

Future Grid Forum

Change and choice

SUMMARY



The future will look very different from today

Australia's electricity landscape has huge potential for transformation as we move towards 2050 and the greatest changes will be defined by consumer choices. Australians could have unprecedented opportunity to tailor their electricity use and better meet individual needs.

The major impacts that have changed and challenged the electricity sector and consumers in recent times include:

- ◆ High retail electricity prices
- ◆ Widespread use of solar panels, generating your own electricity
- ◆ Greenhouse gas emissions are reducing
- ◆ Peak electricity demand and consumption has declined in most states

Recognising the significance of this time in the electricity sector's history, CSIRO convened the Future Grid Forum to develop and explore potential scenarios for Australia's energy future and support the decision making process around what comes next.

The Forum brought together more than 120 representatives of the electricity industry, government and community to inform and inspire the national conversation about the future of electricity in Australia and provide a way forward for the sector, its stakeholders and, most importantly, all Australians.

Forum partners recognised that the electricity system cannot be analysed and optimised by only examining its separate parts. The result is Australia's first extensive whole-of-system evaluation that encompasses the entire energy chain from generation through to consumption.

Findings from the Forum are presented in a comprehensive report, *Change and choice: The Future Grid Forum's analysis of Australia's potential electricity pathways to 2050*. The report can be viewed and downloaded at www.csiro.au/future-grid-forum.

ENERGY TERMS

- ◆ **PEAK DEMAND:** the highest use of electricity at any one point in time, typically influenced by cold or hot weather (air conditioning in residential and commercial buildings) and periods when most residents wake in the morning and arrive home in the evening (e.g. lighting, cooking and other appliances in use).
- ◆ **DEMAND MANAGEMENT:** applying various methods to reduce the volume of consumption or level out peaks in electricity use.
- ◆ **ON-SITE GENERATION:** energy generated at the site of the electricity consumption such as roof-top solar panels as opposed to that sourced from the grid.

Change and choice: potential electricity pathways

The Future Grid Forum has developed four key scenarios that have far-reaching implications for the current and future electricity supply chain and would alter the electricity system in Australia.

How much and in what ways could consumers choose to manage their electricity use? What are the implications for electricity bills and the structure of the electricity sector?

How all of this might play out in the decades to 2050; and how we best manage and benefit from the scenarios is a crucial conversation.

These important questions were asked:

- ◆ What might Australia's electricity system look like in 2050?
- ◆ What are the risks and opportunities that might arise along the way?
- ◆ What can the electricity sector and its stakeholders do to most effectively respond?

The scenarios are not predictions; they are windows through which we can view potential futures for Australia's electricity sector and have been developed through extensive quantitative modelling, analysis and social dimensions research.

The Forum acknowledges that the future is likely to be a hybrid of the four options and does not endorse any particular scenario.

Five fast Forum facts

1. Scenario modelling shows that consumer choice around the use of on-site generation and managing peak demand can greatly influence the future direction of Australia's electricity system.
2. Disconnecting from the grid as a residential customer is projected to be economically viable from around 2030 – 2040.
3. Technologies like smart air conditioners and in-home storage systems will facilitate more sophisticated ways of managing household demand during peak times.
4. Electricity will not get cheaper in the coming decades but bills can be reduced via the adoption of energy efficiency, peak demand management and on-site generation.
5. The steps listed in point number four, in combination with general wages growth, means the share of income spent on electricity in 2050 (2.3 – 2.9 per cent) is projected to be similar to 2013 (2.5 per cent).

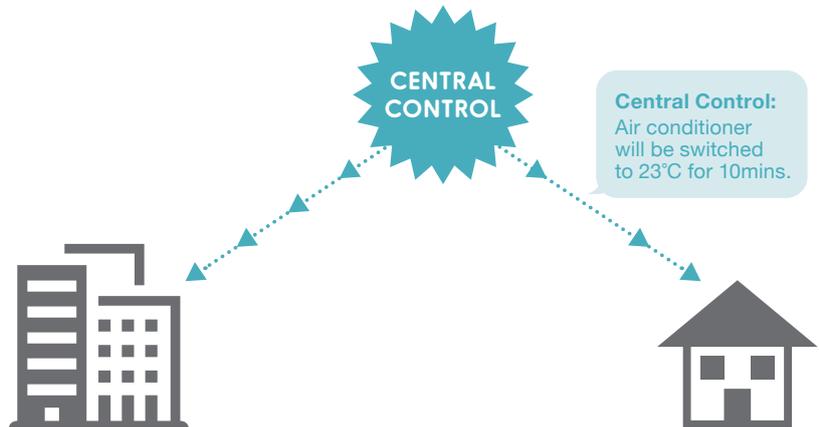
ELECTRICITY IN 2050

Set & Forget Scenario

CONSUMERS SIGN UP TO VOLUNTARY DEMAND CONTROL SCHEMES

Appliances can be automated to adjust their power use when certain conditions are met. This could be determined by a price point or a time of system stress depending on how the scheme is set up.

Consumers do not play an active role in demand control but rely on utilities for the solutions to integrate and operate the schemes.



Energy Sources



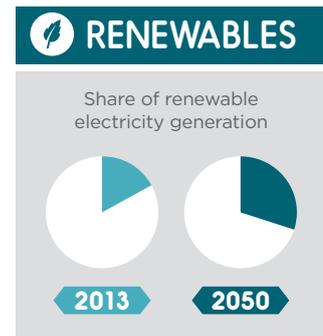
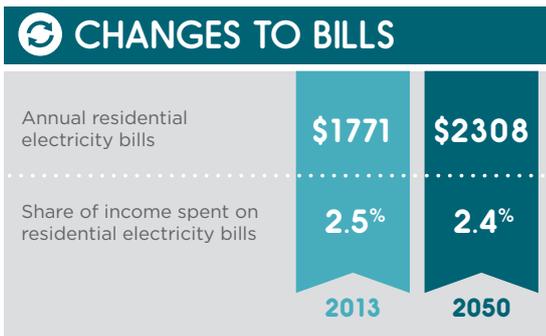
19%



81%

By 2050, a niche of consumers take up onsite generation (19%) and electric vehicles (also 19%), **but most rely on centralised power and liquid fuelled transport.**

Scenario Snapshot

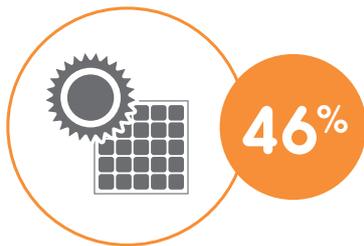


ELECTRICITY IN 2050

Rise of the Prosumer Scenario

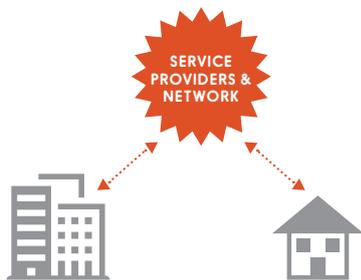
WHAT IS A PROSUMER ?

A consumer who becomes **involved with designing or customising** products for their own needs – this can include electricity.



By 2050, a tide of consumers take up on-site generation and electric vehicles.
The role of centralised power and liquid fuels declines considerably.

Distribution System

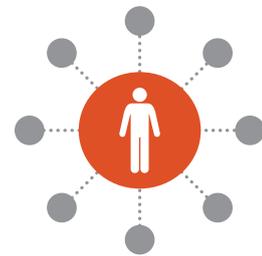


Moving away from a one-way relationship, **the network becomes a platform for transactions**. Service providers compete to integrate and facilitate these transactions.

Service Provider:
 Price has reached high set point - curtail air conditioner 25%?

Customer: Yes

Customers choose their **level of control** from a wide variety of plans.



Customer-centric model where customers consume, trade, generate and store electricity.

Scenario Snapshot

CHANGES TO BILLS

Annual residential electricity bills

\$1771 \$2793

Share of income spent on residential electricity bills

2.5% 2.9%

2013 2050

COST

The level of investment and running costs required to realise this scenario by 2050

\$950 BILLION

RENEWABLES

Share of renewable electricity generation



2013

2050

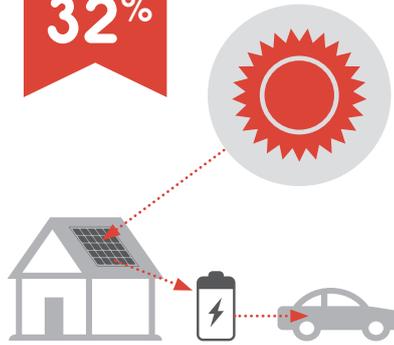
ELECTRICITY IN 2050

Leaving the Grid Scenario

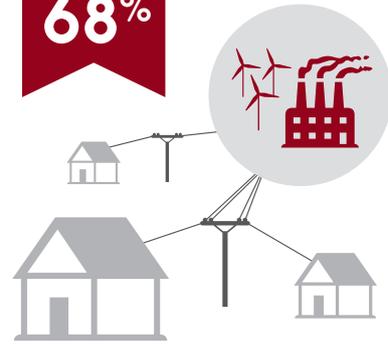
AROUND A THIRD OF CONSUMERS COMPLETELY DISCONNECT FROM THE GRID

Using a combination of gas generation, solar panels, storage and energy efficiency.

32%

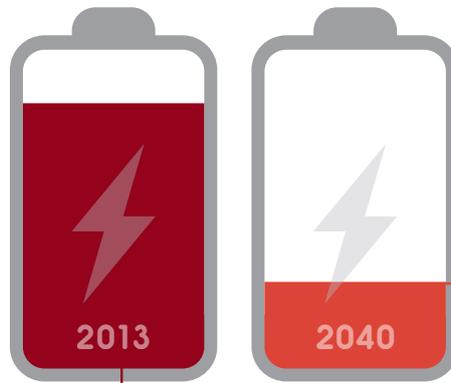


68%



Battery Costs

Disconnecting from the grid as a residential consumer is projected to be **economically viable from around 2030 - 2040** as battery costs fall.



110 c/kWh

2013 costs of disconnecting from the grid

35-40 c/kWh

2030 - 2040 costs of disconnecting from the grid

Scenario Snapshot

CHANGES TO BILLS

Annual residential electricity bills

\$1771

\$2213

Share of income spent on residential electricity bills

2.5%

2.3%

2013

2050

COST

The level of investment and running costs required to realise this scenario by 2050

\$1042 BILLION

RENEWABLES

Share of renewable electricity generation



2013



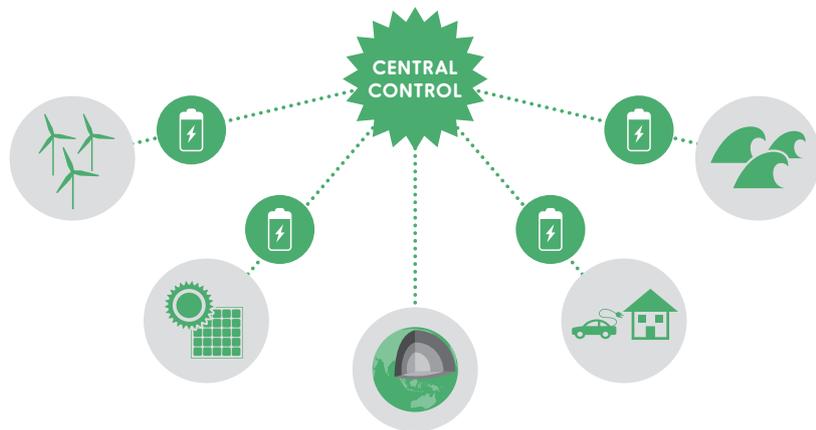
2050

ELECTRICITY IN 2050

Renewables Thrive Scenario

STORAGE PLAYS A LARGE ROLE IN ALL ASPECTS OF THE ELECTRICITY SYSTEM.

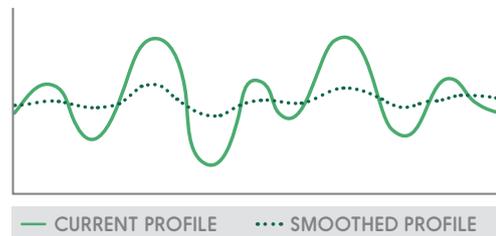
Storage supports a **100% share of renewables in centralised power** supply by 2050, high electric vehicle uptake (37% by 2050) and strong demand control.



Storage

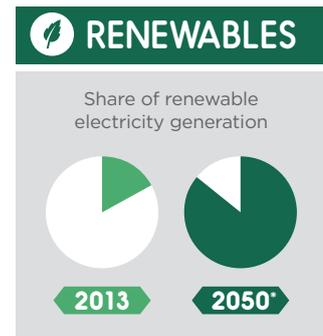
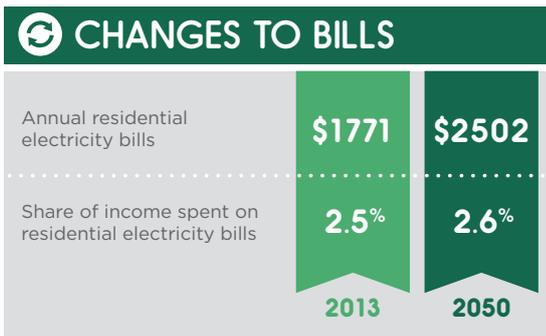


Batteries are used widely in houses, cars and at large scale at power stations.



Battery storage smoothes out the intermittency of renewable-generated energy and helps to **level the profile of peak electricity demand.**

Scenario Snapshot



*some fossil generation remains in decentralised supply

New options to consider

The Future Grid Forum developed a collective view on actions for increasing the preparedness and flexibility of the electricity sector to deal with a period of significant change. The Forum recognised that many issues can be addressed by existing processes and market arrangements.

The Forum also developed four new options that could be considered as potential approaches to addressing the issues identified in the scenarios:

- 1. Implementing a long-term program to increase consumer awareness of electricity pricing and demand management:** Gaining more knowledge about the appliances that contribute most to peak demand and what sort of alternative pricing might be offered to provide incentives for demand management and on-site generation will mean consumers will be in a better position to make choices to benefit them and the system as a whole.
- 2. Review Australia's electricity consumer social safety net:** Our scenarios indicate that electricity bills may still increase in the future. Some people are more exposed to electricity costs in their household budget and may also have fewer resources to implement new energy-saving technologies. To provide support to these people a number of different measures could be used including consistent national electricity bill assistance and concessions.
- 3. Developing bipartisan agreement on Australia's long-term greenhouse gas emission reduction target and implementation:** Agreement on the policy mechanism and long term targets (beyond 2020) to reduce greenhouse gas emissions would allow the electricity industry to respond to the challenge in the most efficient way.
- 4. Identifying any changes that might be required to market and regulatory frameworks:** The Forum has explored plausible futures which indicate significant changes for Australia's electricity future. Some consideration now needs to be given as to whether the current market and regulatory frameworks will be able to accommodate these futures.



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**FOR FURTHER INFORMATION AND
A COPY OF THE FULL REPORT VISIT
www.csiro.au/future-grid-forum**