



Residential Energy Demand and its drivers In the greater Sydney region

Never Stand Still

Hua Fan

SPREE CEEM CRC-LCL

Led by Ausgrid



In partnership with

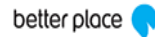
Retail partner



Technology partners



GE Energy



Research, utility and education partners



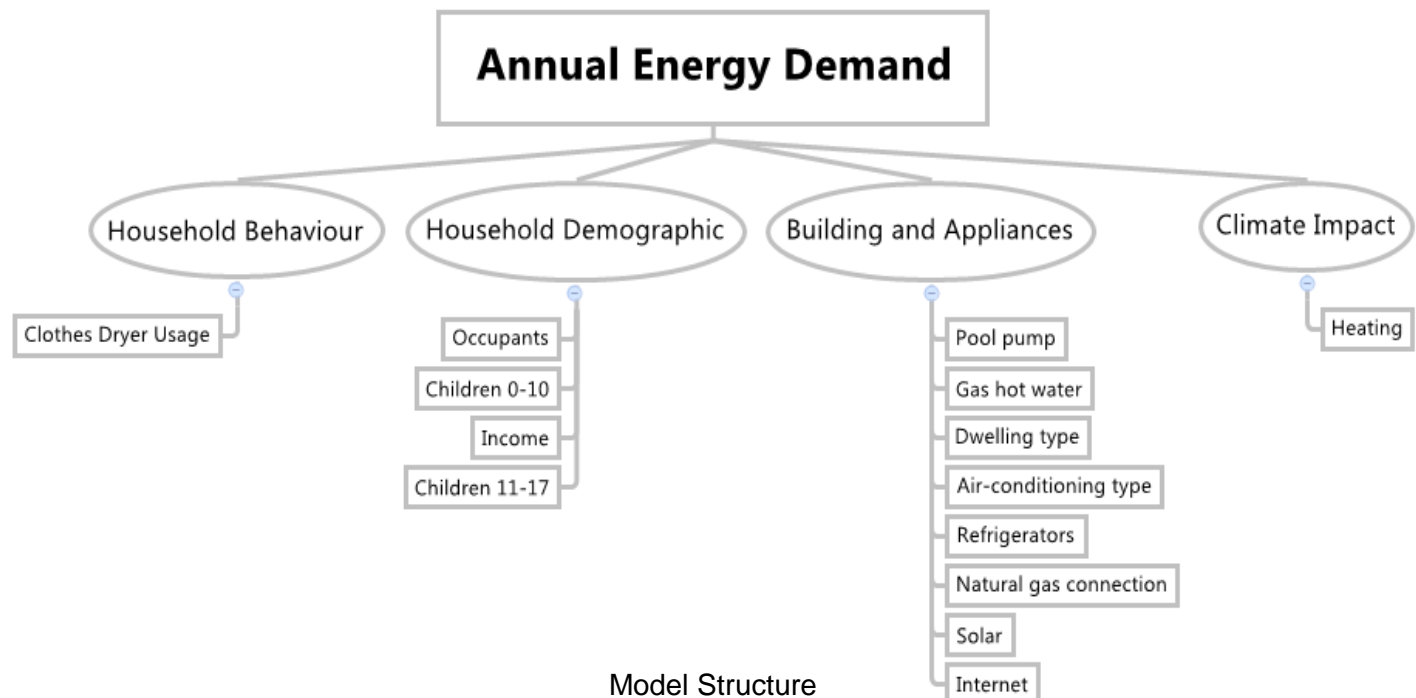
Community partners



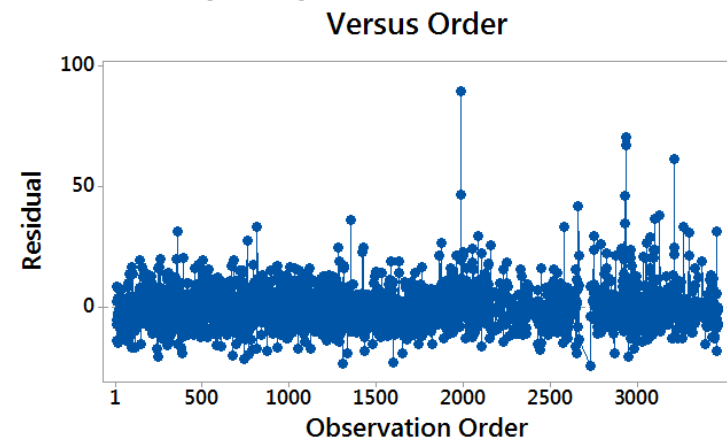
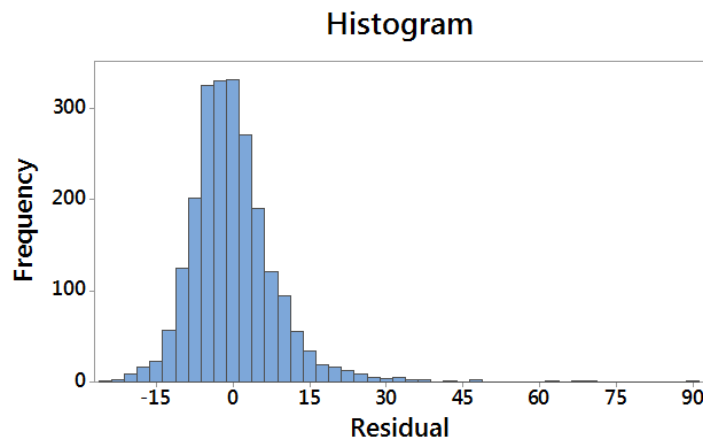
Smart Grid, Smart City was a \$100 million Australian government funded project, led by Ausgrid.

Key elements:

- **In total, around 30,000 households participated in the project**
- **Gathering information about energy, cost, benefits** (over four billion data points had been recorded)
- **Ran between 2010 and 2014**
- **Tested innovative technology and pricing offers that gave homes greater choice and control over their utility bills**

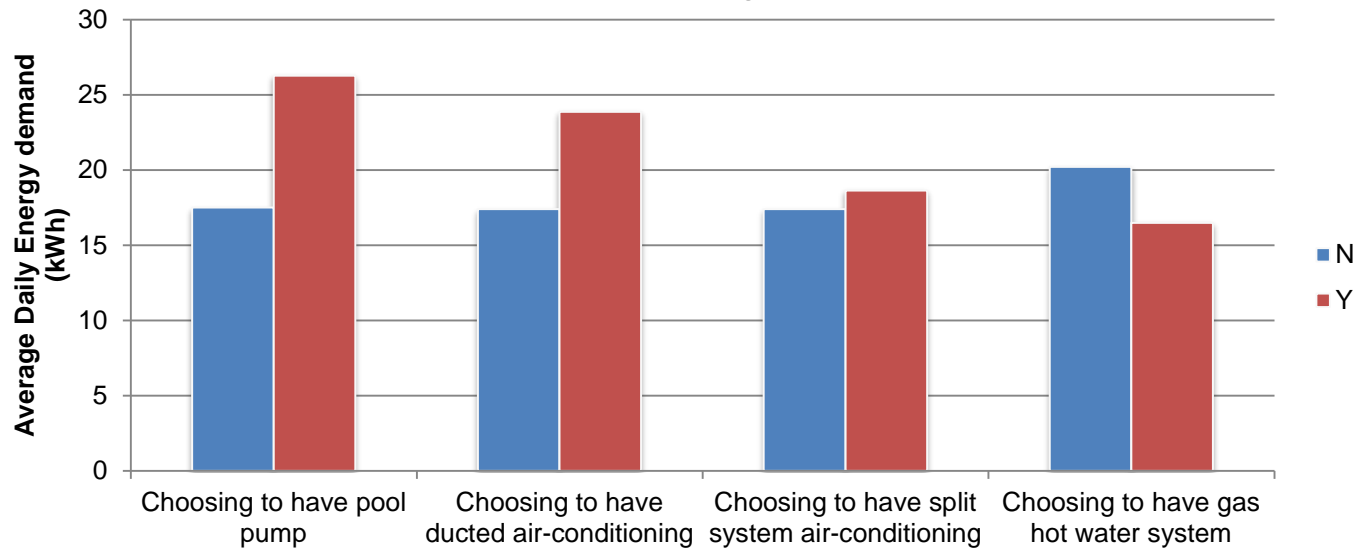


Model Structure

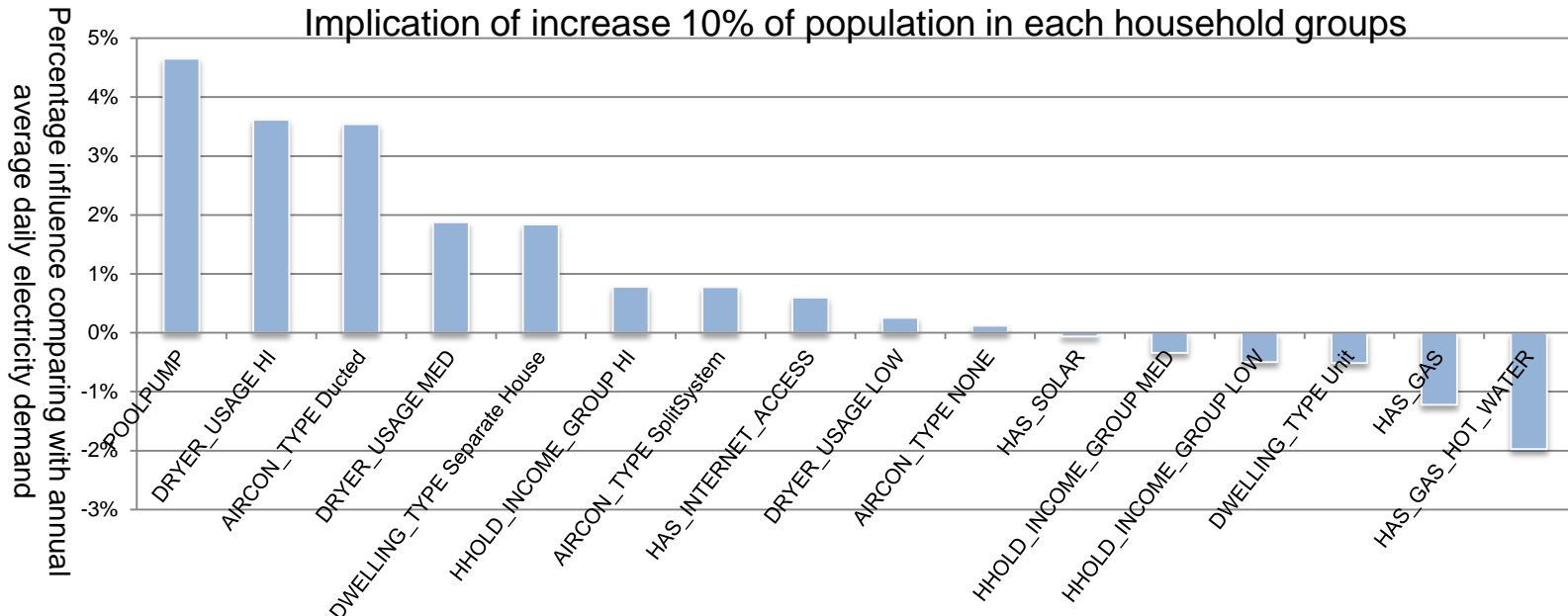


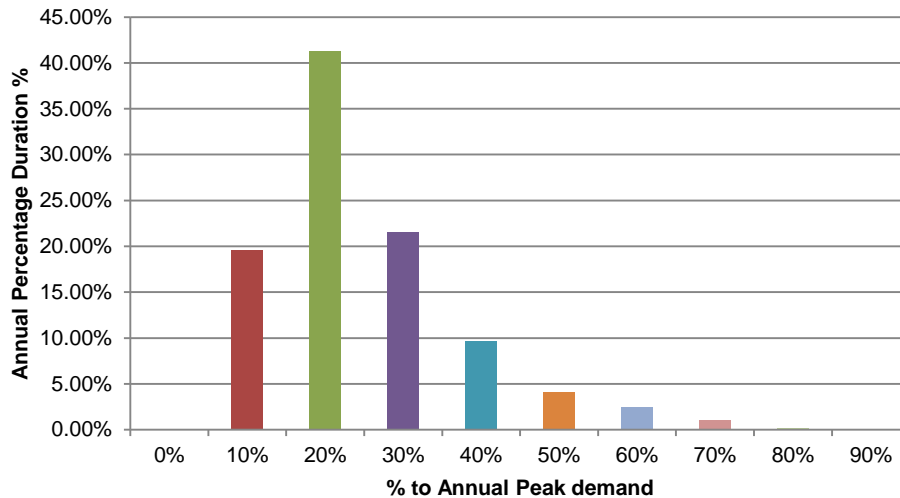
Residual plot of household model (residual in average daily electricity consumption kWh).

Impact of key driving factors



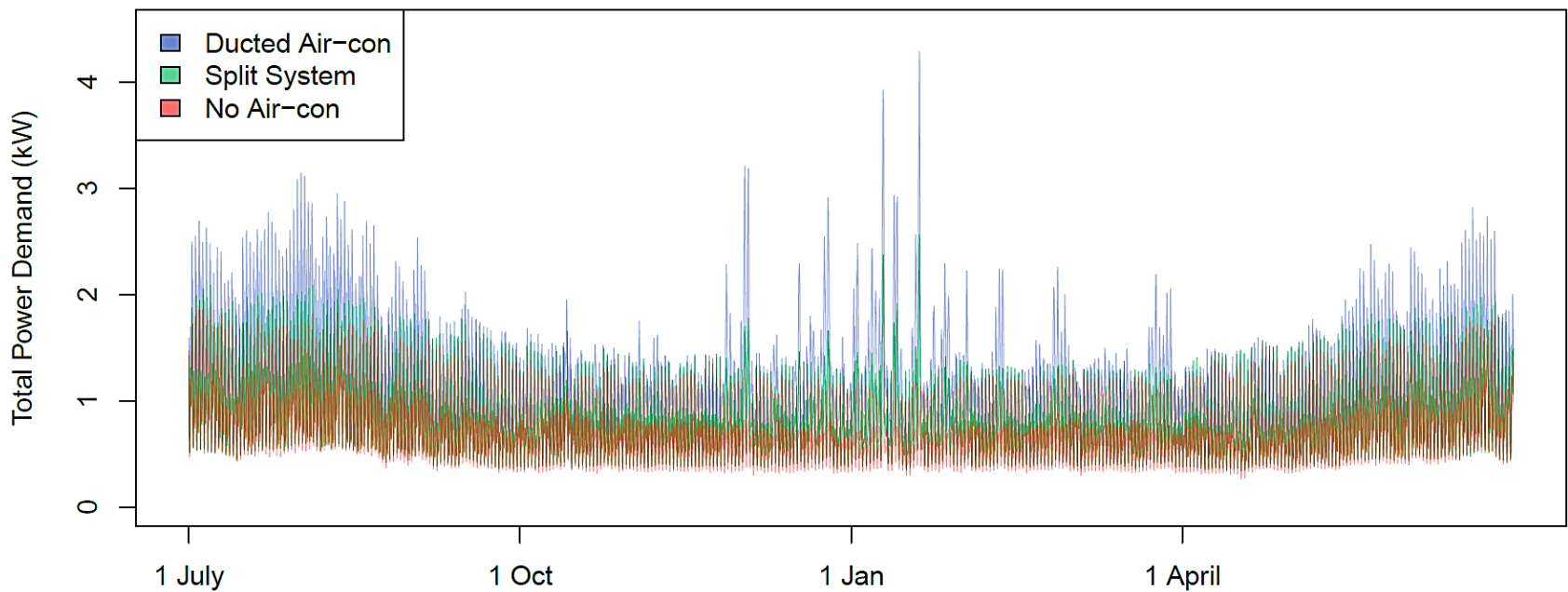
Implication of increase 10% of population in each household groups





Residential energy demand exceeds **80%** of the peak demand capacity less than **1 %** of the time

Waste of infrastructure requiring expensive grid augmentation

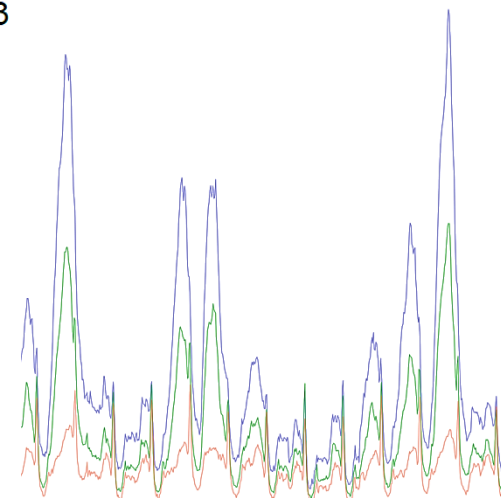
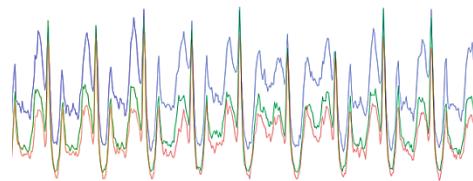
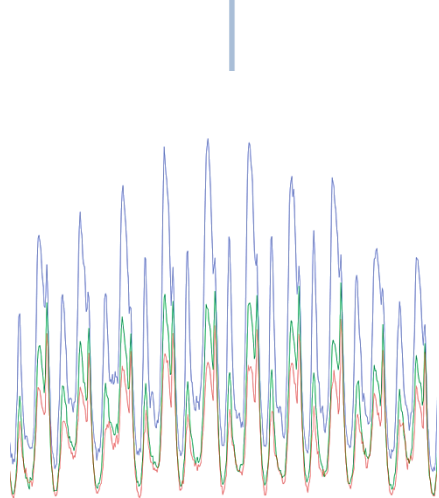
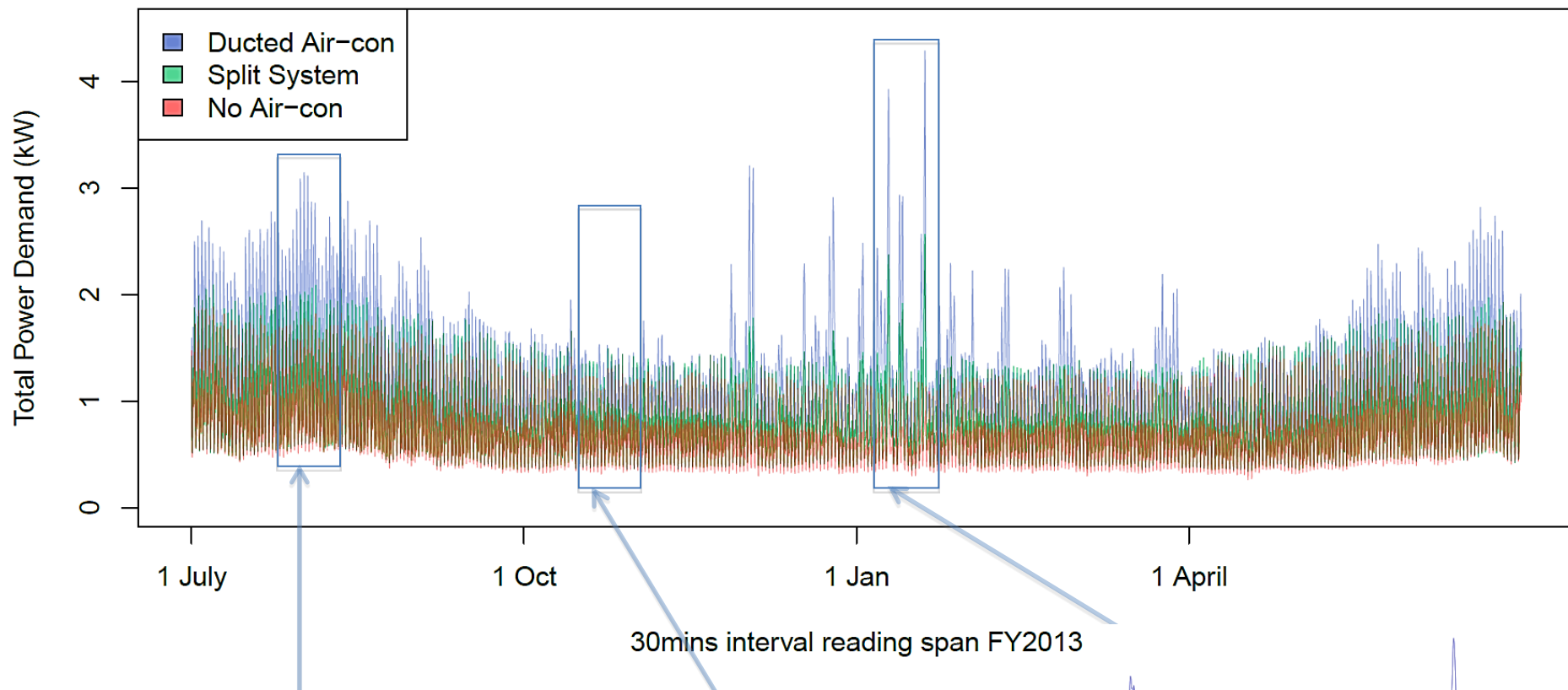


30mins interval reading span FY2013

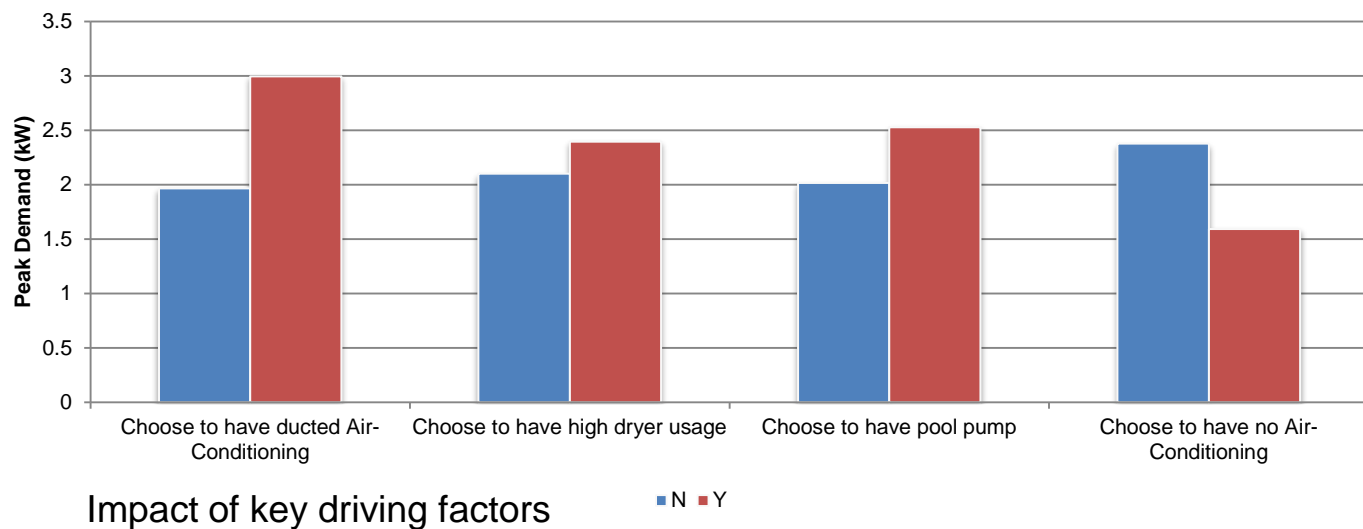
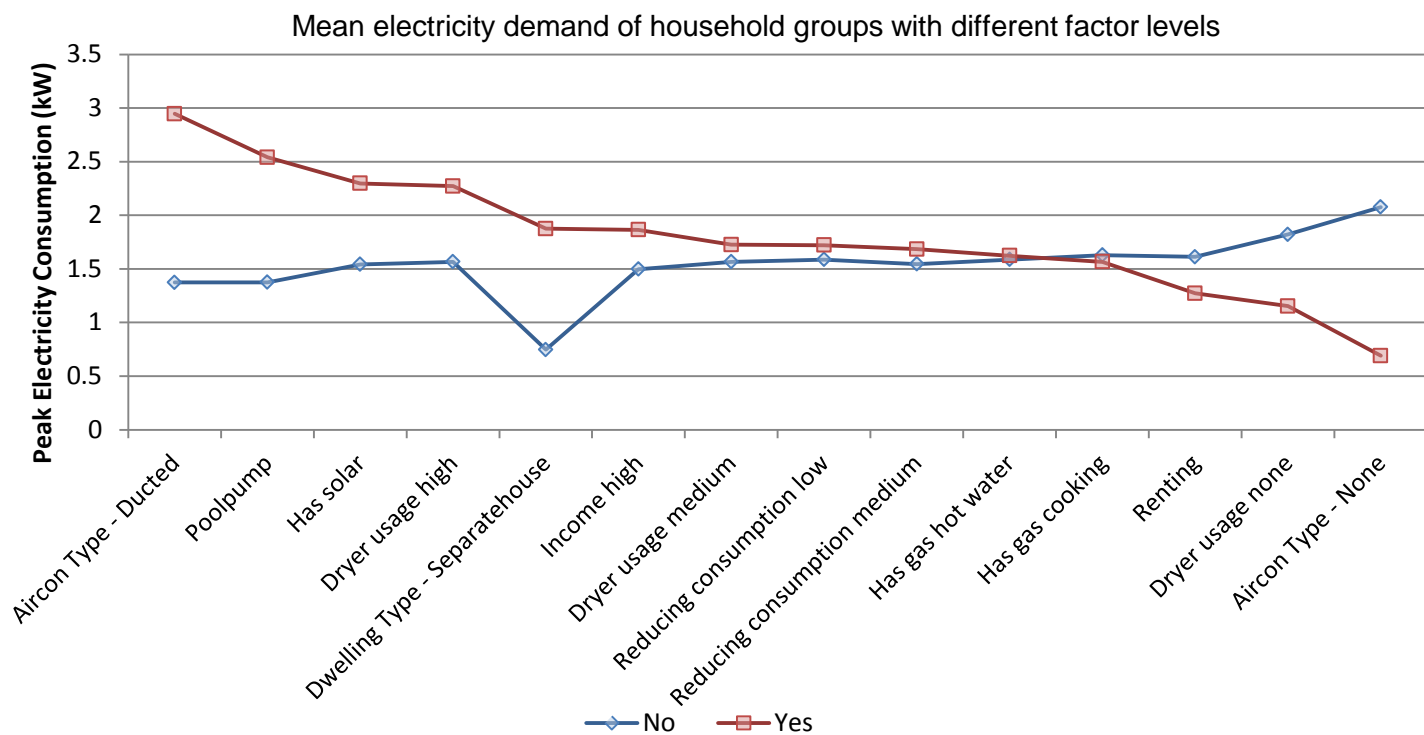
Peak Electricity demand analysis



UNSW
AUSTRALIA

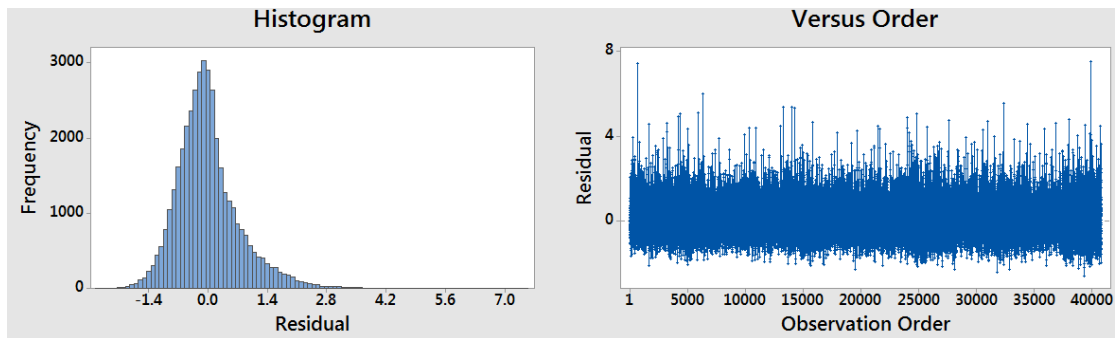


Peak Electricity demand analysis

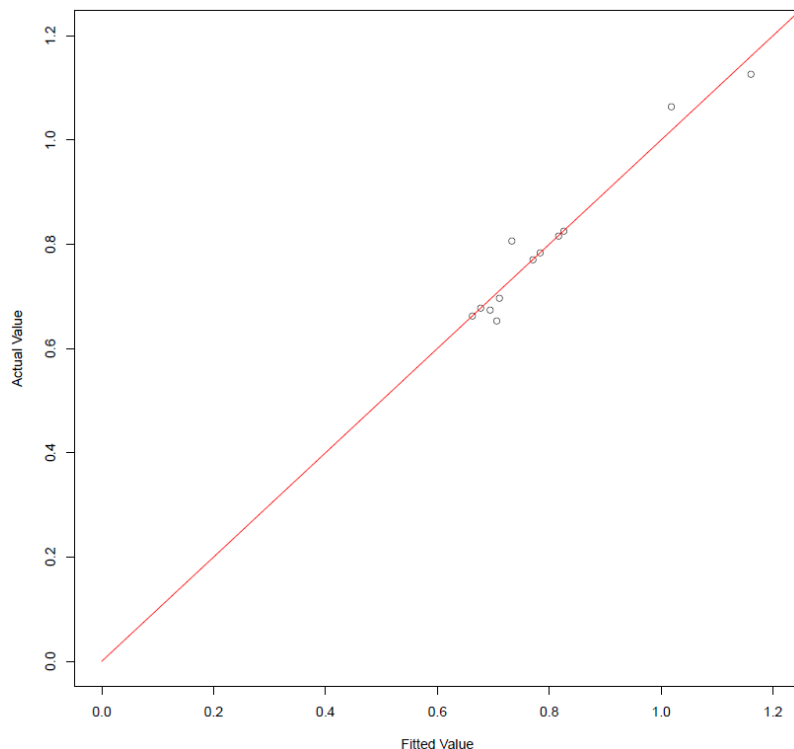


Peak Electricity demand analysis

Peak electricity demand forecast



Individual household model



Aggregated household fitting

Model	GLM
MAPE	1.61%
MAE	0.01232
MSE	0.00058
RMSE	0.02419
MBE	-1.02 E-04
CVRMSE	3.03%

5 folds cross validation

Potential Benefit:

Utility providers

- to better manage peak demand supply

Future researches

- Critical groundwork relate to peak demand investigation

Inform government decision makers

- on the “sweet spot” to treat energy demand problem
- Potential energy efficiency opportunities

H. Fan, I.F. MacGill, A.B. Sproul, Statistical analysis of driving factors of residential energy demand in the greater Sydney region, Australia, Energy and Buildings, Volume 105, 15 October 2015, Pages 9-25, ISSN 0378-7788,
<http://dx.doi.org/10.1016/j.enbuild.2015.07.030>

SPREE: <http://www.engineering.unsw.edu.au/energy-engineering/>
CEEM: <http://www.ceem.unsw.edu.au/>
CRC LCL: <http://www.lowcarbonlivingcrc.com.au/>

Hua Fan
PhD Candidate
Faculty of Engineering
School of PV and Renewable Energy Engineering
University of New South Wales, Sydney NSW 2052, Australia
Mobile: 0425 488 181
Email: hua.fan@unsw.edu.au

Questions?



UNSW
AUSTRALIA