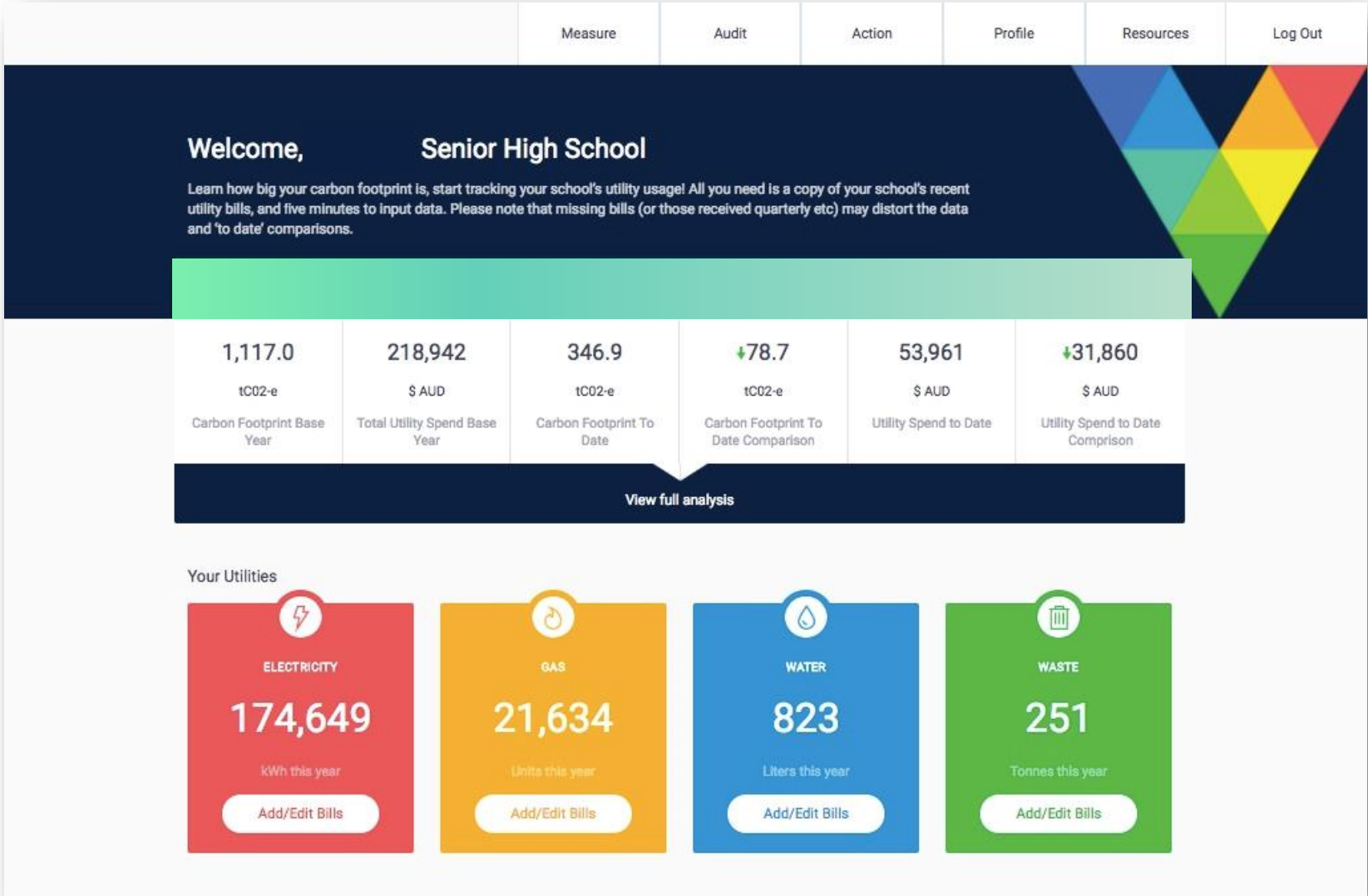


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Climateclever has online tools where schools can measure, track and report their carbon emissions



Thank you



John Curtin College of the Arts.

Credit: <https://horrephotography.com/>

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Portia Odell

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Next presenters:
Roberto Minunno
Timothy O'Grady

Higher degree
research



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Credit: <https://i.ytimg.com/vi/iox18xFDhs4/maxresdefault.jpg>



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L3: the Legacy Living Lab

Roberto Minunno

roberto.Minunno@postgrad.curtin.edu.au

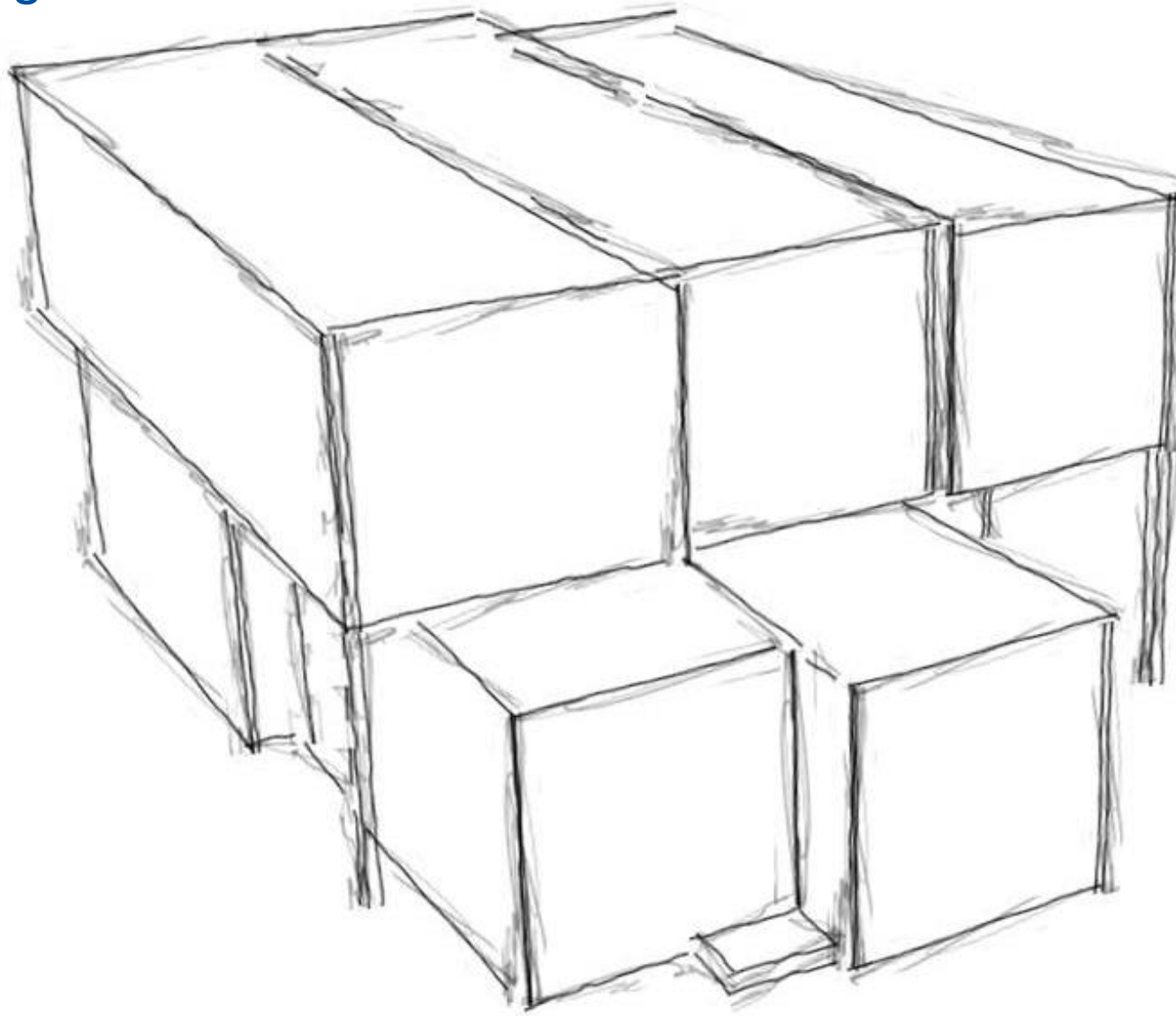
Timothy O'Grady

timothy.ograde@postgrad.curtin.edu.au



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The Legacy Living Lab



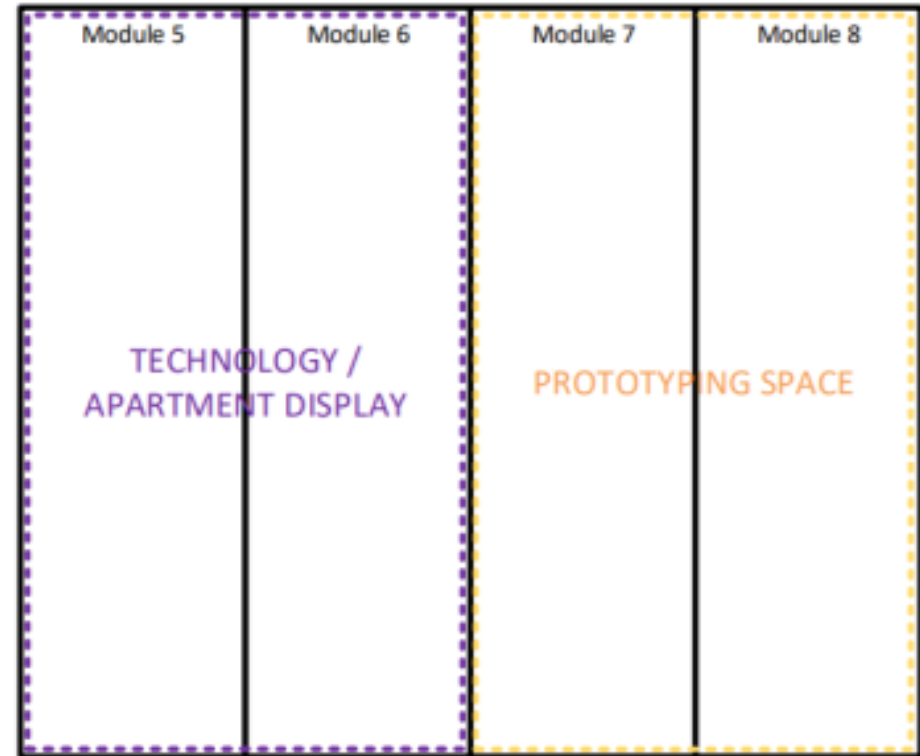
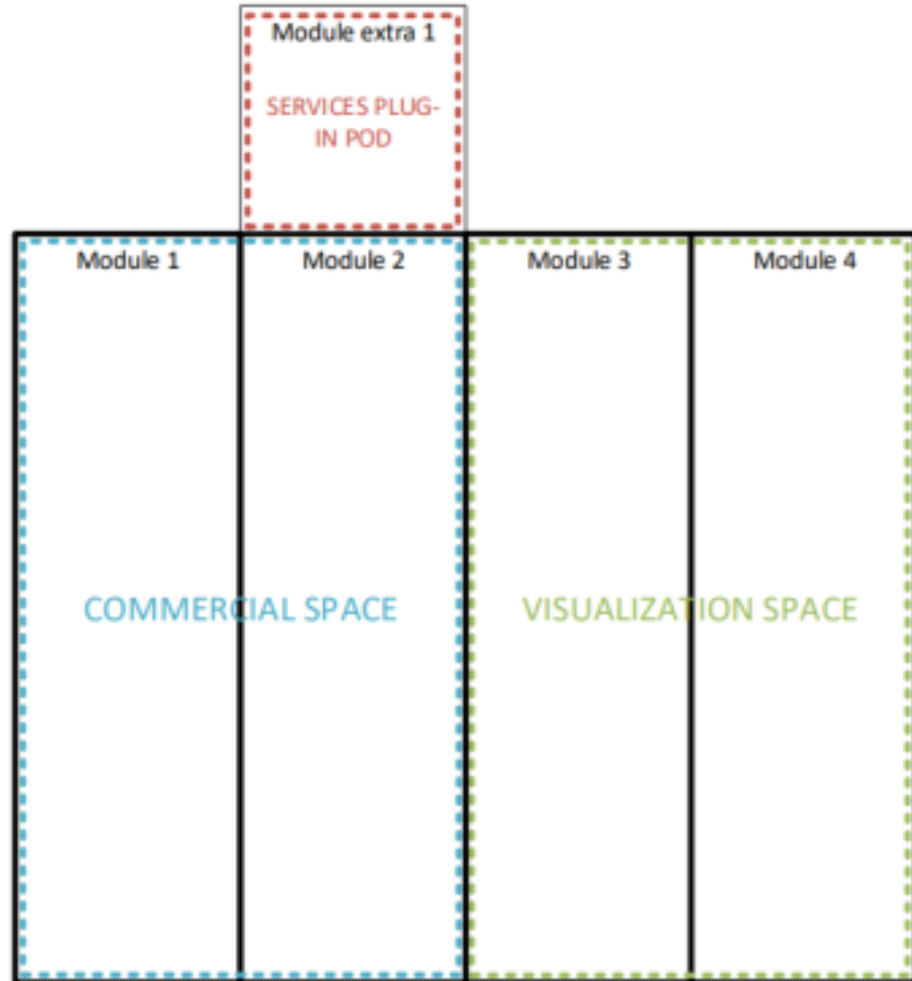
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Credit: authors



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Conceptual space definition



The L3: Legacy Living Lab



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Credit: authors



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Born out of the circular economy



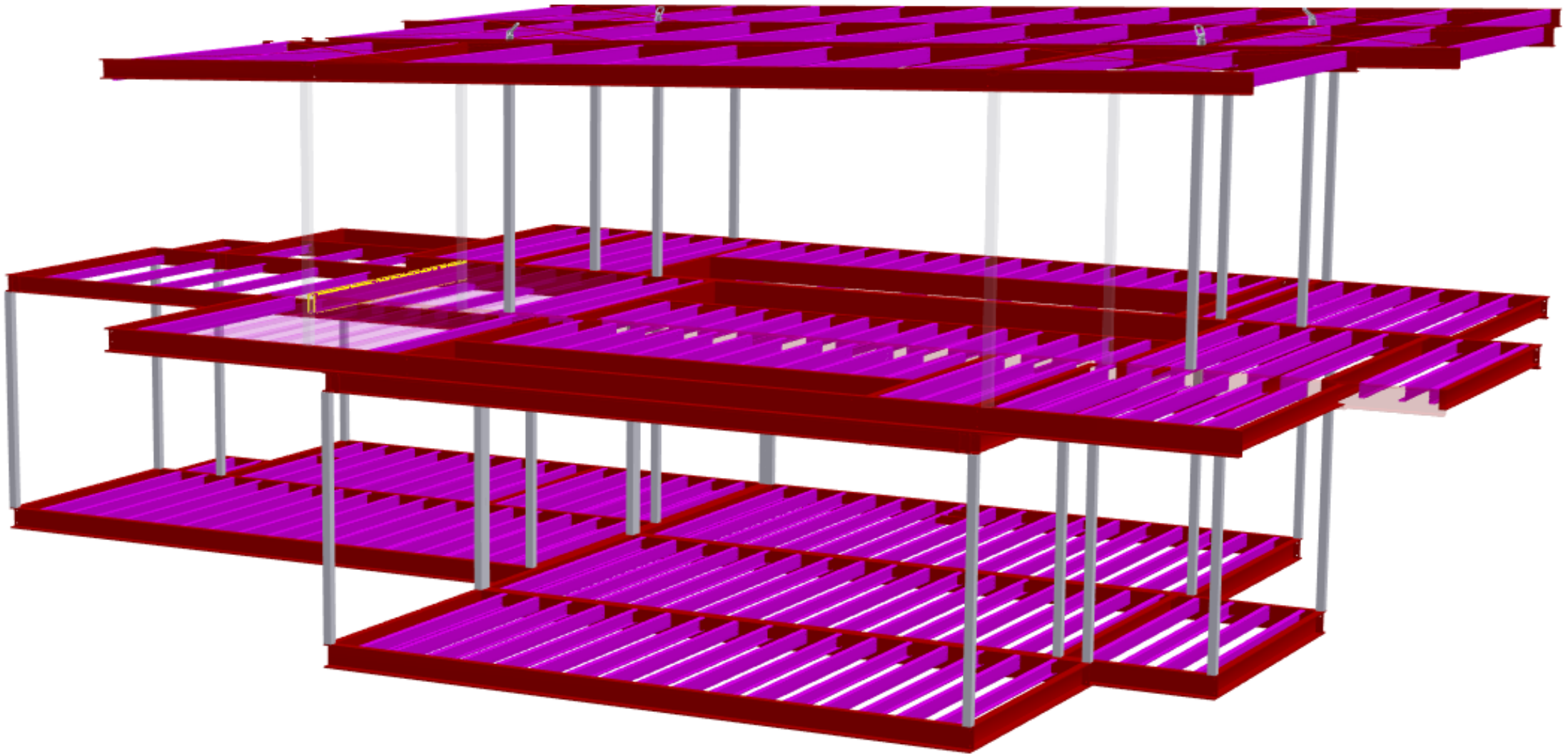
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Credit: authors

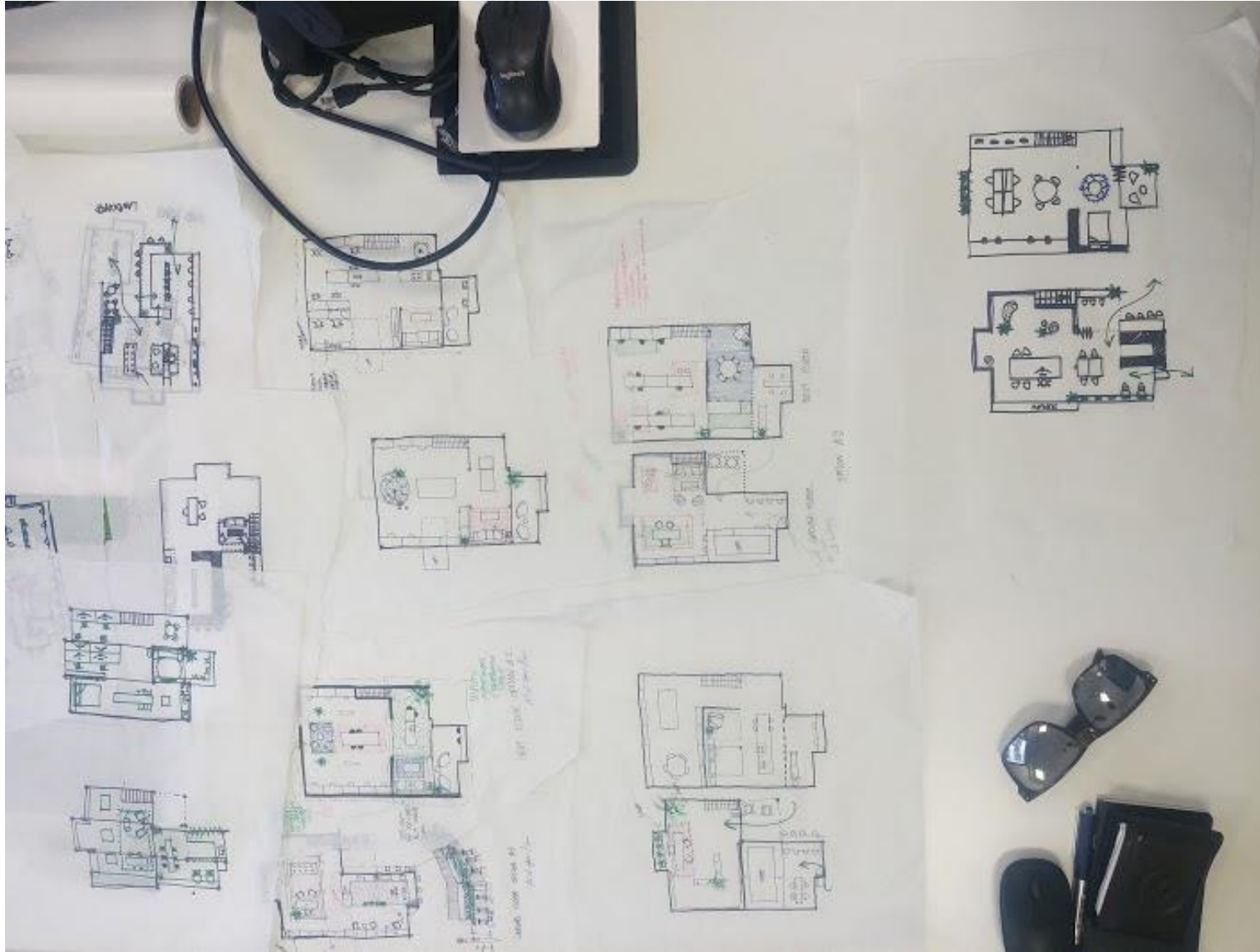


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Designed for disassembly



Designed for adaptability



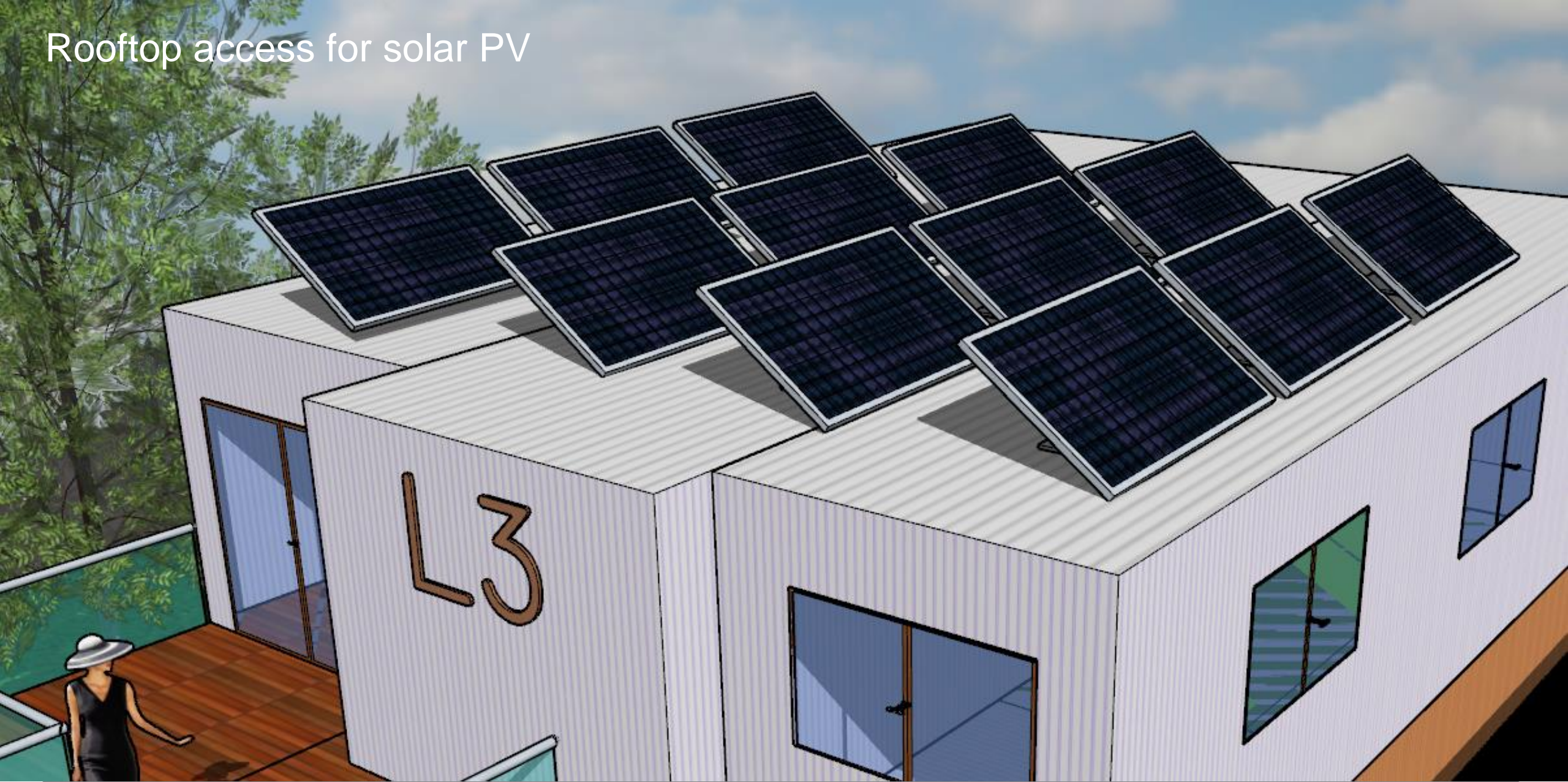
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Rooftop access for solar PV



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Credit: authors



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Sensors to test the building performance



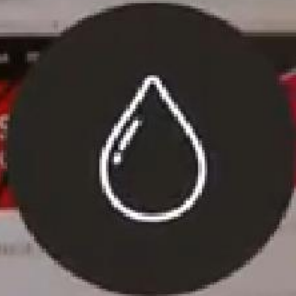
MOISTURE
CONTENT



TEMPERATURE



WOOD
MOISTURE
EQUIVALENT



DEW POINT



RELATIVE
HUMIDITY

In-wall sensors



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Credit: <https://www.youtube.com/watch?v=fby72Bq8z-k>



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Apartment display



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Credit: Emma Whettingsteel



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Inspired by HSB Living Lab: panels can be changed to test different technology



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Credit: <http://www.buildup.eu/en/practices/cases/hsb-living-lab-student-housing-gothenburg-sweden>

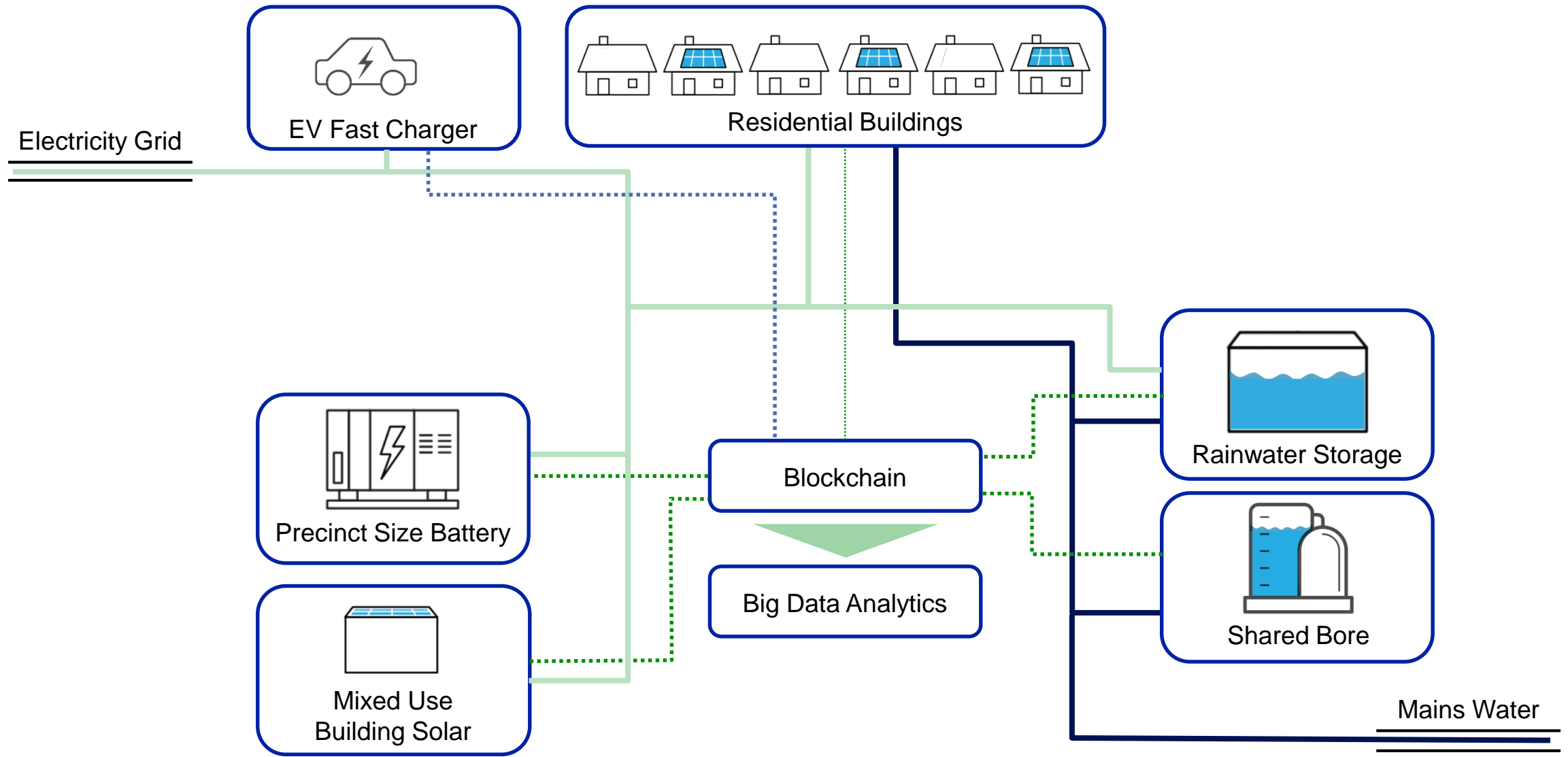


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L3 location: East Village at Knutsford



P2P of electricity and water



RENeW project—data collection



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Credit: <https://video-facts.com/en/quiz/6HSEOPVCFD9X/question/YQQ91XBC0HDW>



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Who wants to grasp the data?



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Credit: <https://www.blogs.hss.ed.ac.uk/pubs-and-publications/2018/02/23/postgraduate-community/>



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Where will the data be visualised?



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Credit: <https://www.flickr.com/photos/wendelinjacober/14146317398/>



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Electricity to display



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Credit: Josh Byrne & Associate JBA



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Visualization space



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Industry and program partners



Smart Cities Plan

RENeW Nexus



Special thank to CRC for their contribution to the project

Thank you

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Thank you for listening to our research for a bright future



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Credit: <https://www.tiq.qld.gov.au/edify-energy-making-collinsville-solar-capital/>



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