PV Output, Temperature, Electricity Loads & NEM Prices – Summer 2003-04

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Introduction

- Summer peaks in SA, Vic & NSW have resulted in occasional extreme spot prices in the NEM and even supply interruptions
- Driving significant investment in new generation and new or upgraded network capacity
- State governments considering demand-side responses to defer or eliminate some of the planned expansion
- Supply focus of present retail electricity structure makes it difficult to implement effective demand solutions
- Political preference for maintaining uniform residential tariffs
- Reluctance (other than in Victoria) to mandate use of interval metering for residential customers

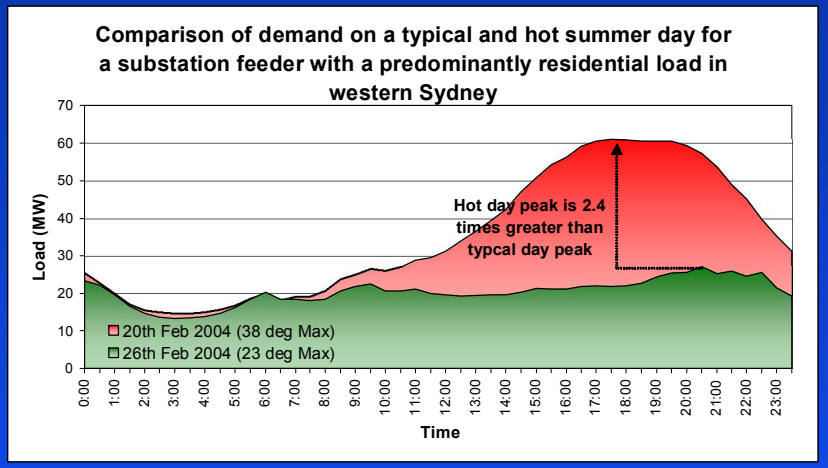
$\Rightarrow$ Eliminates the option of tariff signals for small customers in many areas

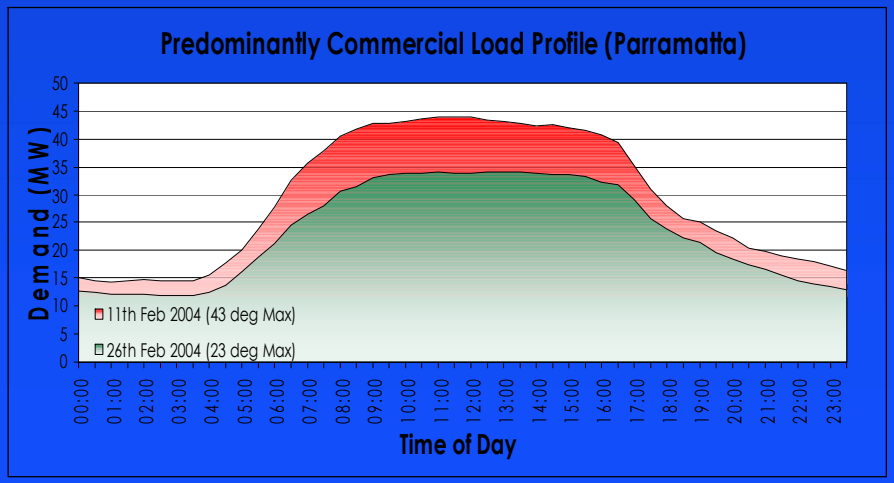
This Paper

- At Solar 2003, a preliminary assessment of PV output from a small number of systems during the summer peak load periods in SA and NSW was reported
- This paper now reports on analyses of the week 9-15 February 2004, which was the peak week for SA and Vic last summer, using data from 15 PV systems, 3 States, 15 substations + State level load and spot price data from the NEM

Background

- Electricity demand growing rapidly in Australia, accompanied by increased “peakiness”
- Increasing air conditioning load considered to be the major cause
- Air conditioning load is highly correlated with temperature extremes



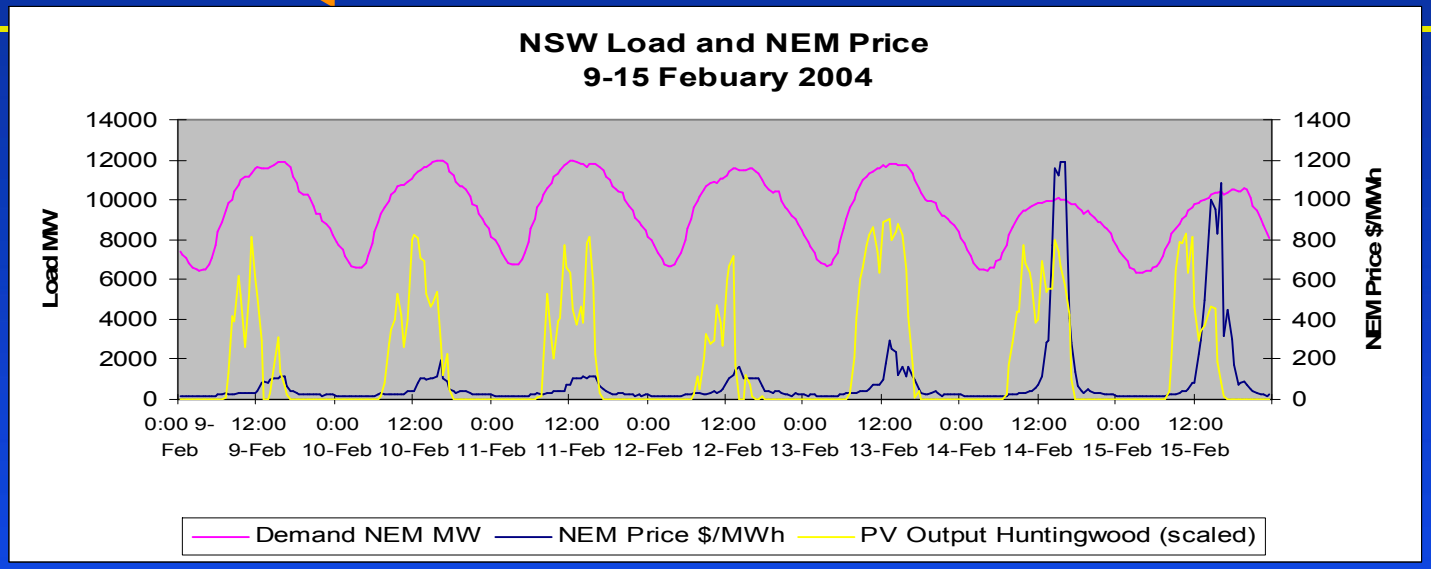


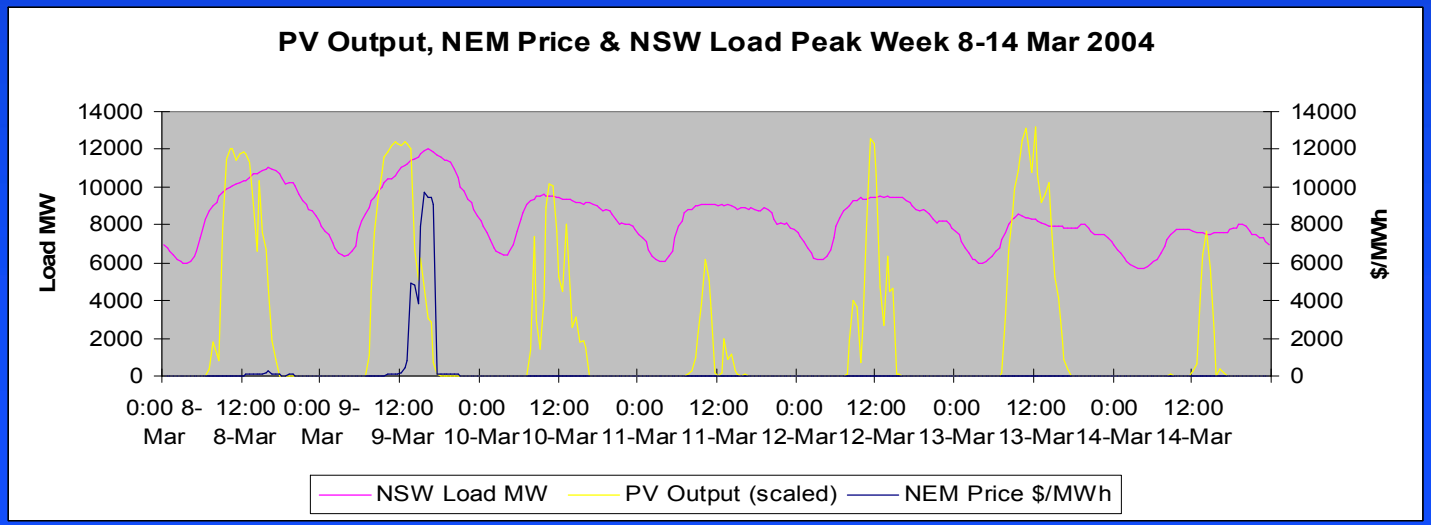
NEM Prices

State	Ave RRP February $/MWh 7am-10pm	Ave RRP 9 –15 Feb $/MWh 7am-10pm	Some Peak 1/2 hour prices for February $/MWh
NSW	$48.72 ($116.44 Mar Ave)	$116.19	$1188, 3:30pm, Sat 14 Feb $2521, 1:30pm, Sat 21 Feb $9702, 3:30pm, Tue 9 Mar (NSW Peak day)
SA	$108.35	$252.38	$4750, 9pm EST, Fri 13 Feb $3039, 10am EST, Sat 14 Feb
Victoria	$48.30	$102.79	$1096, 4pm, Sat 14 Feb $1608, 10am, Fri 20 Feb

Note: Typical 24 hour average RRP 2003-04: $25-35

NSW - Load, PV & NEM Price



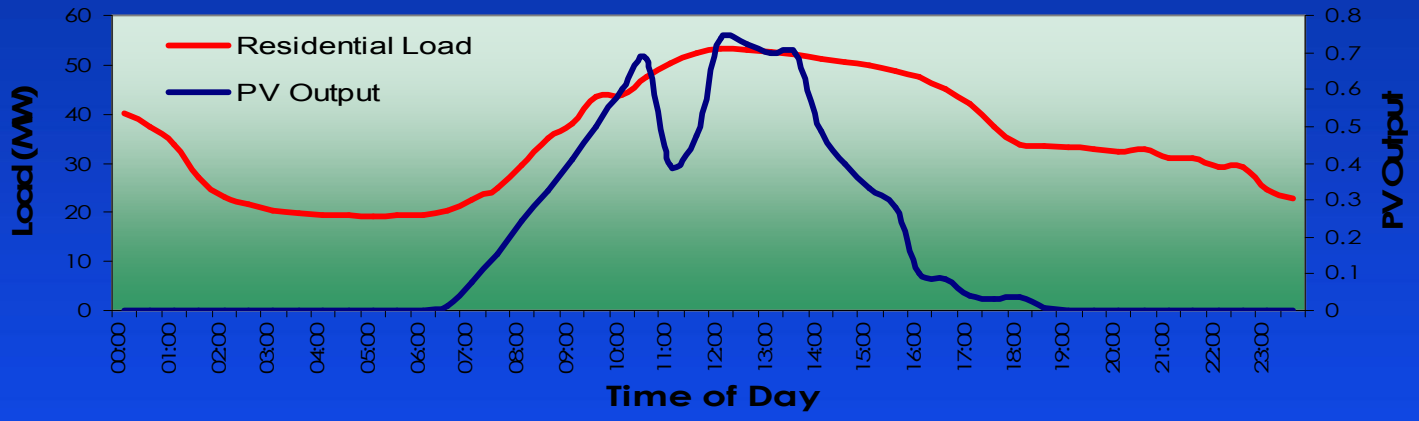


Note 1: Single arrays only

2: All PV ~ North facing but varying tilts (15-25°)

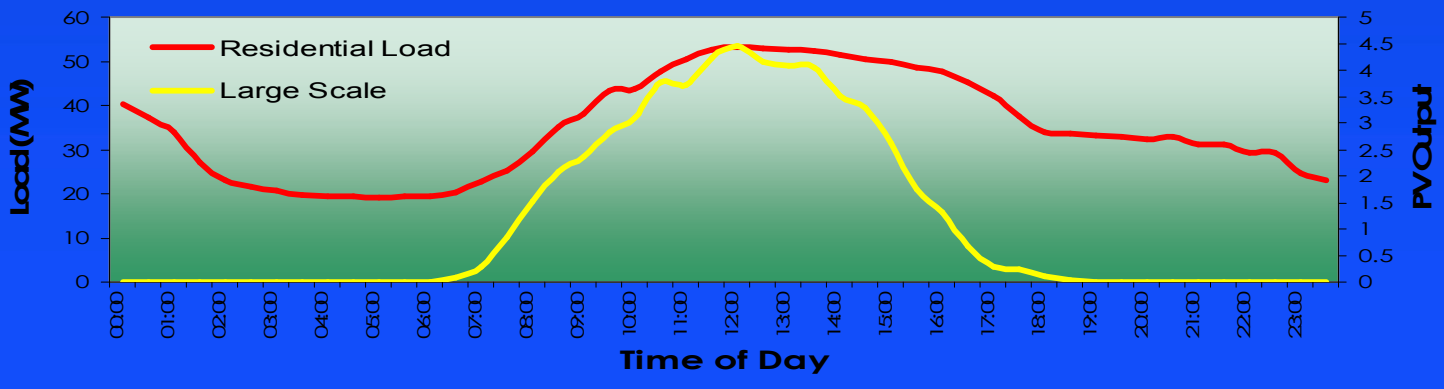
Impact of Distributed PV Systems

Predominantly residential load profile compared with the output from a 1kW PV system, 21/02/04



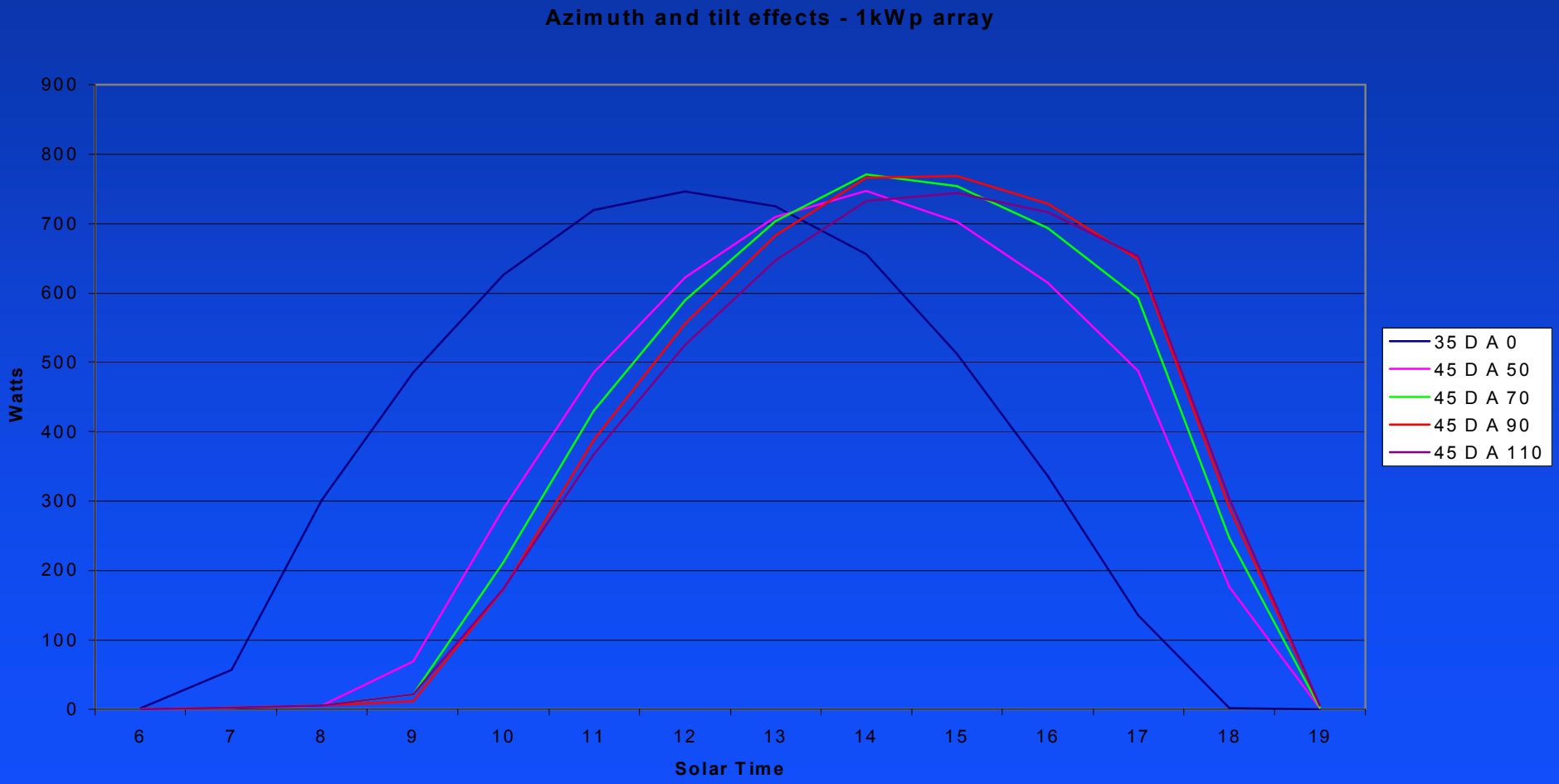
1 Sydney array

Predominantly residential load profile compared with the output from a simulated 6MW PV system, 21/02/04



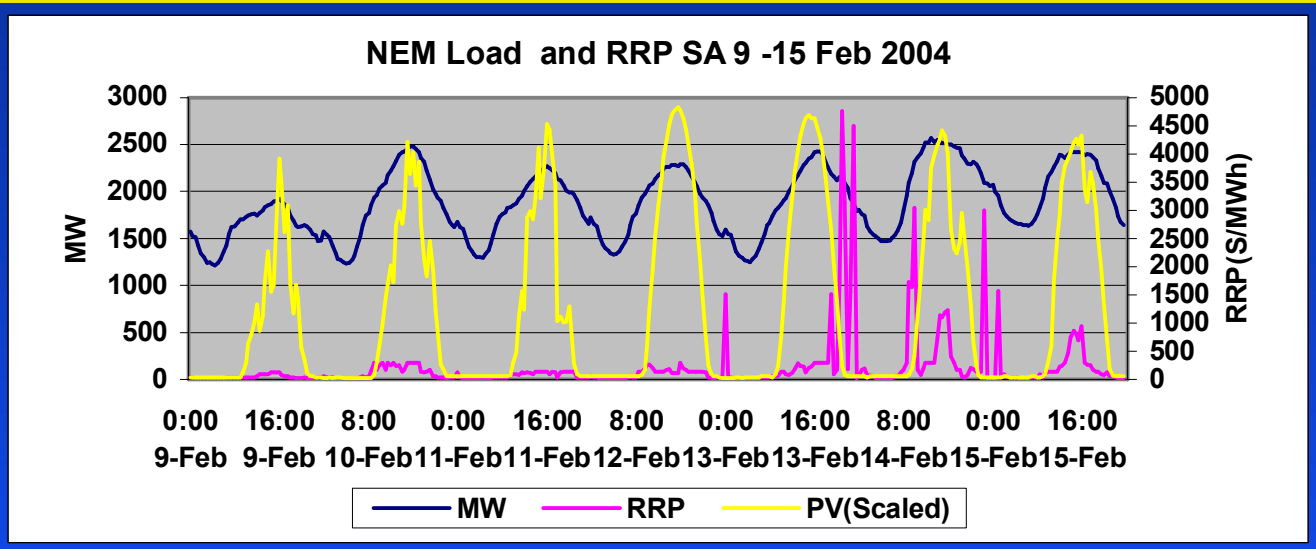
3 Sydney arrays added together

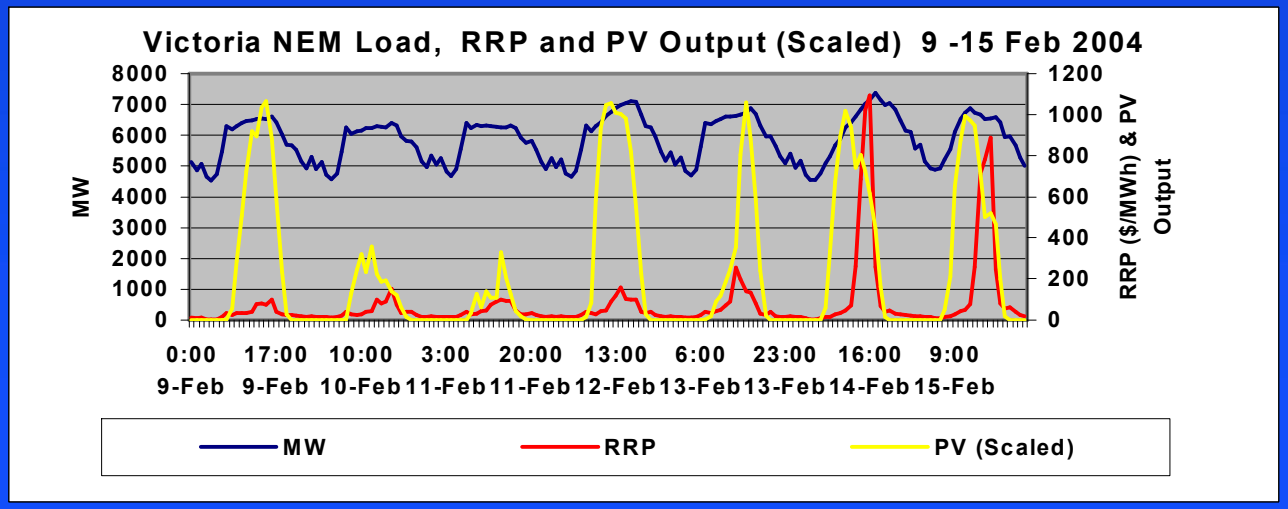
Simulated PV Output by Orientation and Tilt, January Sydney



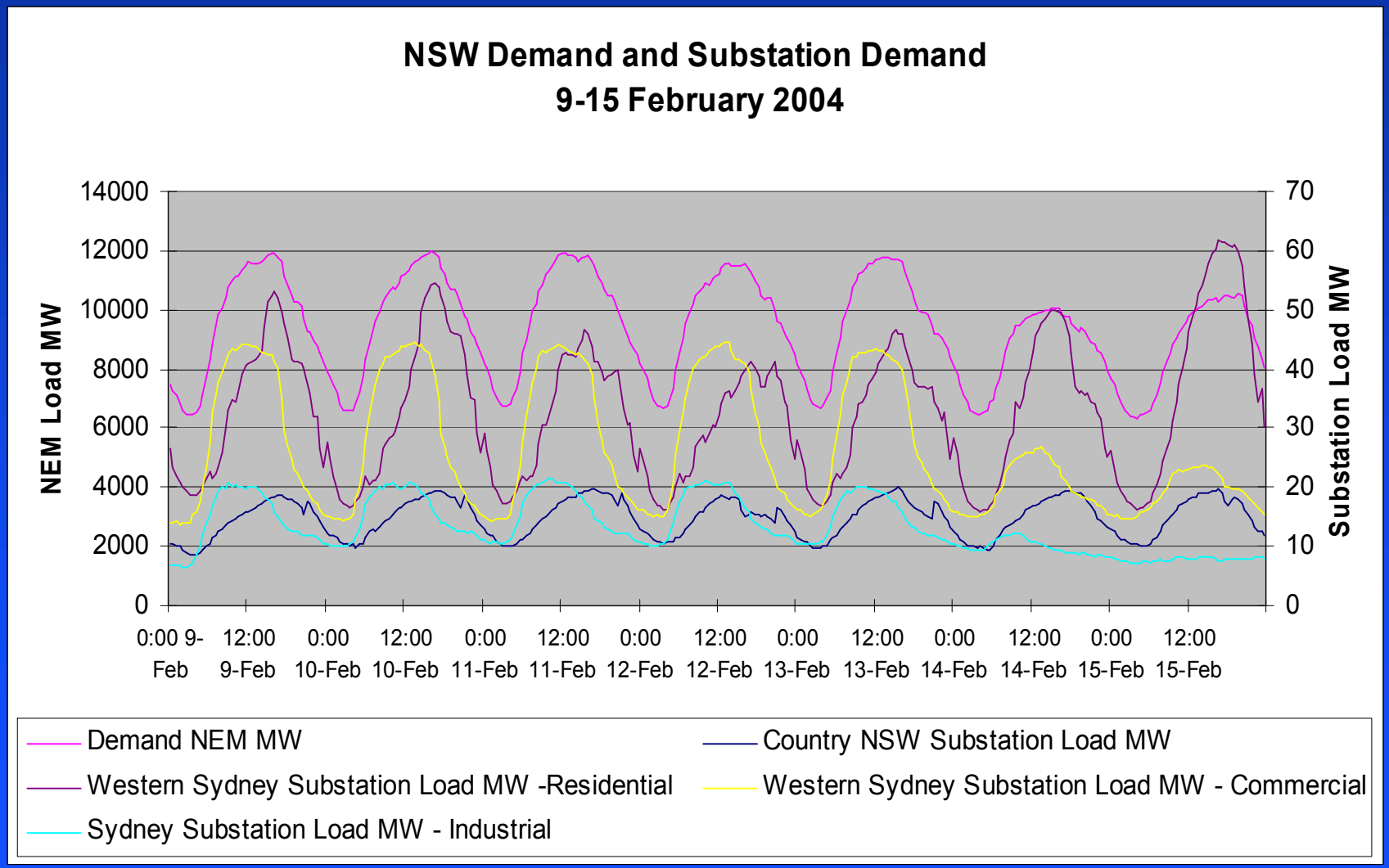
Note: Summer PV output not reduced, but annual output reduced by ~ 20%

SA and VIC Peak Week

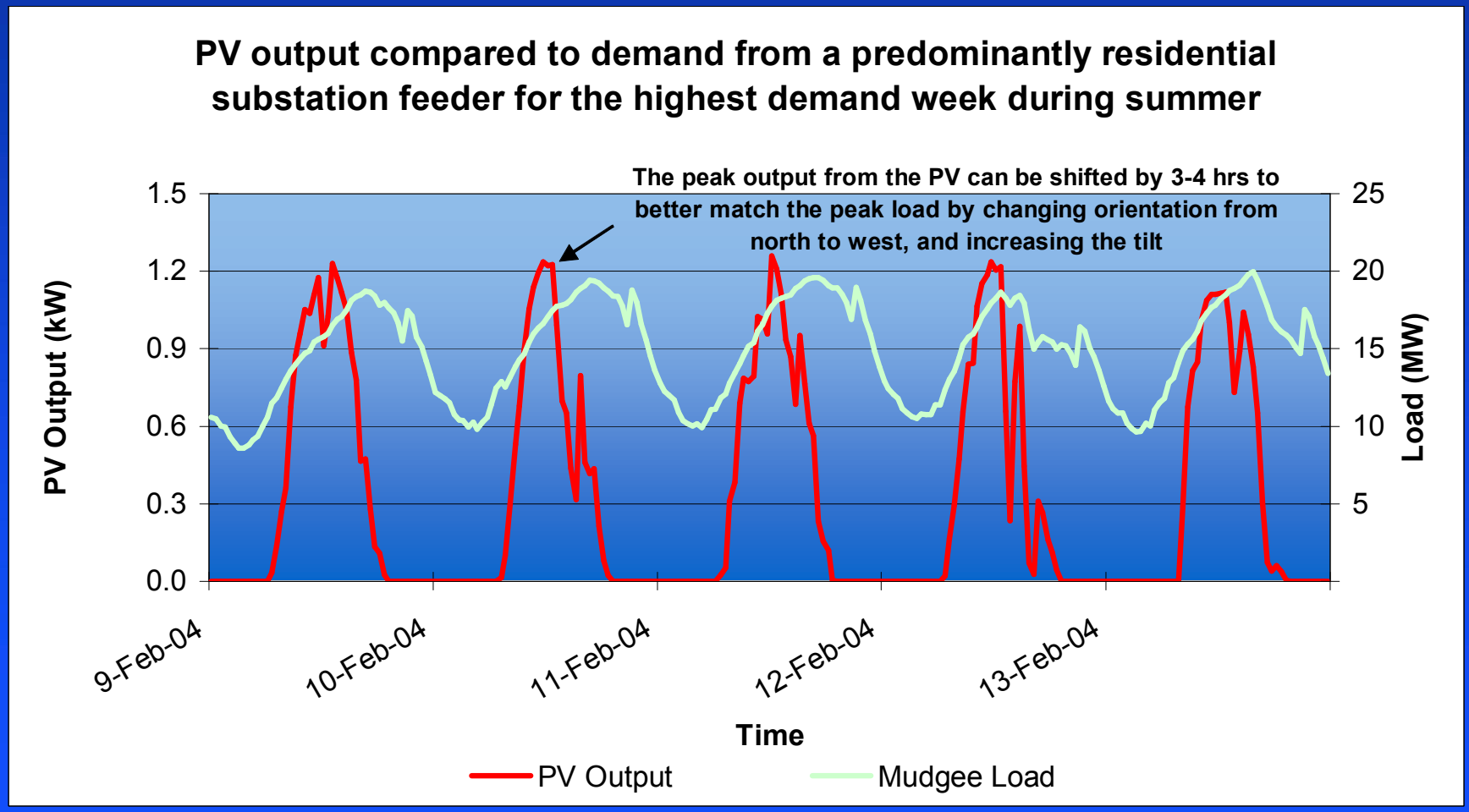




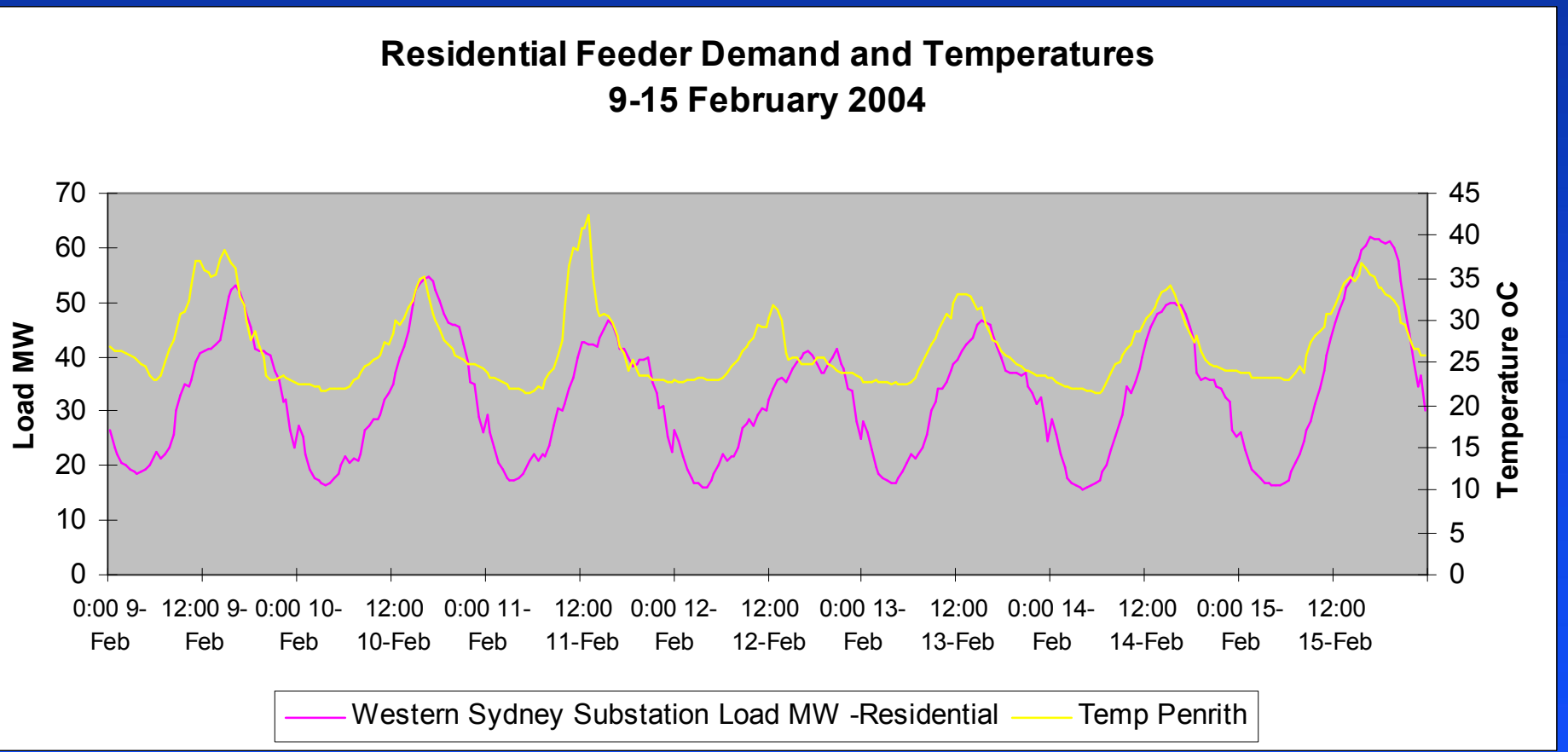
Demand Patterns



PV and Substation Load

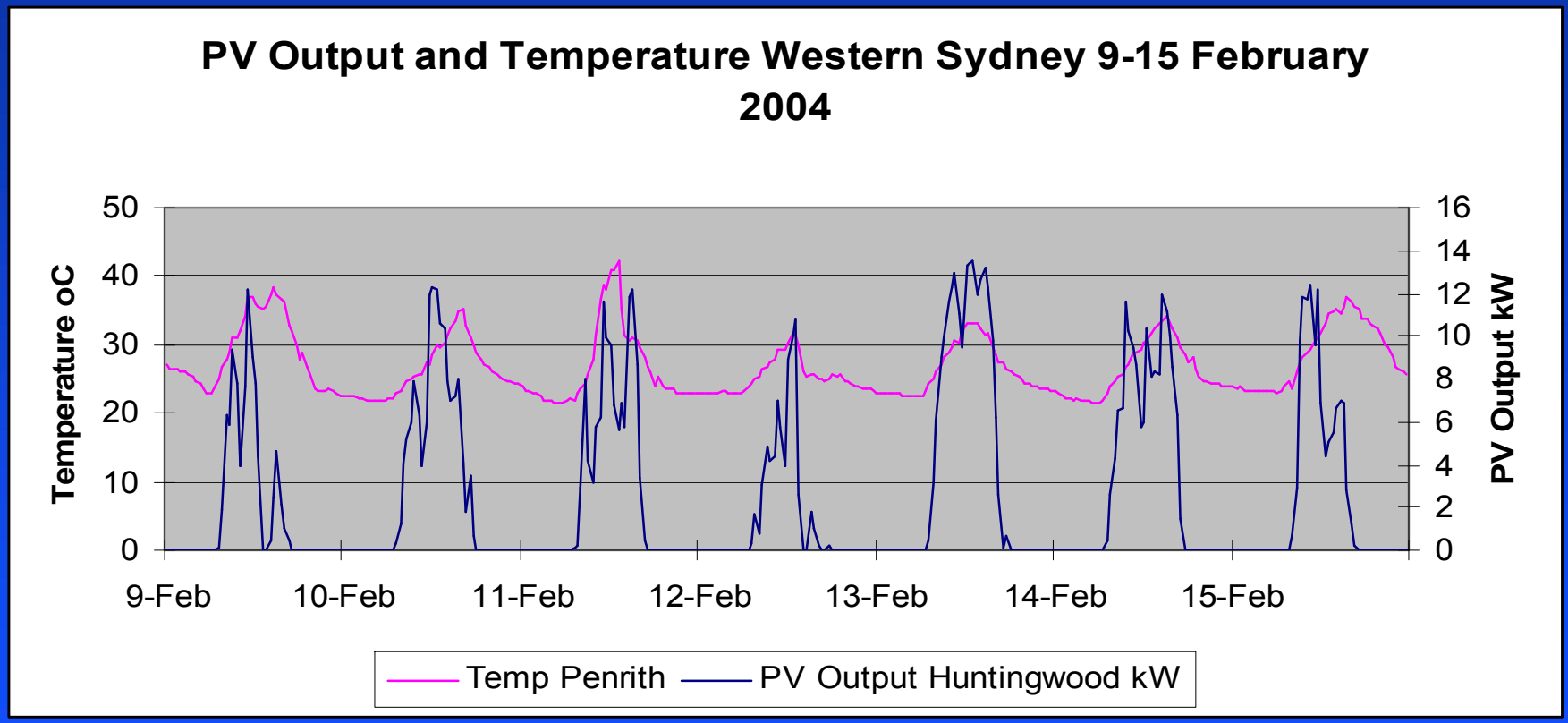


Residential Load and Temperature



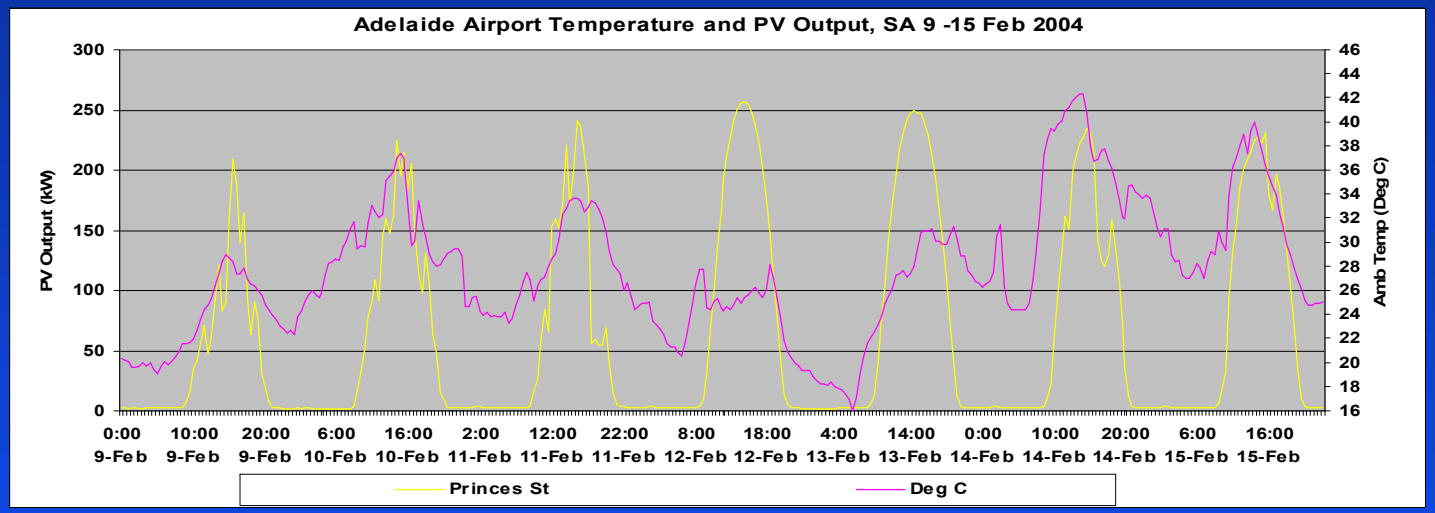
Notes: 9th is Monday. Weekday peaks are later than weekend

PV and Temperature NSW

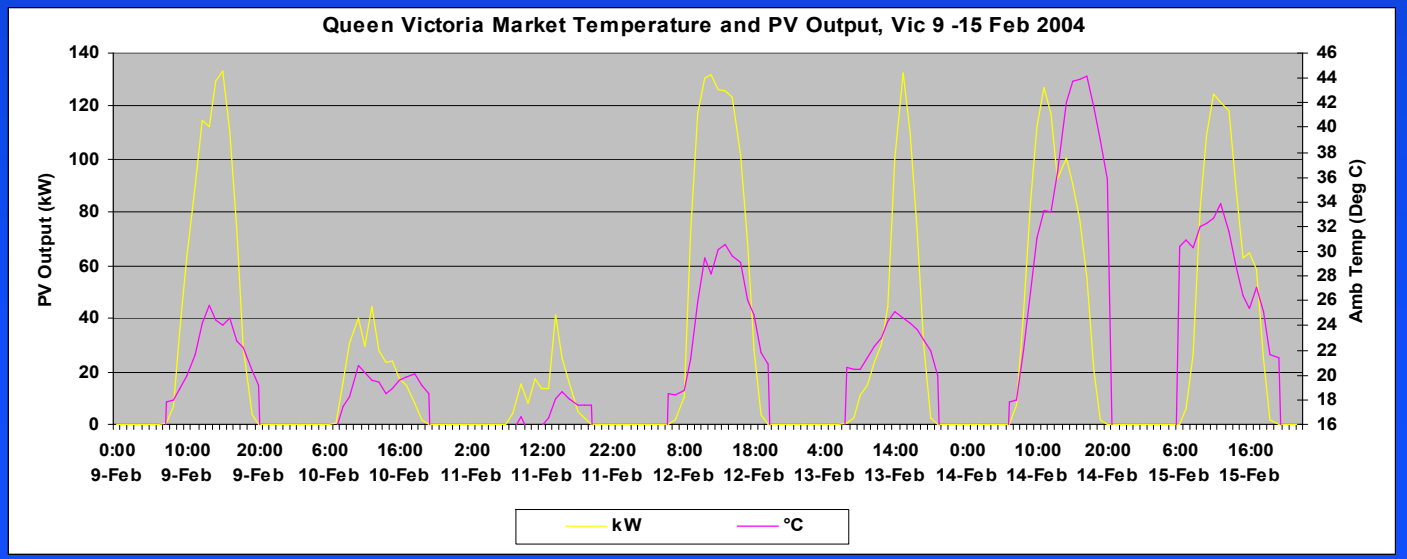


For all sites, 2-6% reduction in PV output on days > 30° cf < 30°

PV and Temp

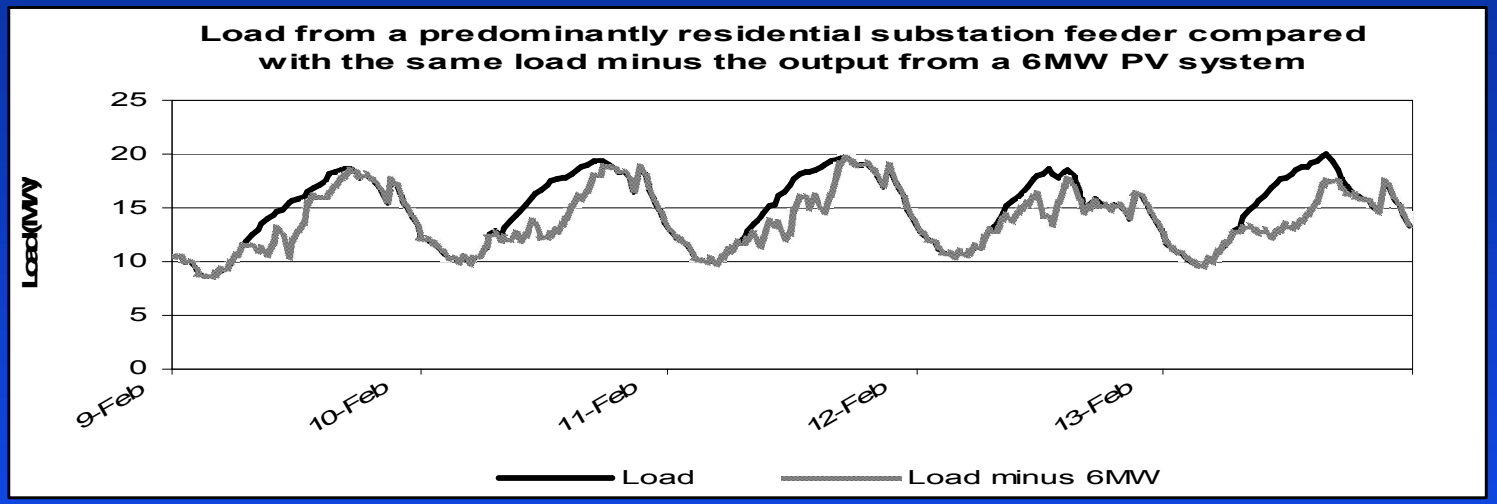


SA



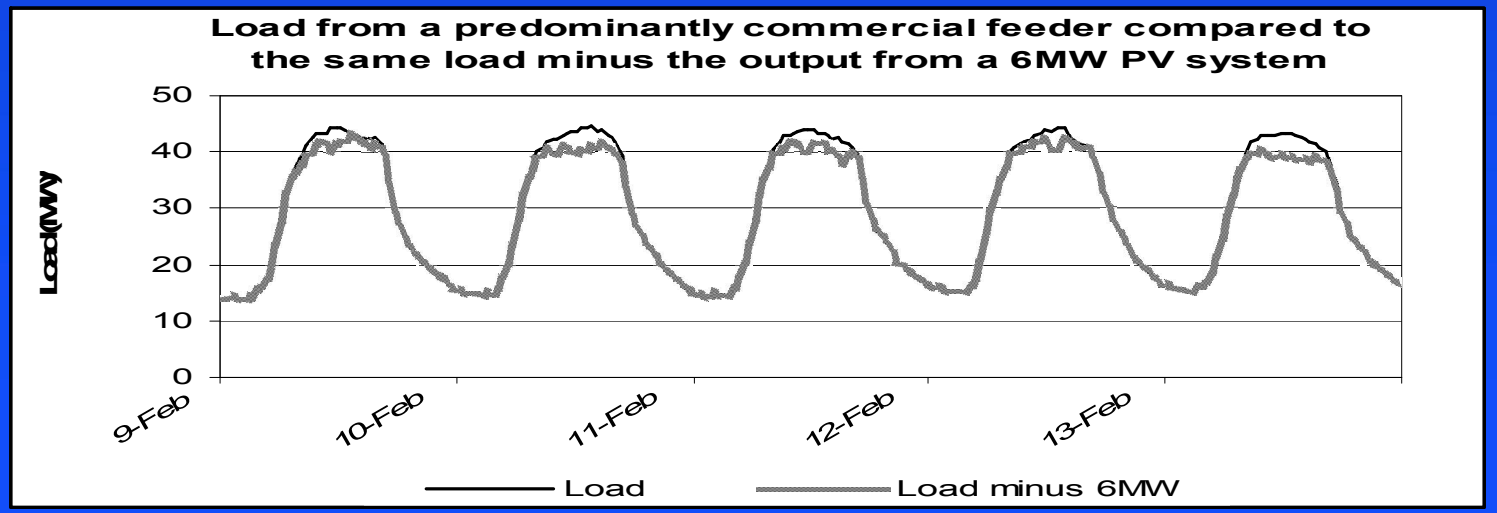
VIC

PV Impact on Substation Load NSW



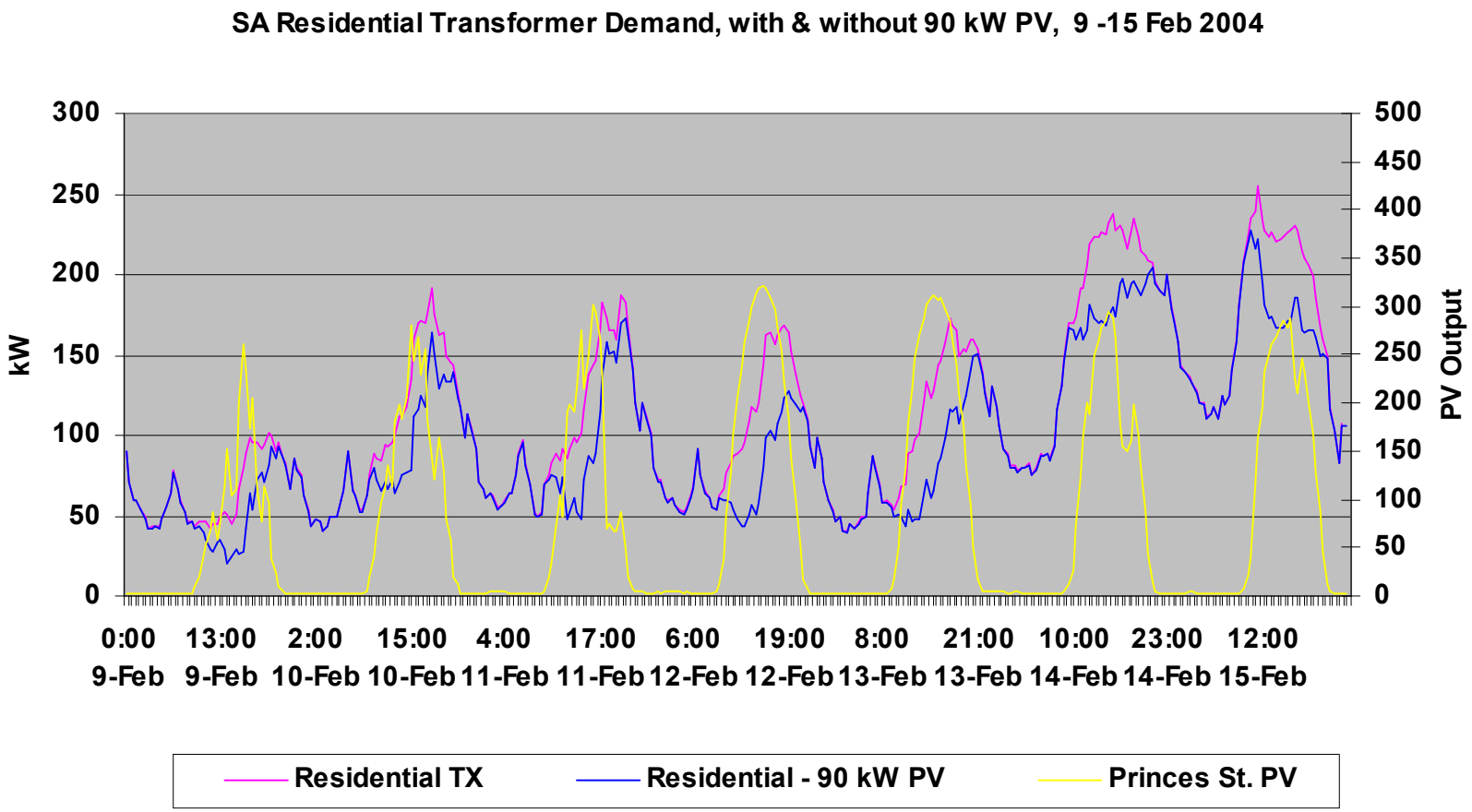
Residential

Output from 3 PV systems added and scaled



Commercial

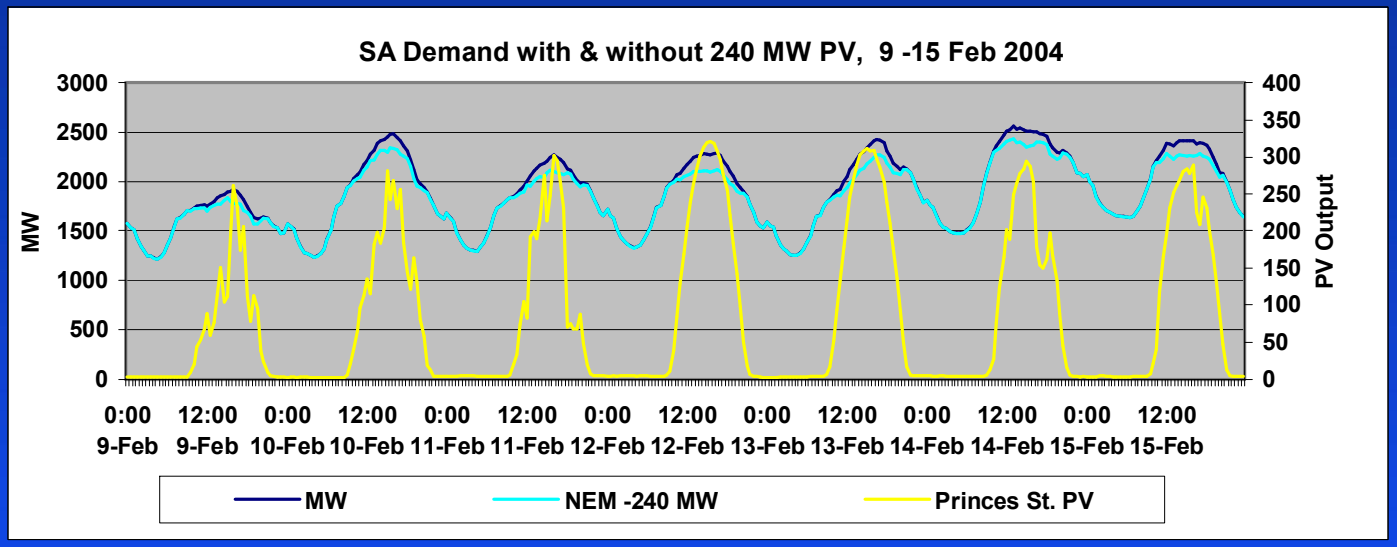
PV Impact on Residential Load SA



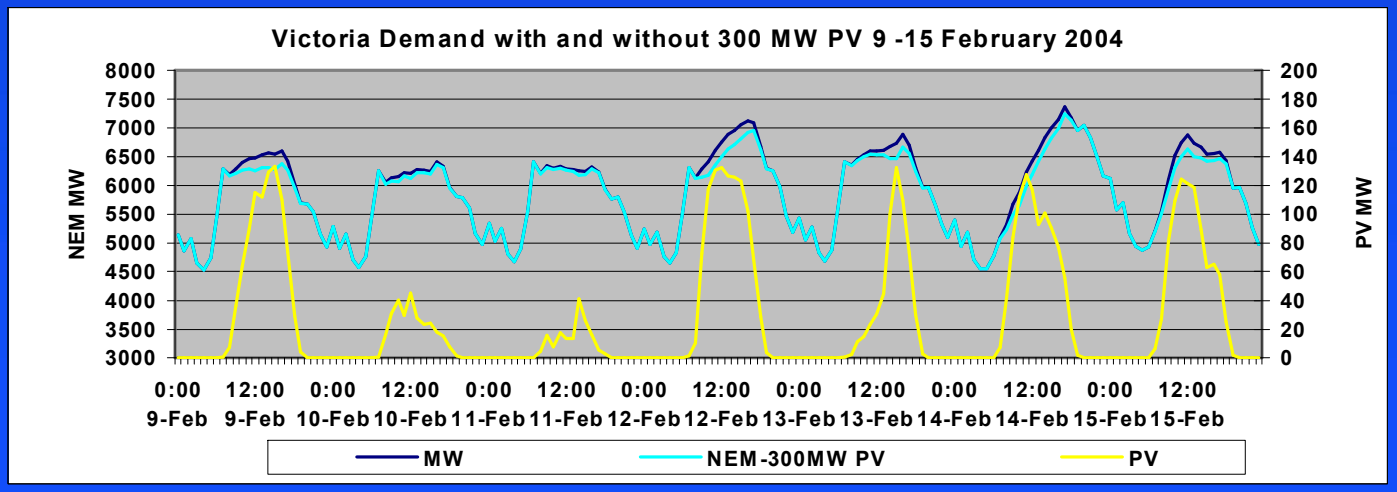
Output from 1 PV system, scaled

PV Impact on System Load

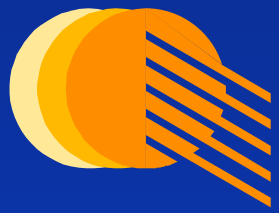
SA



VIC



Note potential for smoothing with more PV systems and different orientations



Conclusions

- PV output over the peak load weeks of last summer has been correlated with system load at regional nodes for SA, Vic and NSW
- PV output typically peaked prior to the peak NEM price in peak load weeks
- PV output correlates well with loads on feeders with a high proportion of commercial load, indictating a strong case for PV use in commercial buildings
- For residential loads:
  - Load peak is typically in mid to late afternoon
  - Where air conditioners used, peak load is significantly higher on hot days and can remain high up to 6 or 7pm
  - For PV to contribute usefully to the peak, the PV output curve must be displaced or storage added
- PV value for peak load reduction is dependent on the load pattern of the individual feeders to which they are connected, but can be improved for the system as a whole by distributed placement
- PV provides a year round daytime electricity supply and reduces greenhouse gas emissions