Solar Photovoltaics –

what effect is this having on the grid?

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Demand Management and Sustainability

Ausgrid

Overview

1. The increase in Solar Photovoltaic (PV) installations
2. History of subsidies and feed in tariffs
3. Grid parity for Solar PV systems
4. Are PV systems reducing network peaks?
5. Other network issues; power quality, standards and safety
6. Summary

Who is Ausgrid?

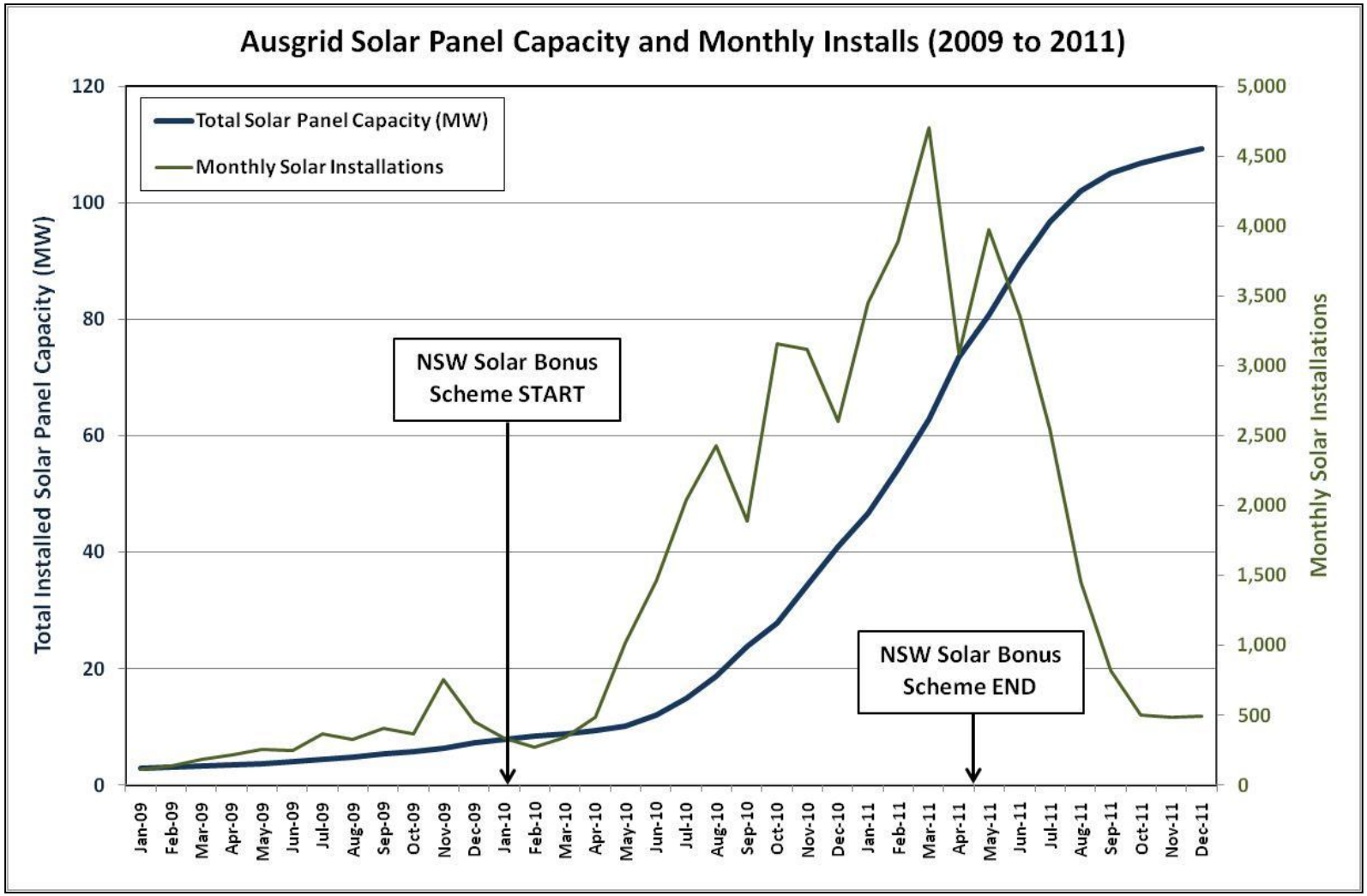
Our network

- Electricity distribution network for the Sydney, Central Coast and Hunter regions
- Over 1.6 million customers

Actively contributing to climate change solutions

- Customer advice through materials and events
- Demonstration projects and innovation

1. Solar PV systems in the Ausgrid network



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1. Top ten local councils by total PV number

Local Government Area	Number of domestic systems	Total Capacity (kW)	Domestic Customers	Households with PV system (%)
LAKE MACQUARIE	5,751	11,861	78,372	7.3%
GOSFORD	4,304	8,015	75,999	5.7%
WYONG	4,261	7,761	65,395	6.5%
NEWCASTLE	3,704	7,306	66,870	5.5%
SUTHERLAND	3,344	6,927	84,358	4.0%
HORNSBY	3,111	5,985	56,086	5.5%
BANKSTOWN	2,547	4,744	64,057	4.0%
WARRINGAH	2,486	5,091	57,567	4.3%
PORT STEPHENS	2,157	4,510	30,864	7.0%
MAITLAND	1,570	3,445	26,348	6.0%
TOTAL NETWORK	**52,750**	**103,700**	**1,440,000**	**3.7%**

2. History of rebates/ subsidies

Scheme	Date Range	Rebate	RET Certificates	Total
Photovoltaic Rebate Program (PVRP)	2000 - Nov 2007	$4,000	$1,250	$5,250
Solar Homes and Communities Program (SHCP)	Nov 2007 - 9 June 2009	$8,000	$1,250	$9,250
Solar Credits (5x)	9 June 2009 - 30 June 2011		$4,700	$4,700
Solar Credits (3x)	1 July 2011 – 30 June 2012		$2,700	$2,700
Solar Credits (2x)	1 July 2012 – 30 June 2013		$1,800	$1,800

*Total RET certificate value based on a 1.5kW system installed in the Ausgrid area and a rough estimate of REC/ STC value at the time ($40<2009, $30>2009), including multiplier (1.382 certificates per kW for 15 year deeming period)

2. History of feed in tariffs (Ausgrid area)

Scheme	Feed in Tariff	Date Range	Metering	Annual Benefit*
EnergyAustralia Buyback tariff	Retail rate (ex GST)	to 31 December 2009	Net	$430
NSW Solar Bonus Scheme (60c)	60c/kWh + retailer offer	1 January 2010 – 28 October 2010	Gross or Net	$1,240
NSW Solar Bonus Scheme (20c)	20c/kWh + retailer offer	28 October 2010 - 28 April 2011	Gross or Net	$490
Under review	Retailer offer only	28 April 2011 to current	Net	$271 to $430
Future (IPART to determine)	Recommending 8 to 10c/kWh	TBD	TBD	TBD

*Total annual benefit is an estimate only and will depend on the energy generated by the system. For the purposes of these calculations, a 1.5kW system located in the Sydney area with an average performance has been assumed (1,875kWh pa).

*2011/12 regulated retail prices for the Ausgrid network area have been used for retail price estimates

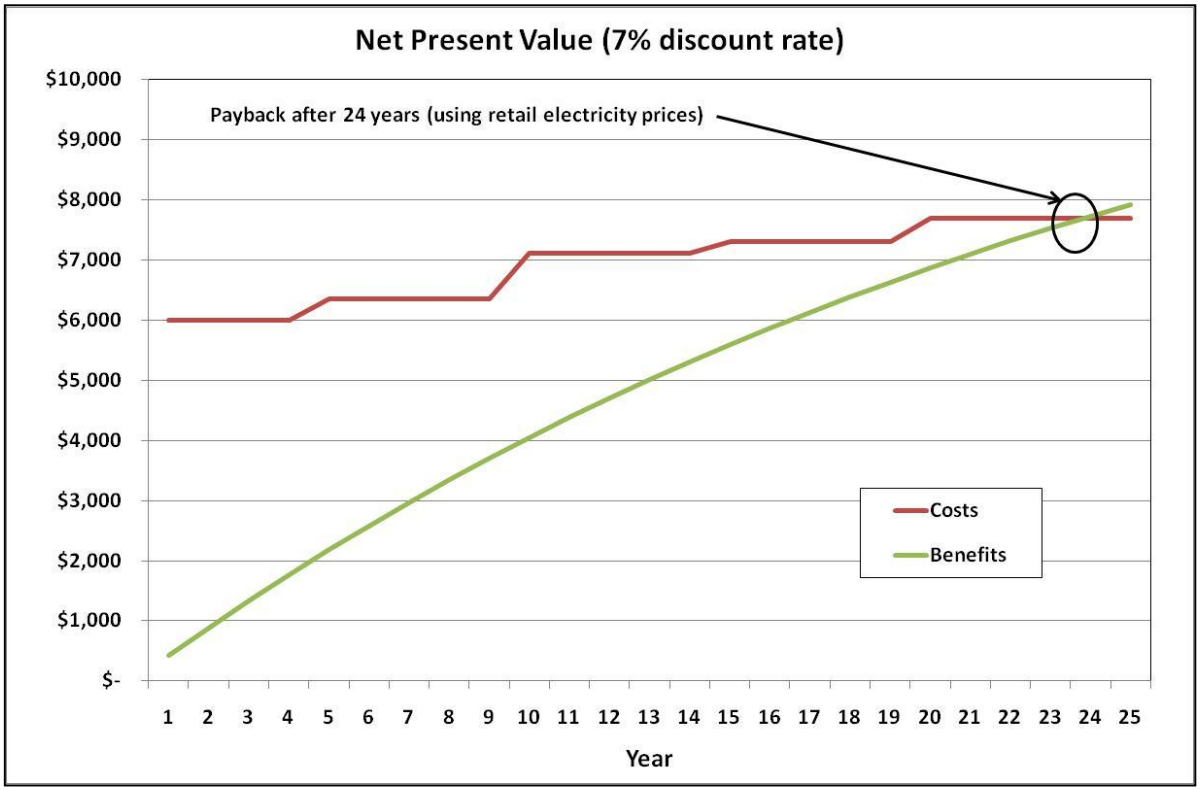
2. Simple payback period for Solar PV system

Scenario	Net system cost to household*	Annual benefit**	Metering	Simple Payback (years)***
NSW Solar Bonus Scheme (60c) – until 28 Oct 2010	$2,500	$1,240	Gross	2
Currently with Solar Credits (3x) – until 30 June 2012	$3,000	$271 to $430	Net	7 to 11
Without Solar Credits	$6,000	$271 to $430	Net	14 to 22

*The net system cost to household can vary significantly, these are estimates only and are based on advertised costs by a major energy retailer in February 2012.
**Annual benefit estimates are based on 1,875kWh pa production from a 1.5kW system and do not include effects of equipment failure or poor performance from poor orientation or shading.
***Above estimates are based on a simple payback calculation for the purchase of a 1.5kW system. Estimates do not take into account maintenance costs or Net Present Value calculations.

3. Approaching Grid Parity (NPV with 7% rate)

Grid Parity; The cost of PV is equal to the cost of electricity supplied from the grid over the life time of the system



Analysis includes maintenance costs each 5 years ($500) and an inverter replacement at Year 10 ($1,500).

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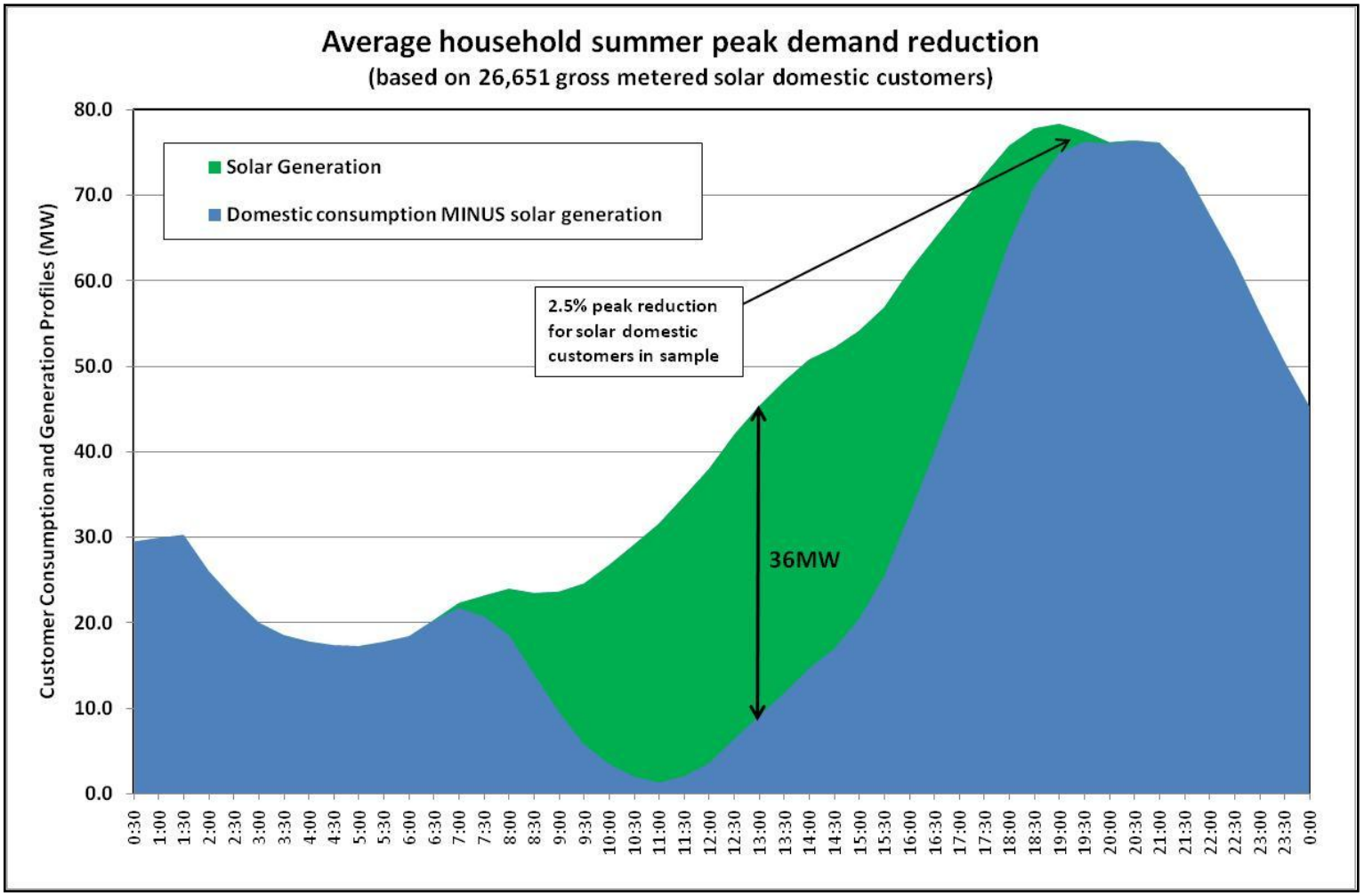
4. Households with solar generation



Total solar panel capacity of domestic customers in sample around 52 MW.

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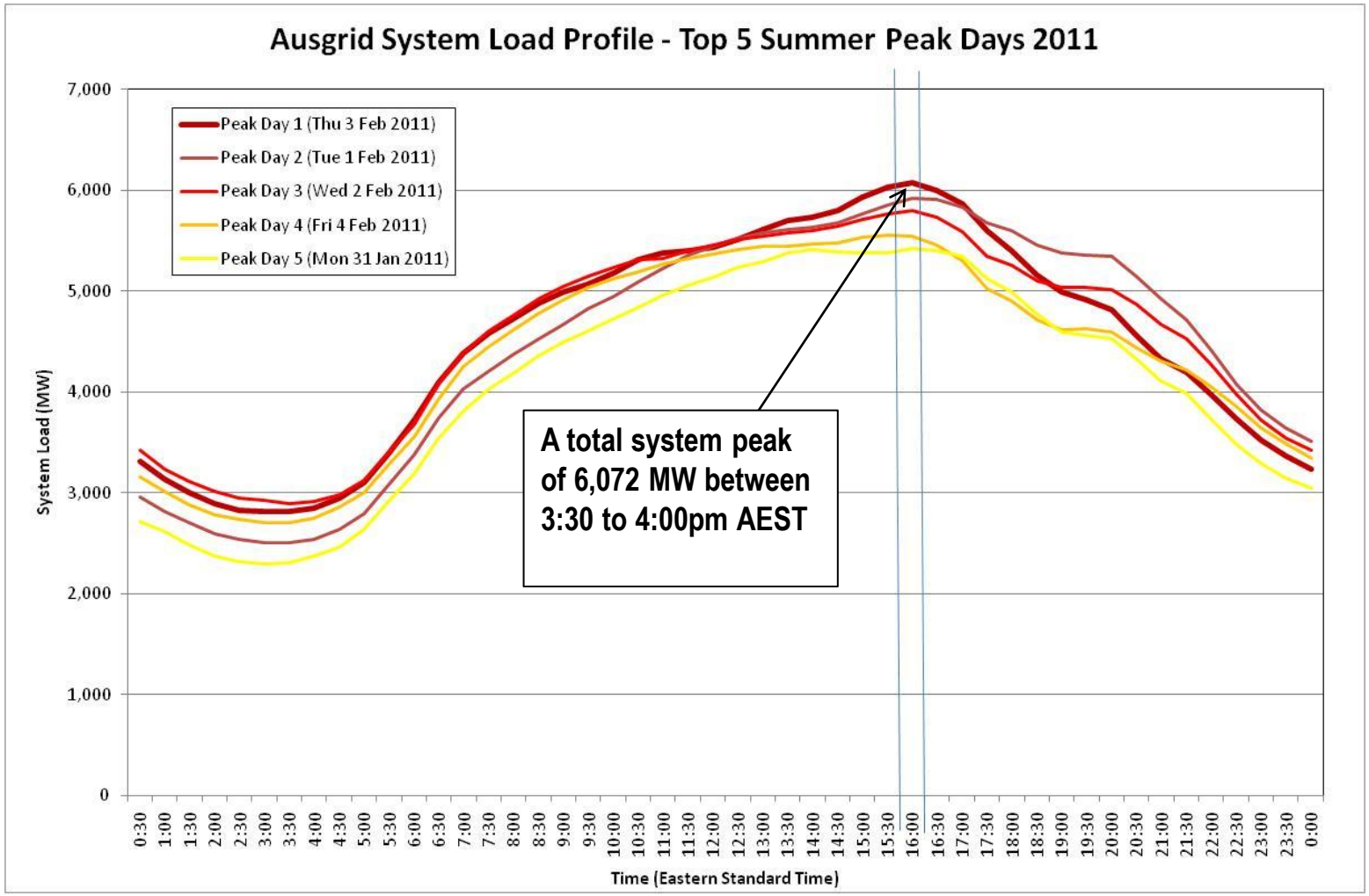
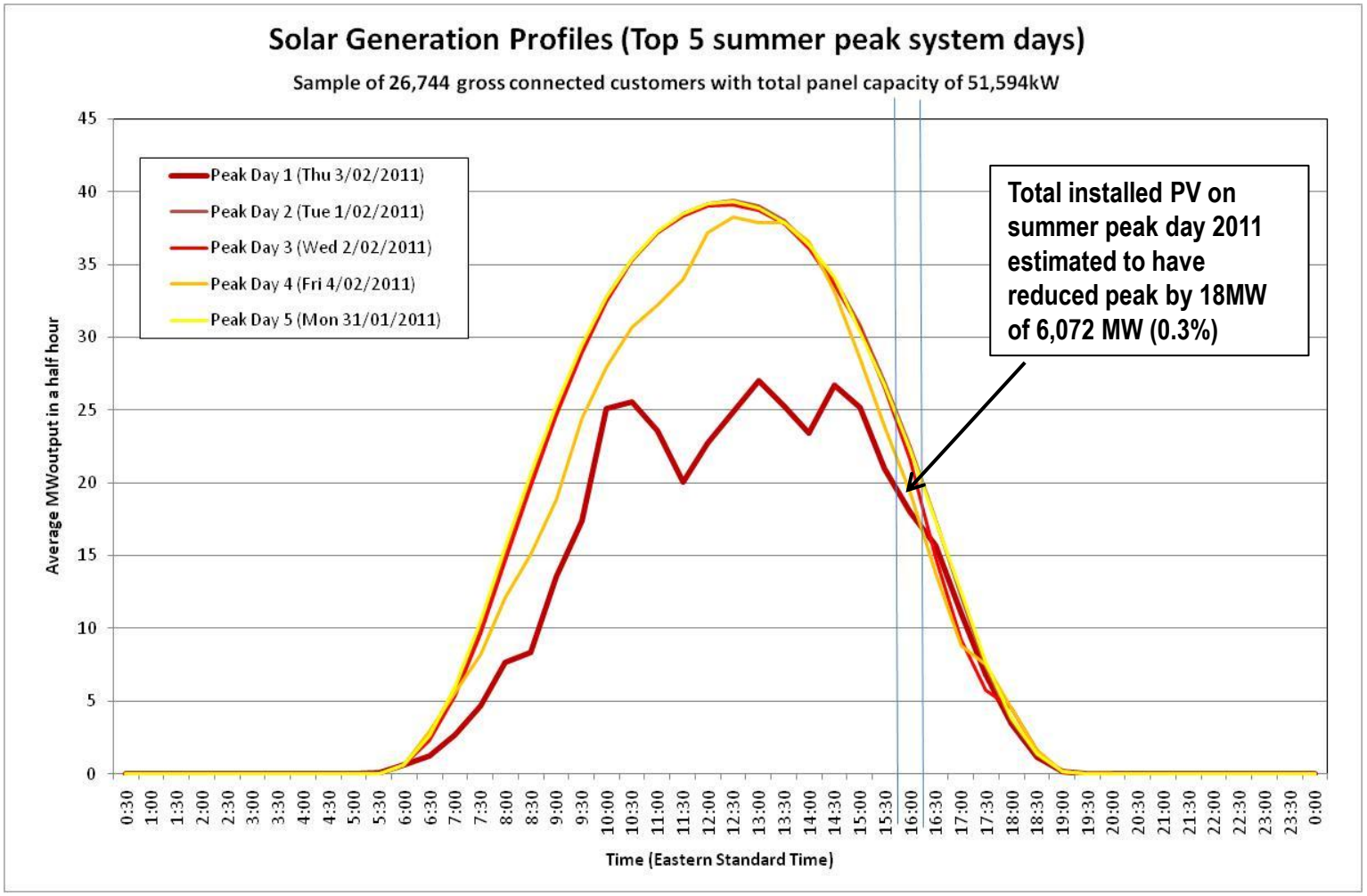
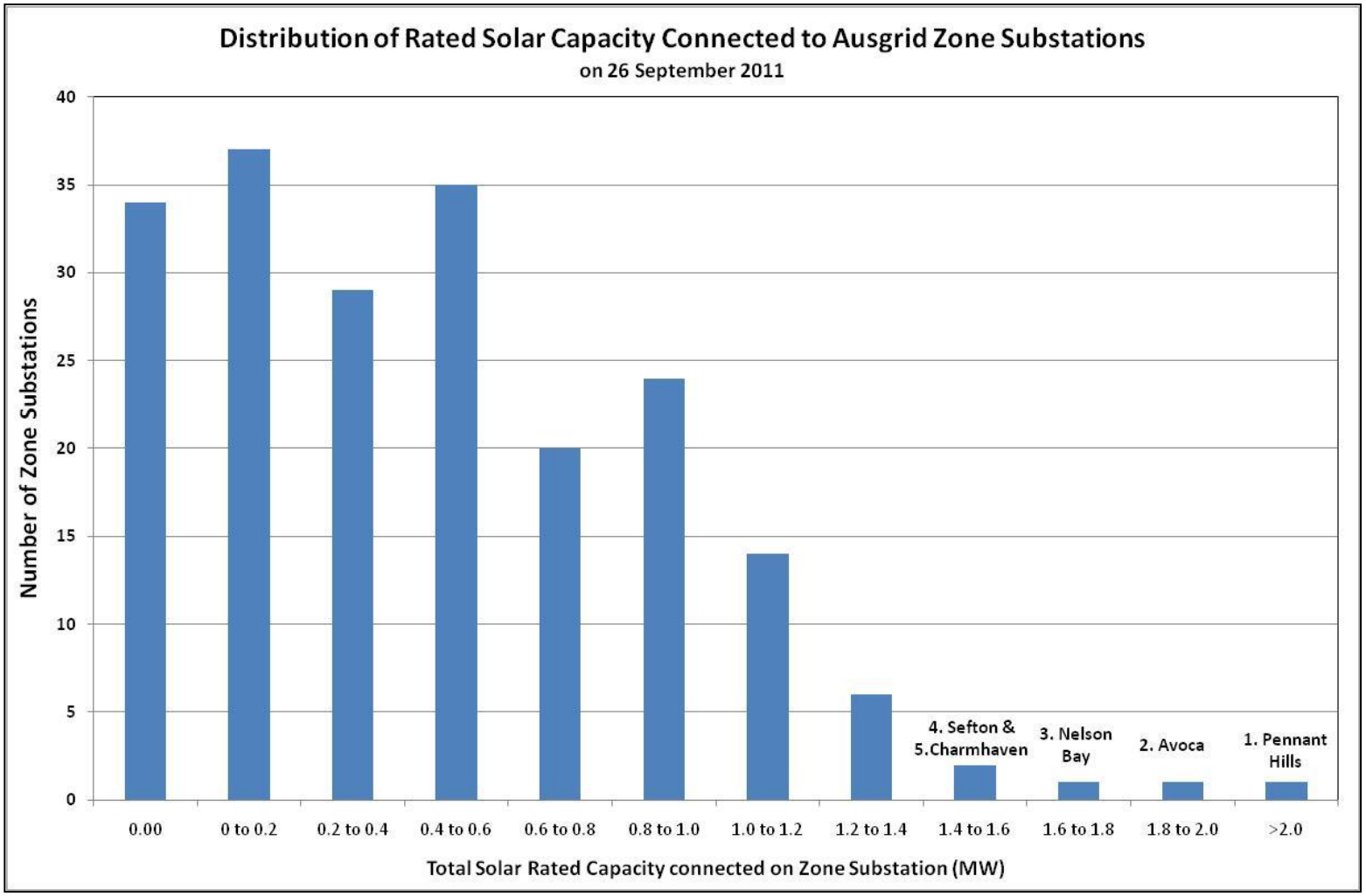
4. Network System Load Profile – Summer Peak



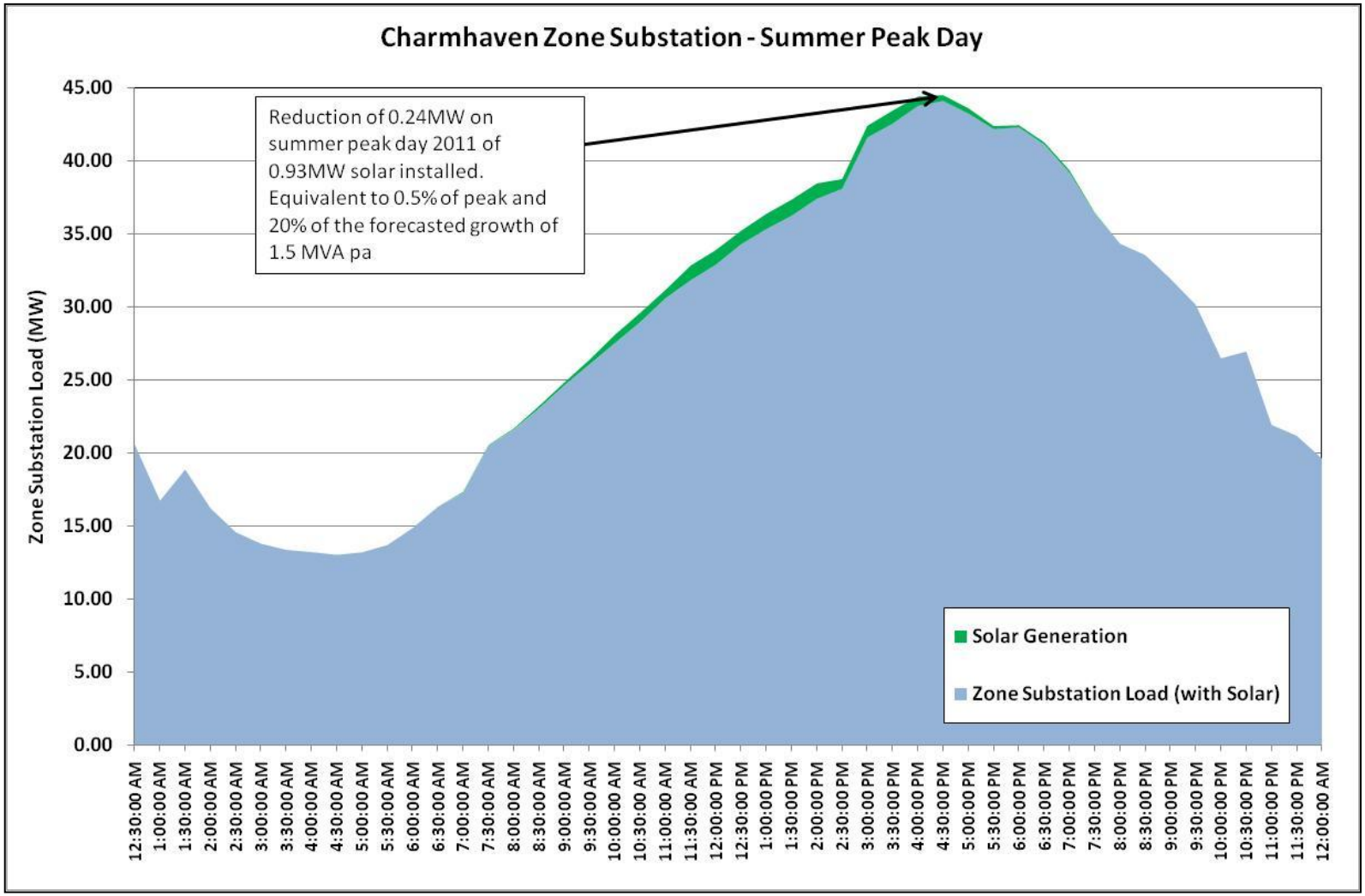
4. Solar profiles for top 5 summer peak days



4. Zone substation analysis of PV Penetration



4. Case study example – Charmhaven Zone



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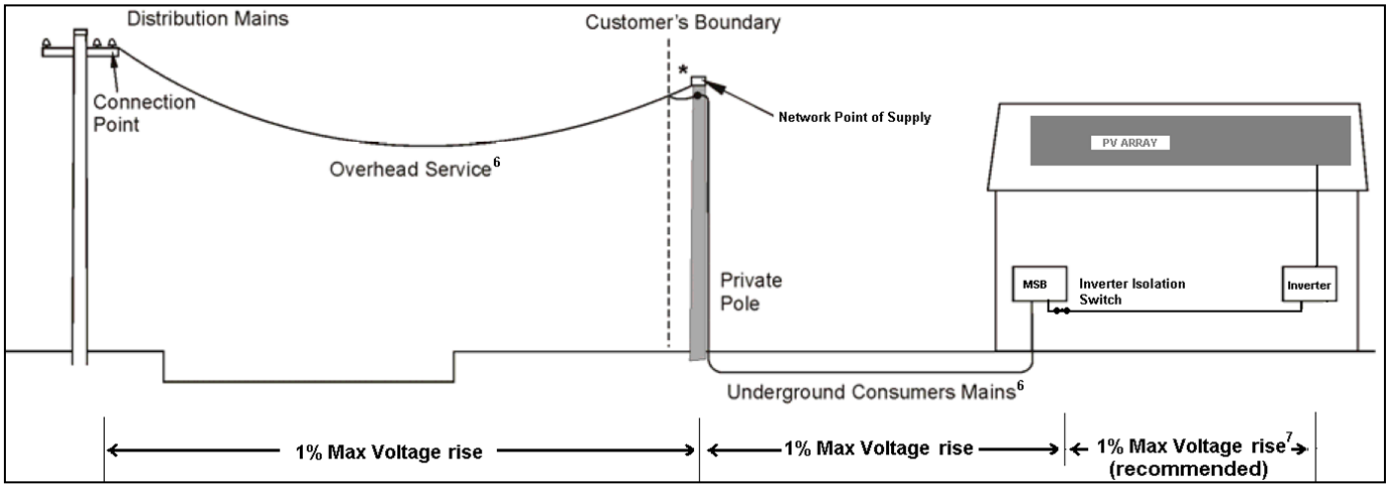
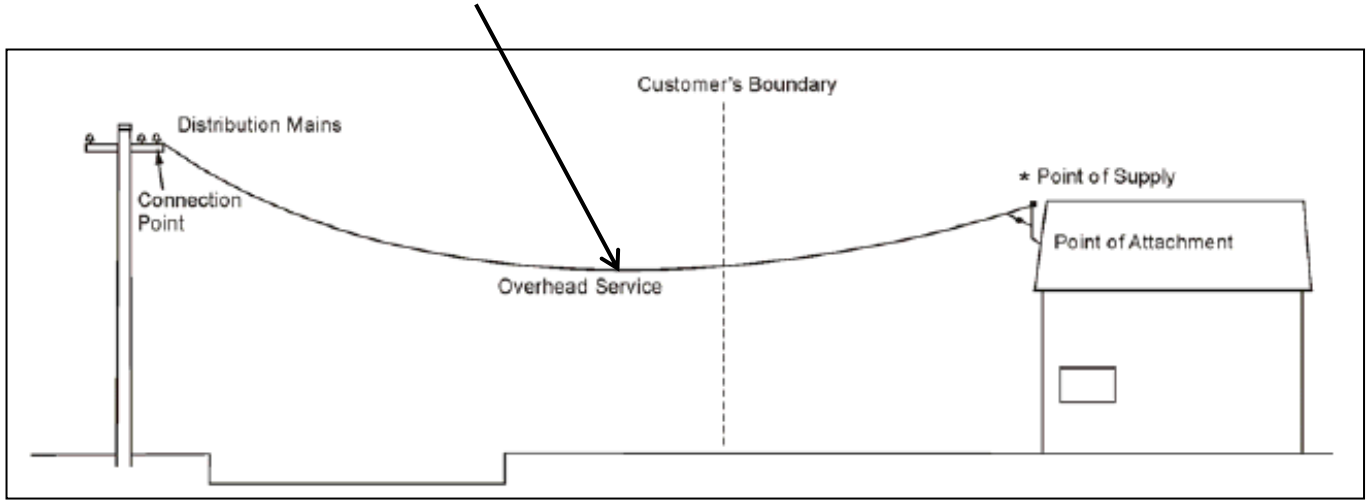
5. Network Considerations – Low Voltage

- Noticeable increase in customer complaints in 2010 requiring;
  - Changes to tap settings on distribution transformers
  - Transformer changes where not enough settings were available
- Voltage rises caused by solar inverters can produce
  - Reduced output from customer installation due to overvoltage protection of inverter.
  - Household circuits operating at higher voltages that may affect household appliance operation.



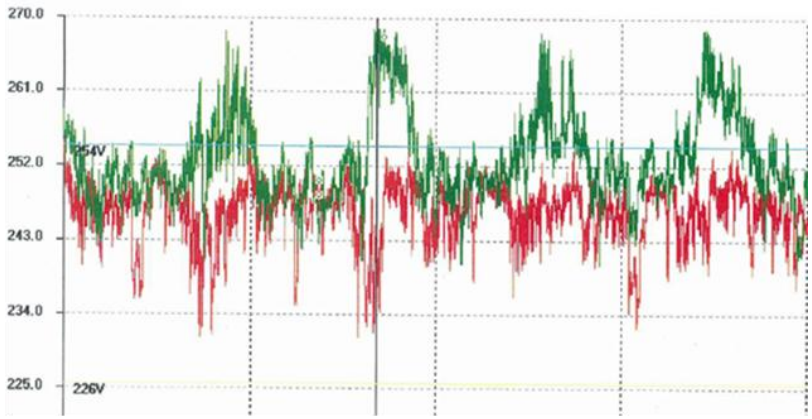
5. Case Study – Low Voltage Rise

- Customer on NSW Solar Bonus Scheme
- Complaint that inverter is intermittent due to high voltage and is losing revenue.
- 10kWp system connected via 3 x 3.75kW inverters
  on one phase.
- 2 phase connection
  ~40metre, 6mm² Service Mains



5. Case Study – Low Voltage Rise

- Voltage Survey confirmed high volts at customers supply point (up to 270v)
- Lower Tap setting on Distribution transformer by 2.5%
  - Marginal improvement
- Upgrade service main (40m) from ~6mm² to 25mm² Al
  - Inverter now operational – customer happy with outcome *but* V99% still on high side (cf AS 61000.3.100)



5. Safety of Solar System Installations

- Ausgrid installation inspections are mandatory for all solar sites;
- DC Isolator safety issue;
  - A common defect was discovered in November 2010 with the incorrect installation of the DC isolator/ breaker.
  - One reported case of a fire caused by this defect.
  - Instance of this defect is improving, fell from 12% in June 2011 to 2% in December 2011.

5. Current and future work

- Updates to guidelines, standards and installation rules for small embedded generation connections
  - NSW electricity service and installation rules
  - Clean Energy Council guidelines for solar installers
  - AS4777 Grid Connection of energy systems via inverter
  - New Voltage standard: AS 61000.3.100-2011 *Limits – Steady state voltage limits in public electricity supply*
- Smart grids
  - The *Smart Grid Smart City* project currently in progress, includes the trial of distributed generation and battery storage devices. For more information visit;

    http://www.smartgridsmartcity.com.au/

6. Summary

1. Large increase in small solar installations due to subsidies
2. Solar PV is approaching grid parity
3. Solar PV provides some peak demand benefit
4. The peak demand benefit is not large enough to reduce near-term network costs
5. There are a range of other network issues being addressed