

THE DEATH SPIRAL

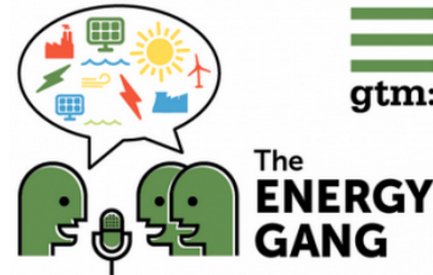
The looming risks facing energy networks

Bill Grace
April 2014



All the hype ...

greentechgrid:



Jigar Shah, Stephen Lacey and Richard Caperton discuss the impact of distributed energy on utilities.

Stephen Lacey
August 18, 2013

THE CONVERSATION
Academic rigour, journalistic flair

24 October 2013, 11.37am AEST

Why wrong pricing has caused the electricity 'death spiral'

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Independent, rigorous and practical solutions to Australia's most pressing problems

11 December 2013

How to avoid the electricity death spiral

By Tony Wood

Published by *Business Spectator*, Wednesday 11 December 2013

REneweconomy
Tracking the next industrial revolution

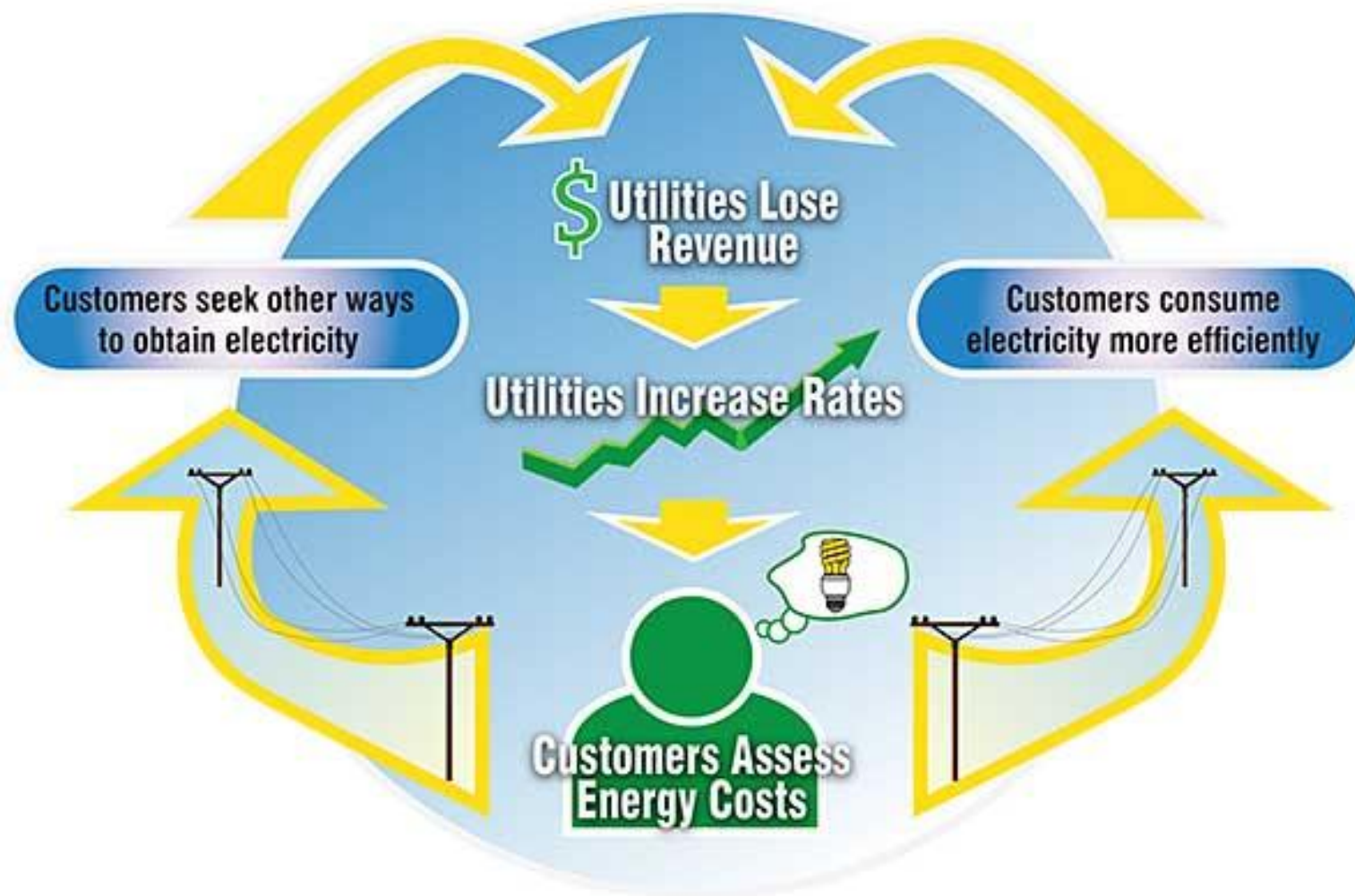
WA grid may become first big victim of "death spiral"

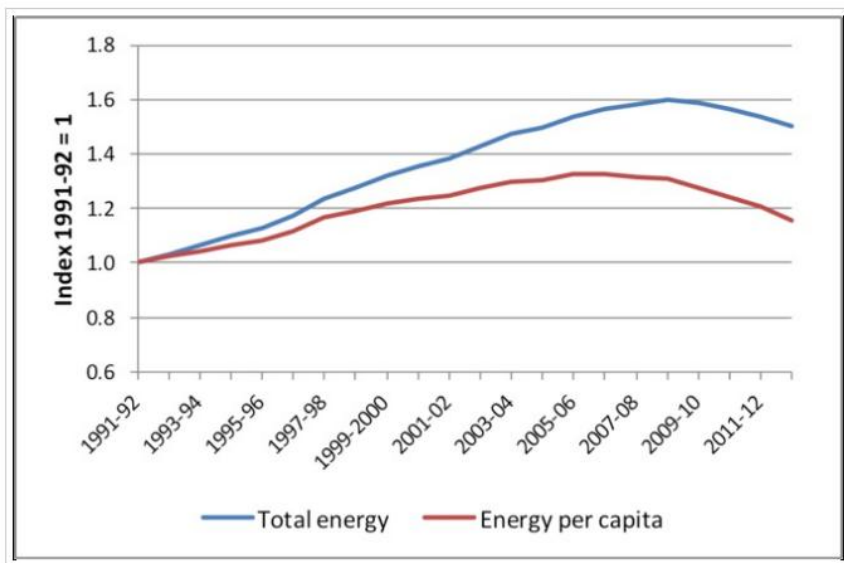
By Giles Parkinson on 30 January 2014

Quotes ...

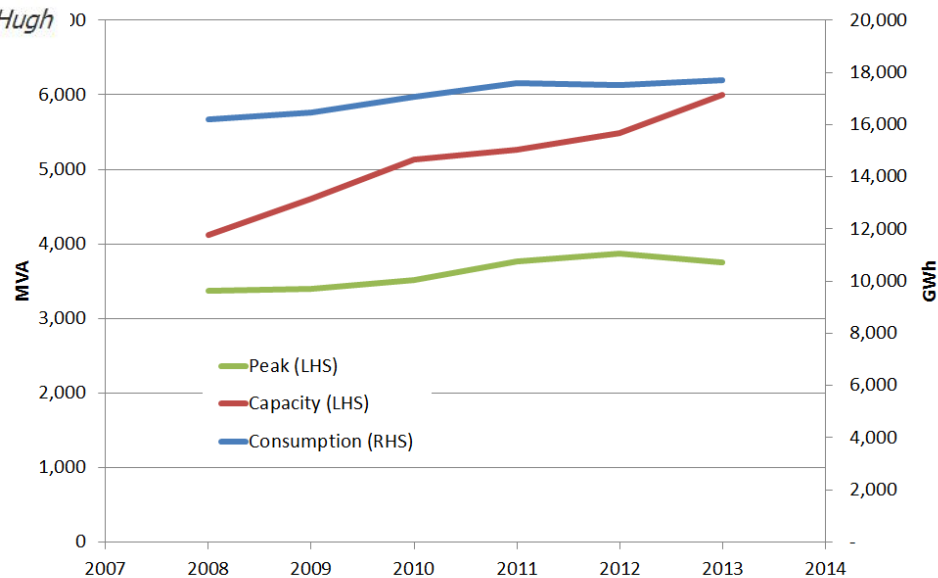
- *“The “death spiral” is a term coined by utilities in an attempt to defend their business models against the rise of the “prosumer”, customers who are no longer just buying energy but who are sourcing cheaper electricity from their own generation, usually rooftop solar, and cutting demand from the grid.” - Parkinson*
- *“This scenario was never anticipated by those who designed the system. It is certainly a nasty surprise for consumers. A little imagination reveals that the arrangements could spiral out of control as costs are spread over an increasingly smaller number of consumers. Analysts at AGL have called this scenario the “death spiral”. – Wood*
- *Utilities may soon be on the verge of a "death spiral" as more customers leave the grid and implement distributed energy technologies like solar. A similar shift happened in telecom as the rise of mobile phones made copper lines nearly obsolete. - Lacey*

Or.....





Trends in total and per capita annual electrical energy consumption in the NEM. Hugh Saddler



Trends on the SWIS

Source: IMOWA

Rooftop solar

State	#systems	Capacity (MW)	Proportion of dwellings with Solar Power
ACT	14,000	38	10%
NSW	252,000	633	10%
NT	3,000	11	4%
QLD	360,000	986	22%
SA	160,000	450	25%
TAS	18,000	55	9%
VIC	201,000	532	10%
WA	149,000	334	18%
National	1,157,000	3,039	14%

A systems model of the SWIS

The Field of System Dynamics

- System dynamics is a computer-aided approach to policy analysis and design.
- It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems -- literally any dynamic systems characterised by interdependence, mutual interaction, information feedback, and circular causality.

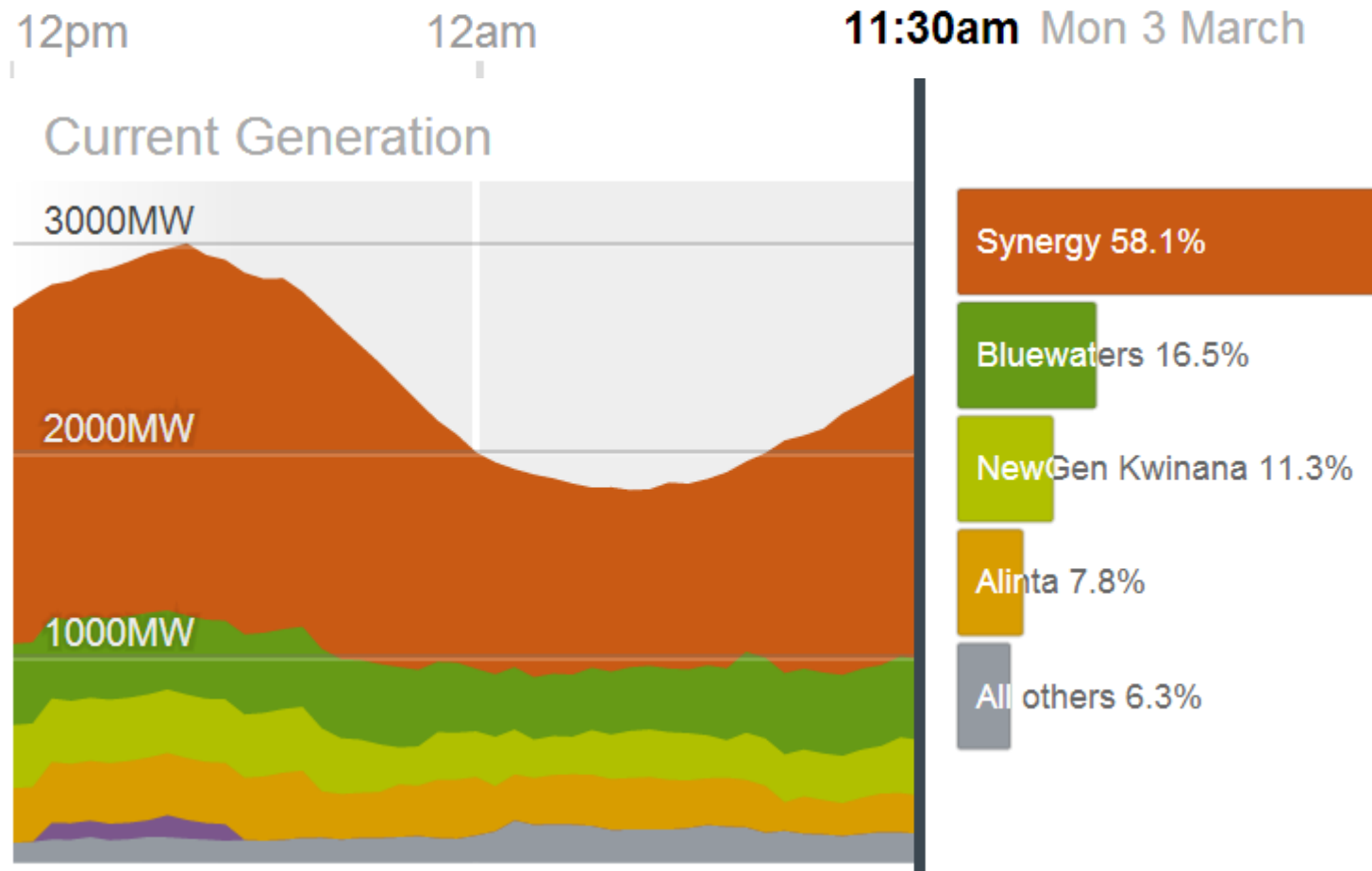
The problem with models!

The system dynamics mantra:

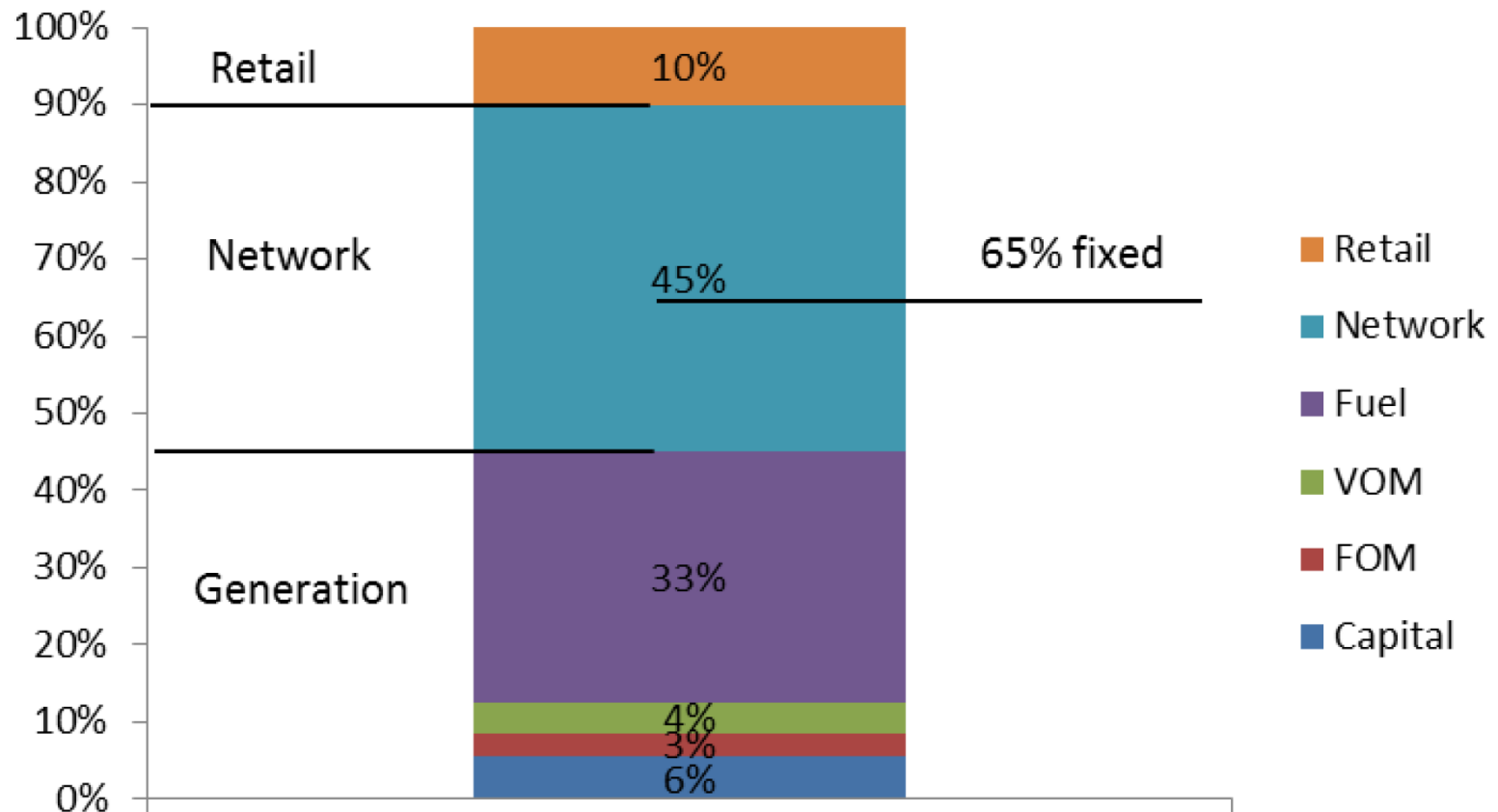
‘All models are wrong – some are useful’

The system behaviour (shape of the curves) is important – the magnitude of the numbers and the timing is indicative only

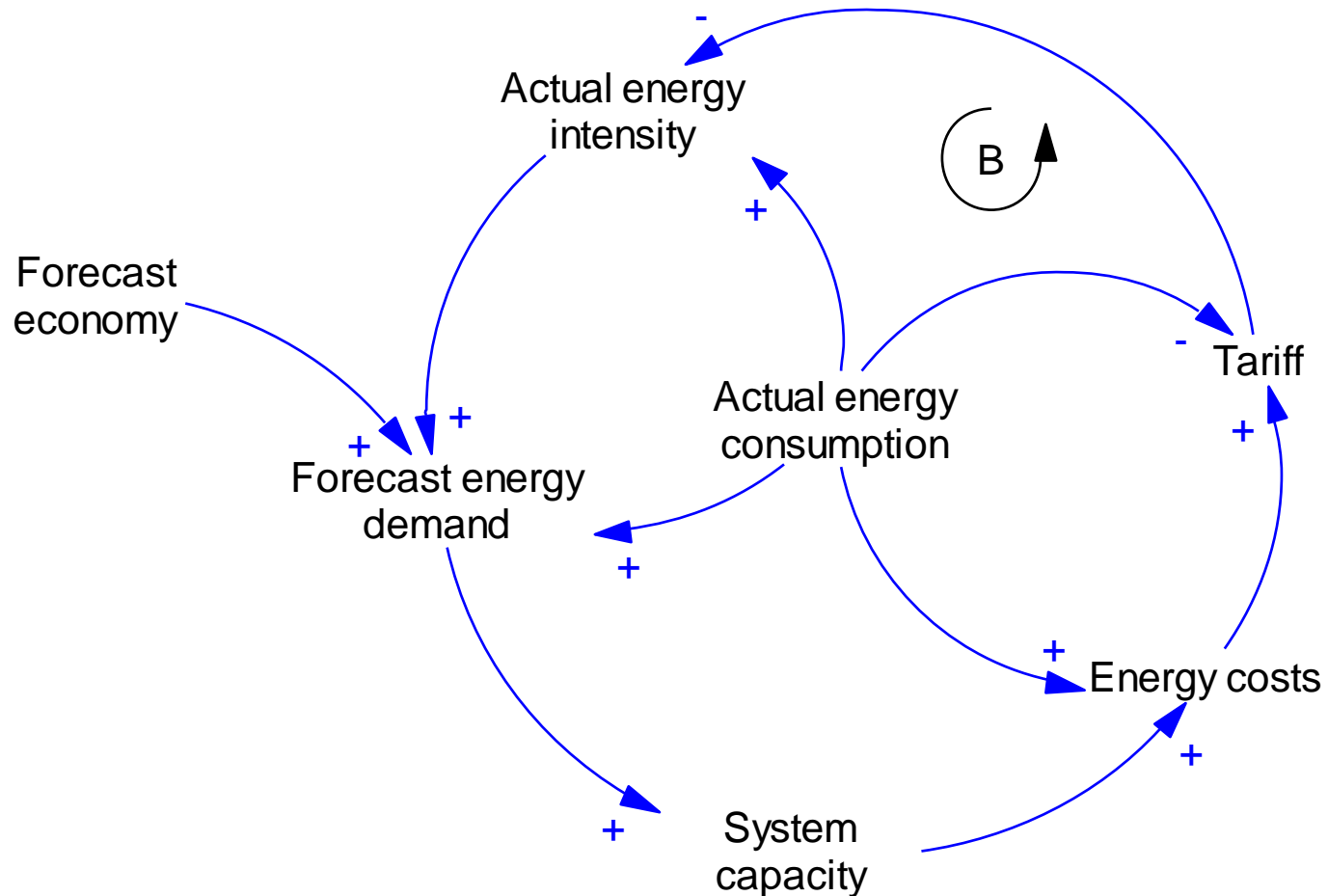
The SWIS



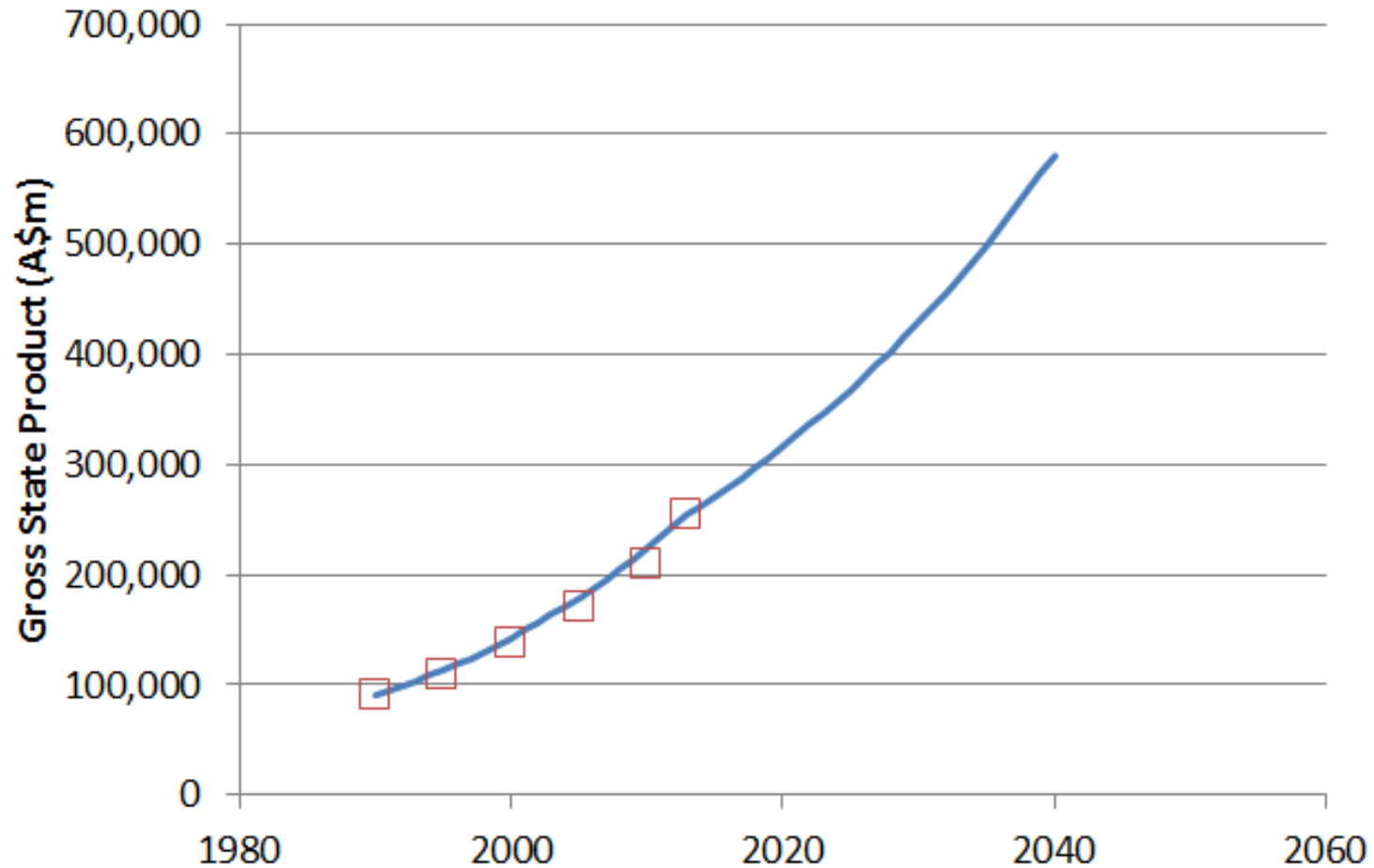
Electricity costs per MWh



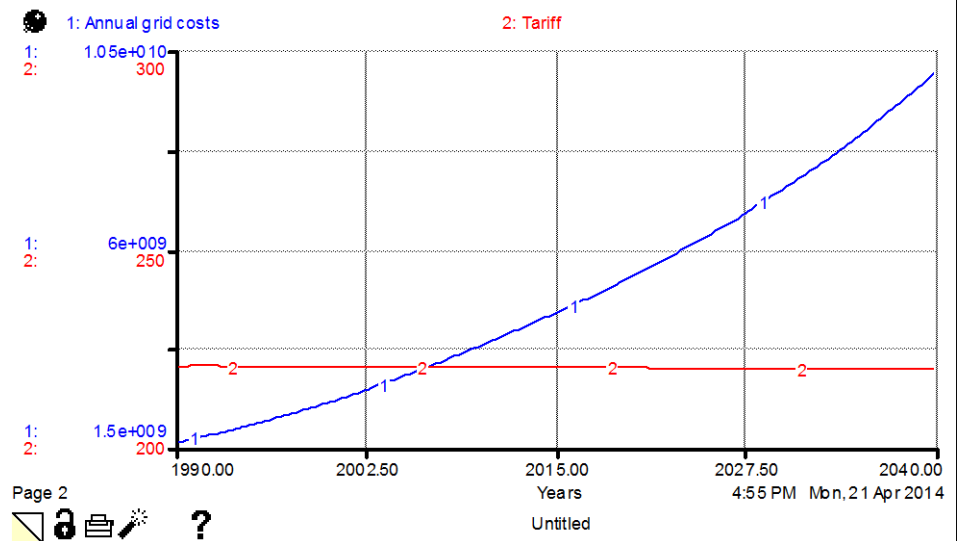
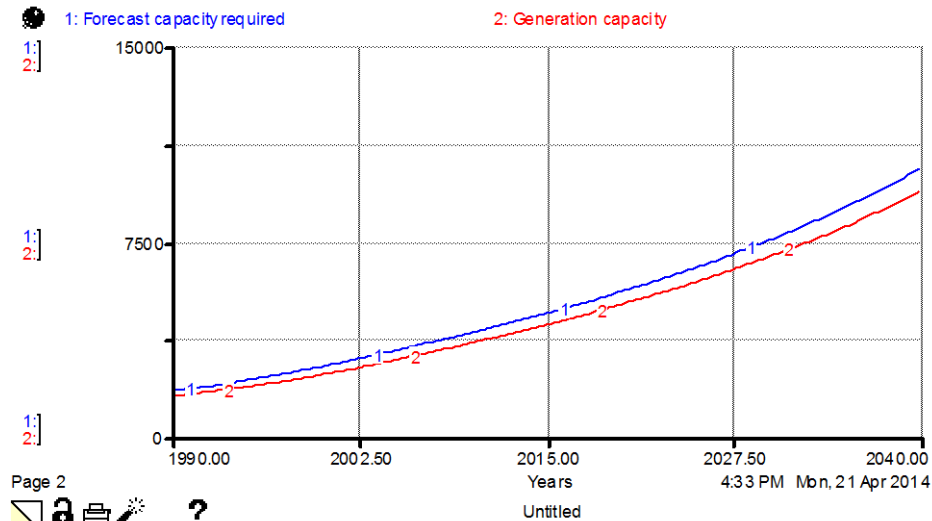
The baseline model



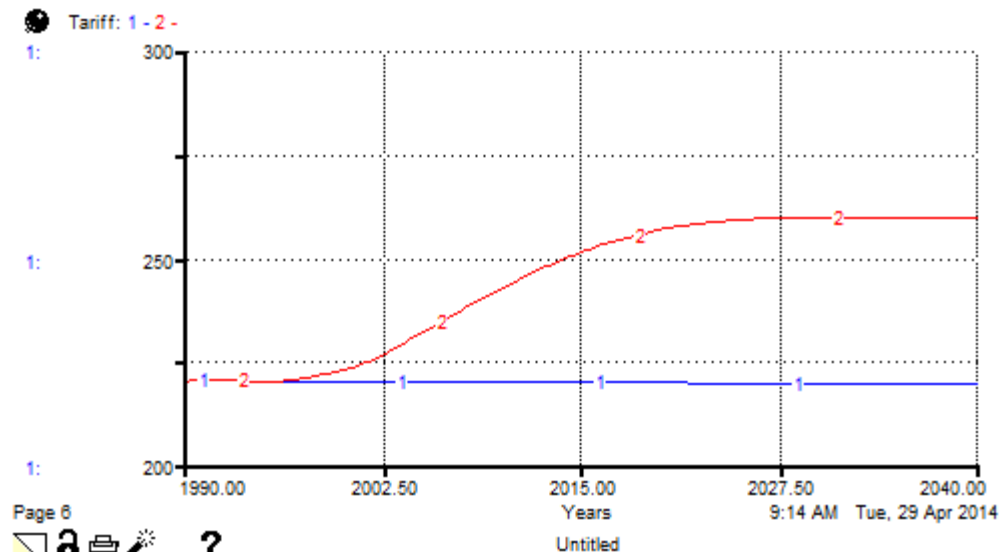
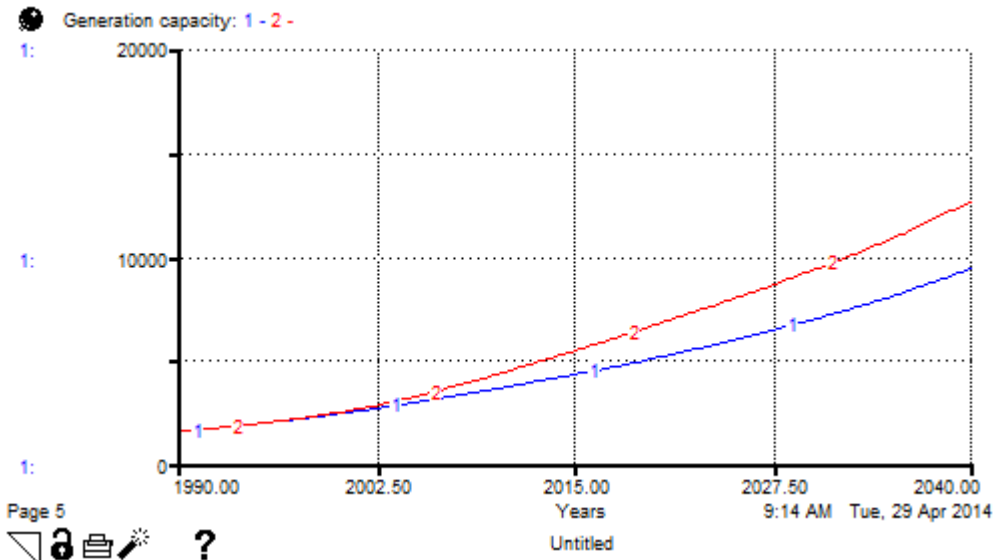
Economy 1990-2040



Business as usual

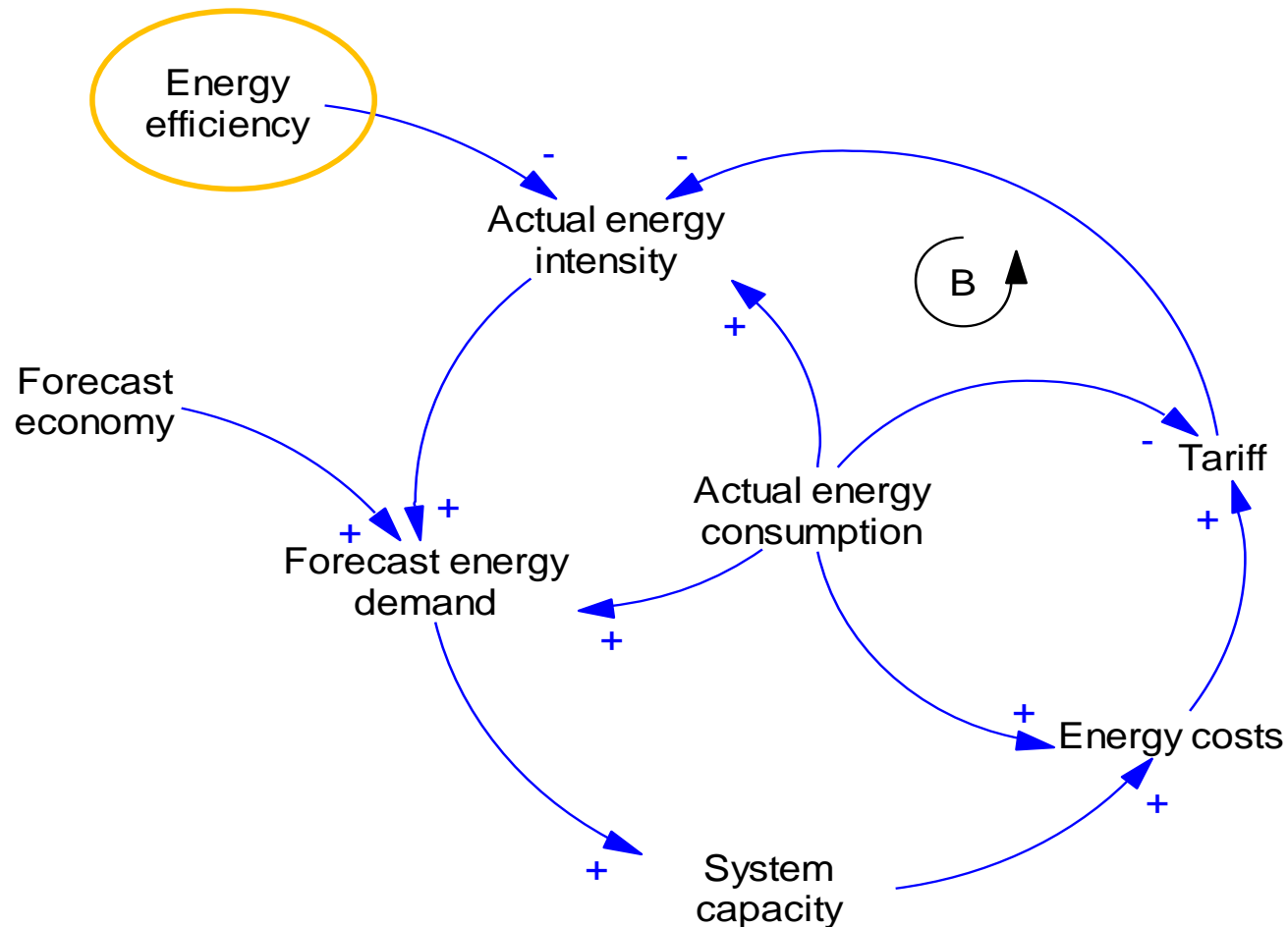


Adding capacity beyond demand (goldplating)

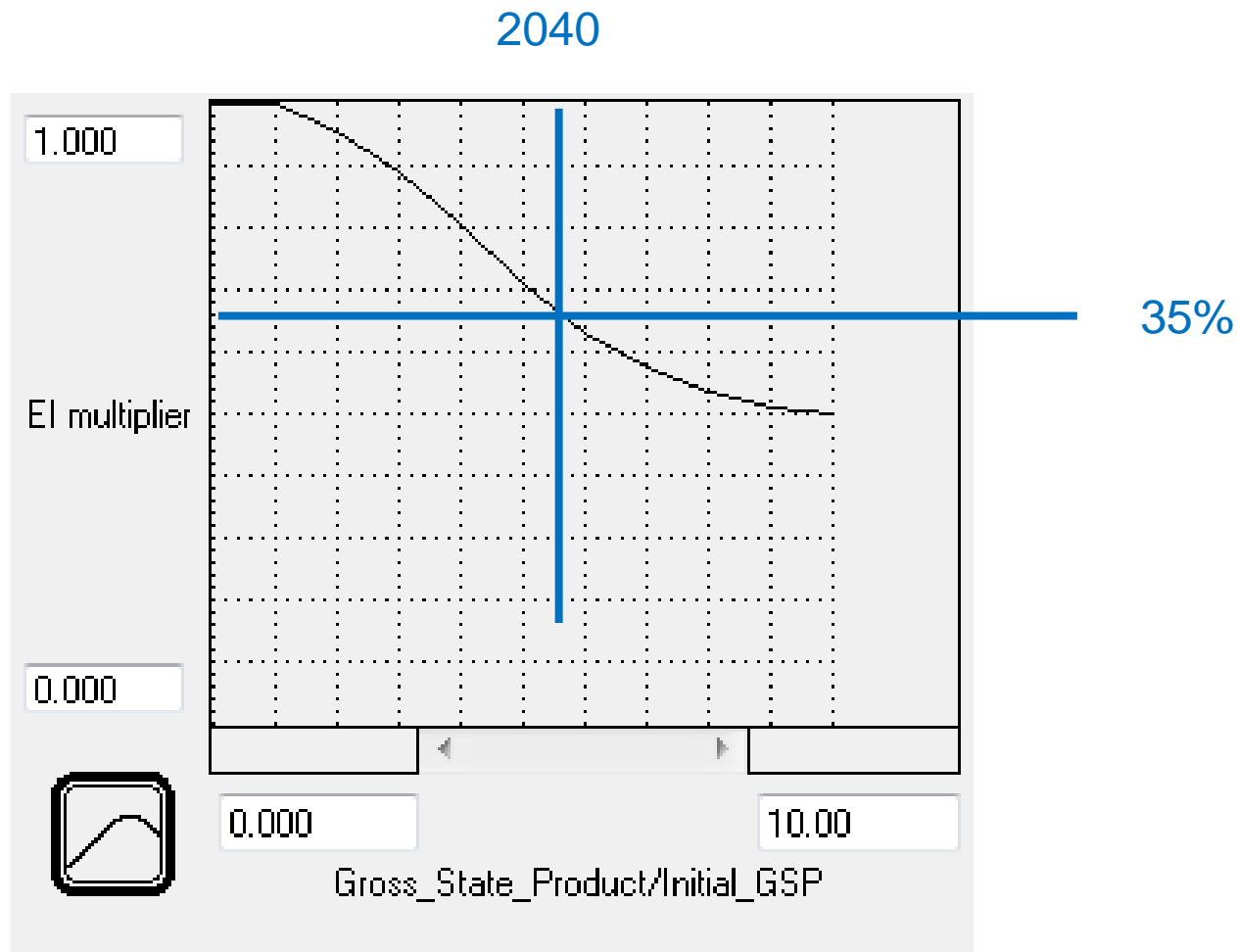


Add energy efficiency

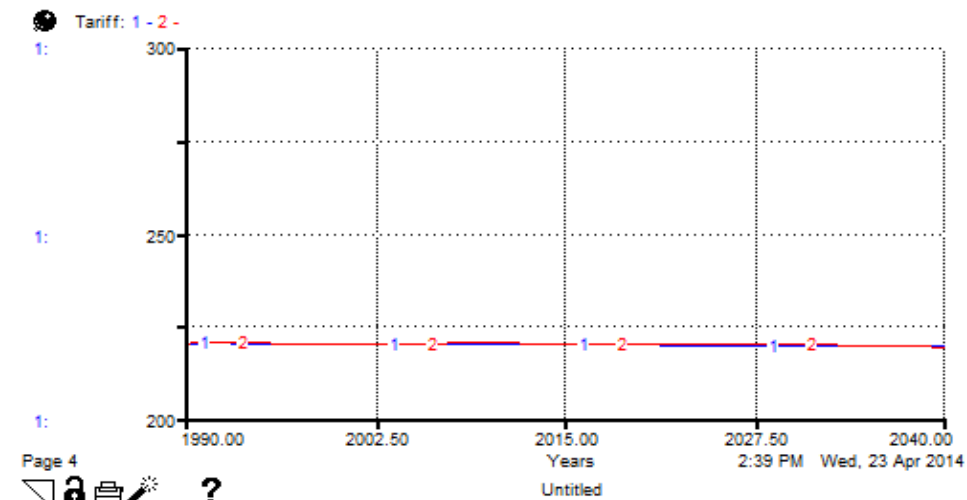
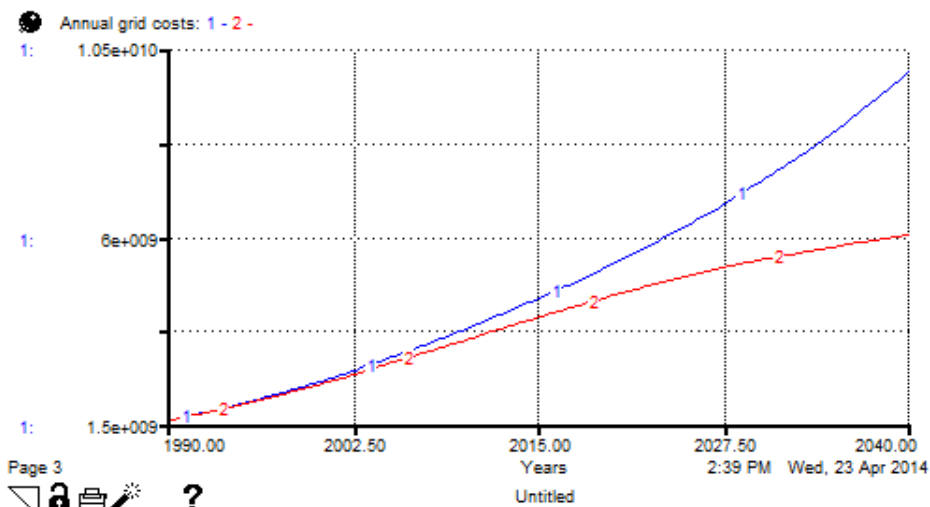
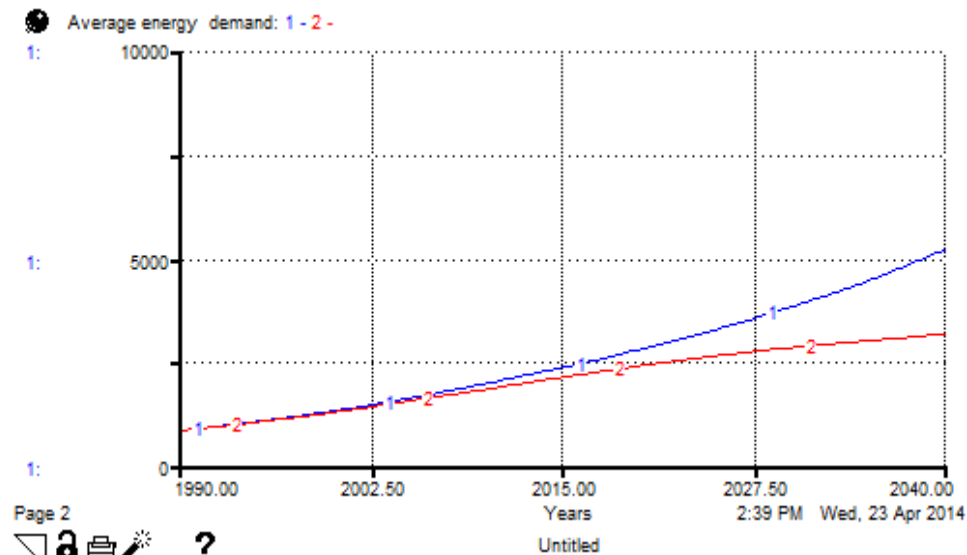
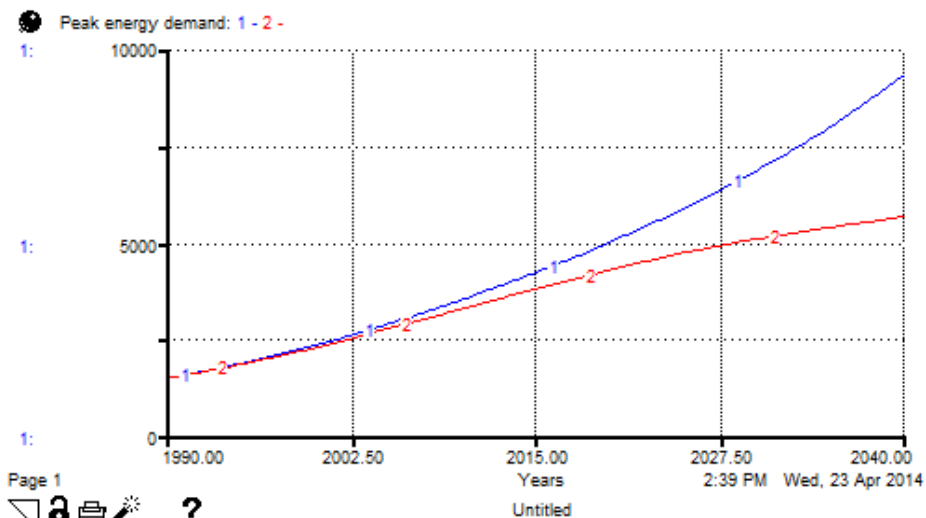
Model 2 – energy efficiency



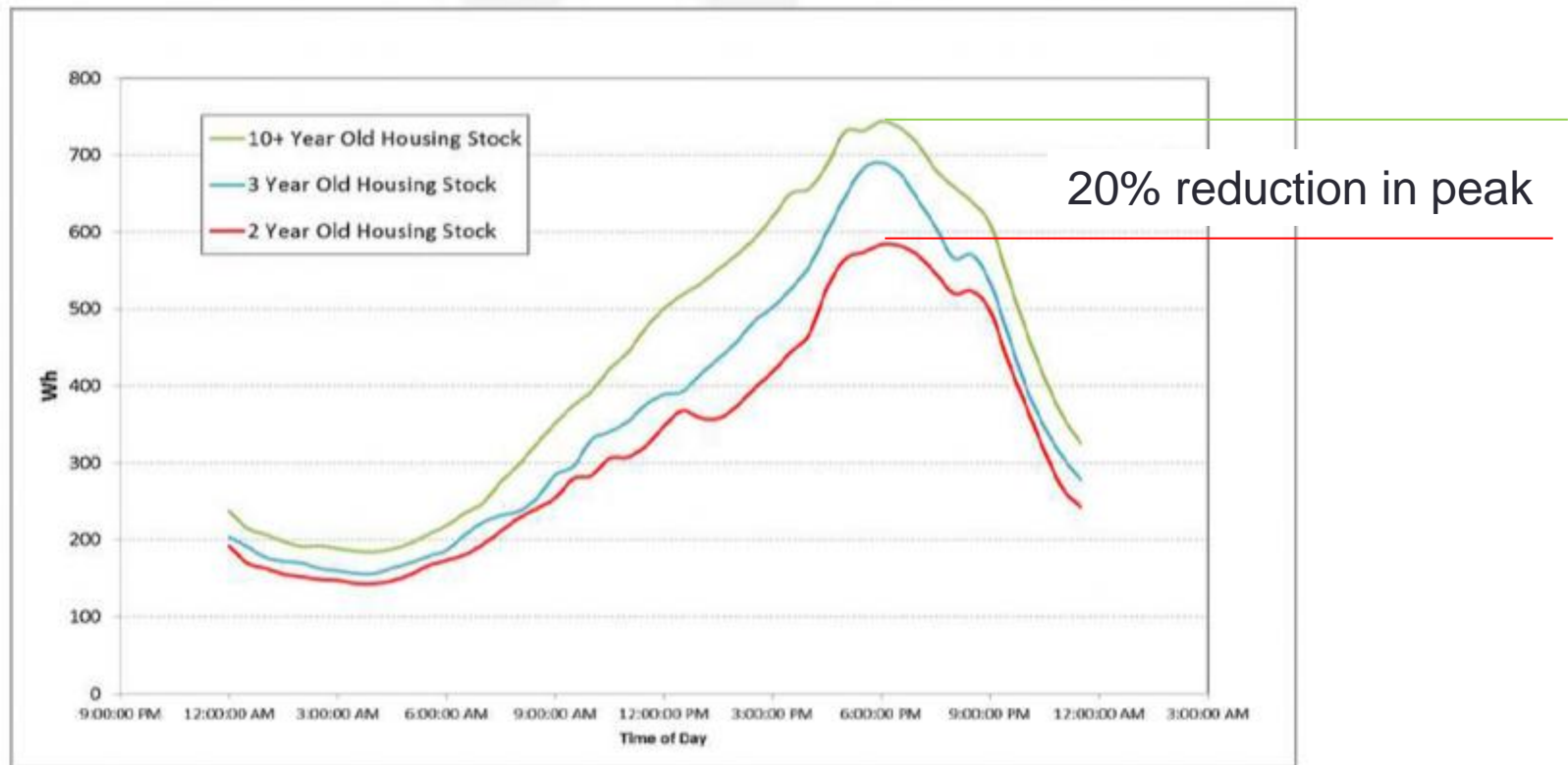
Energy efficiency as a function of economy



Energy efficiency

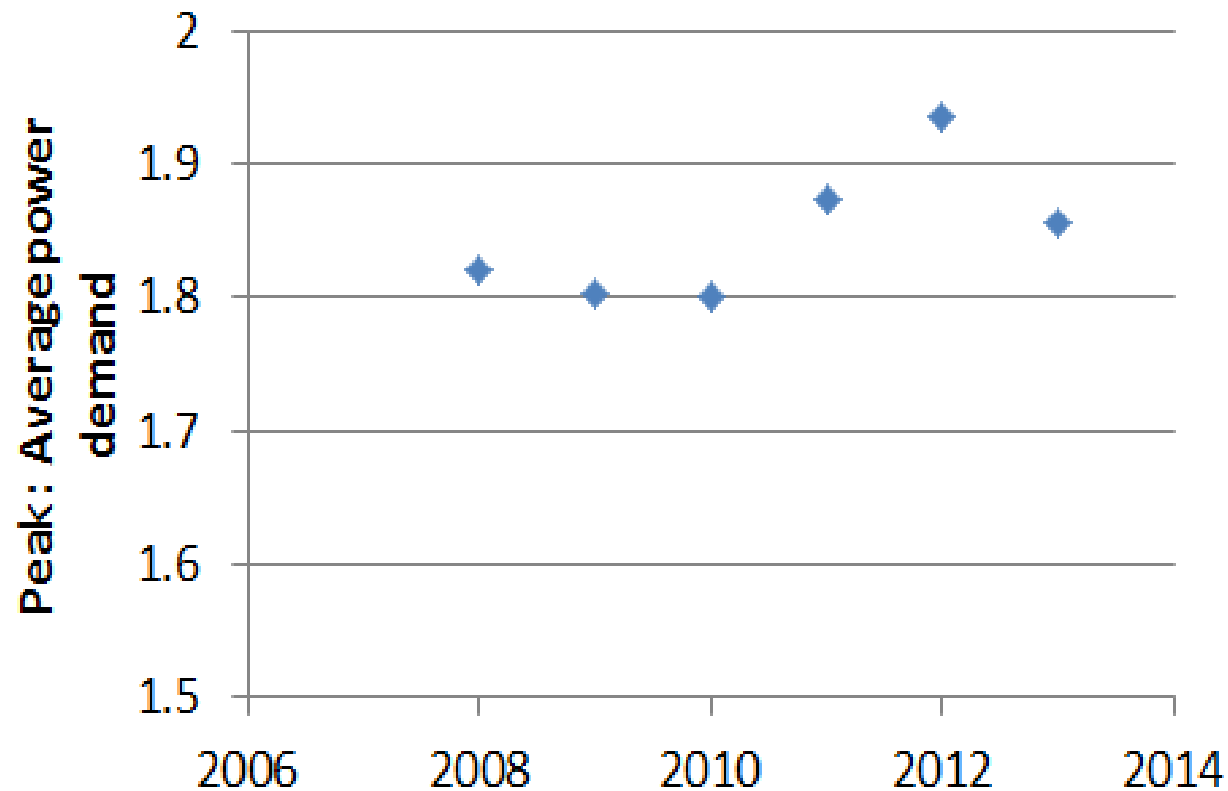


Energy efficiency

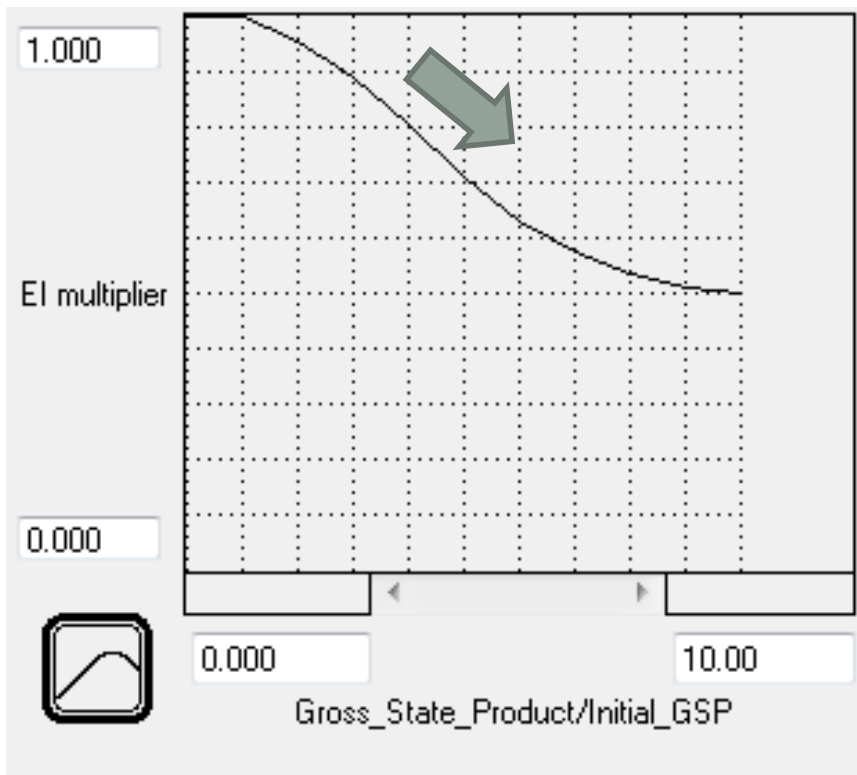


- Multiple energy schemes are impacting household energy efficiency (e.g., six star energy)
- Housing stock connected in the last two years is up to 30% more energy efficient than older housing stock even with larger floor space.

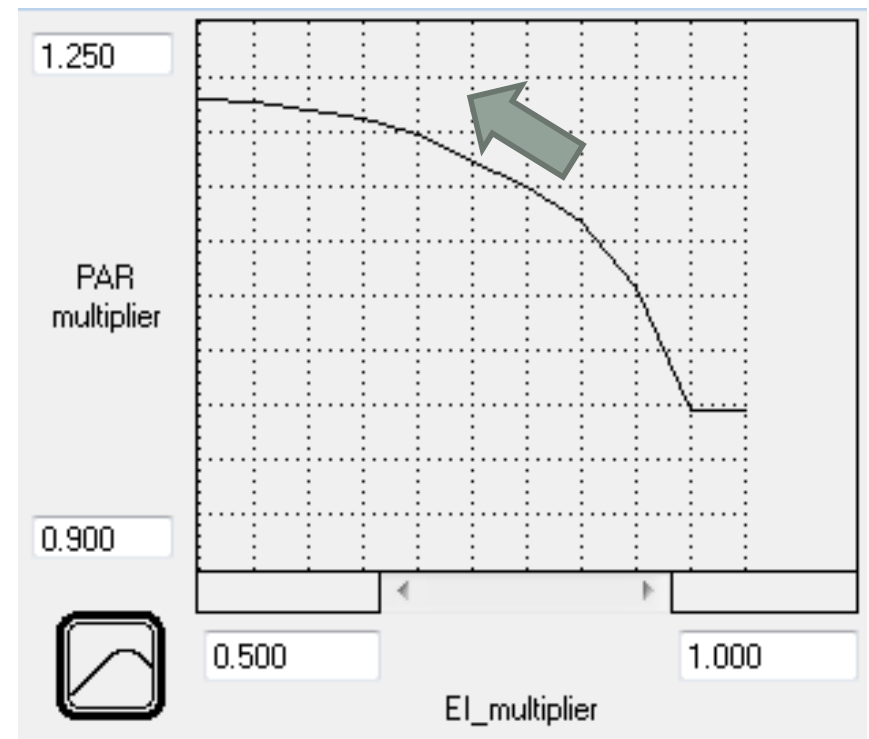
Peak : average demand rising



Modification of energy efficiency model

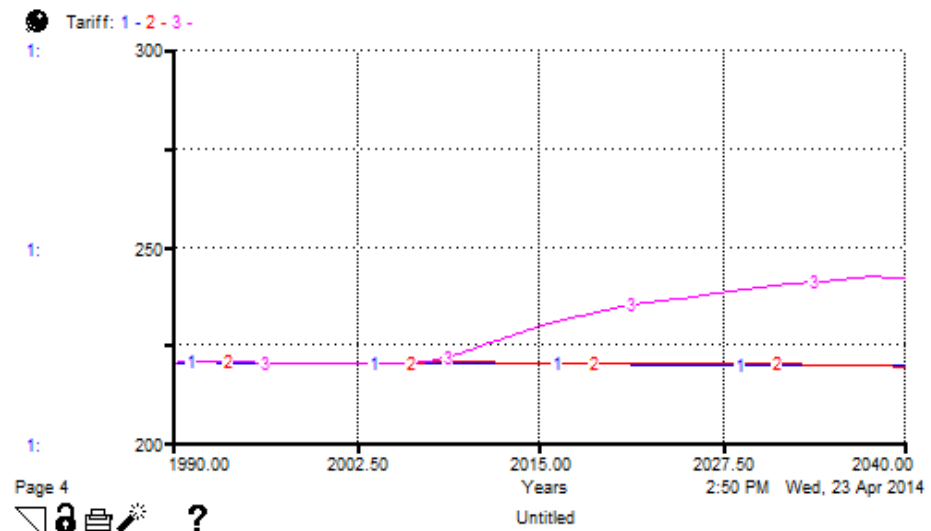
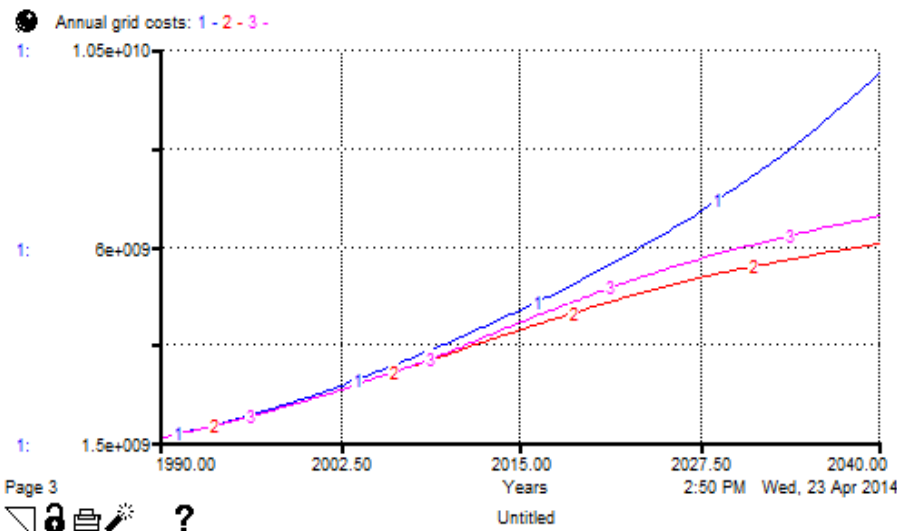
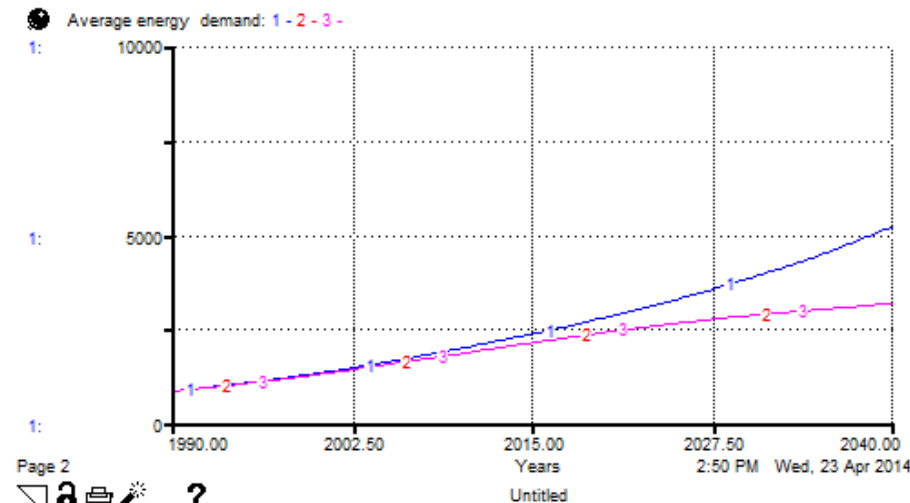
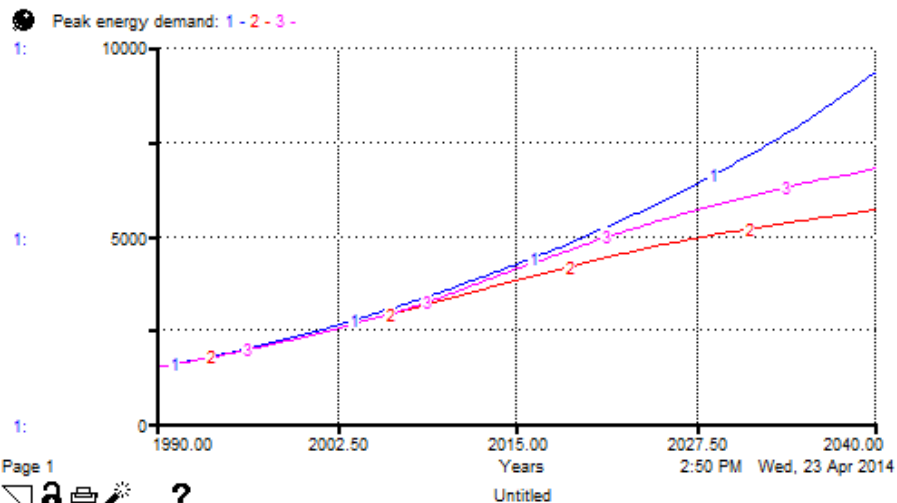


Basic energy intensity reductions



But with increasing P:A ratio

Asymmetrical energy efficiency

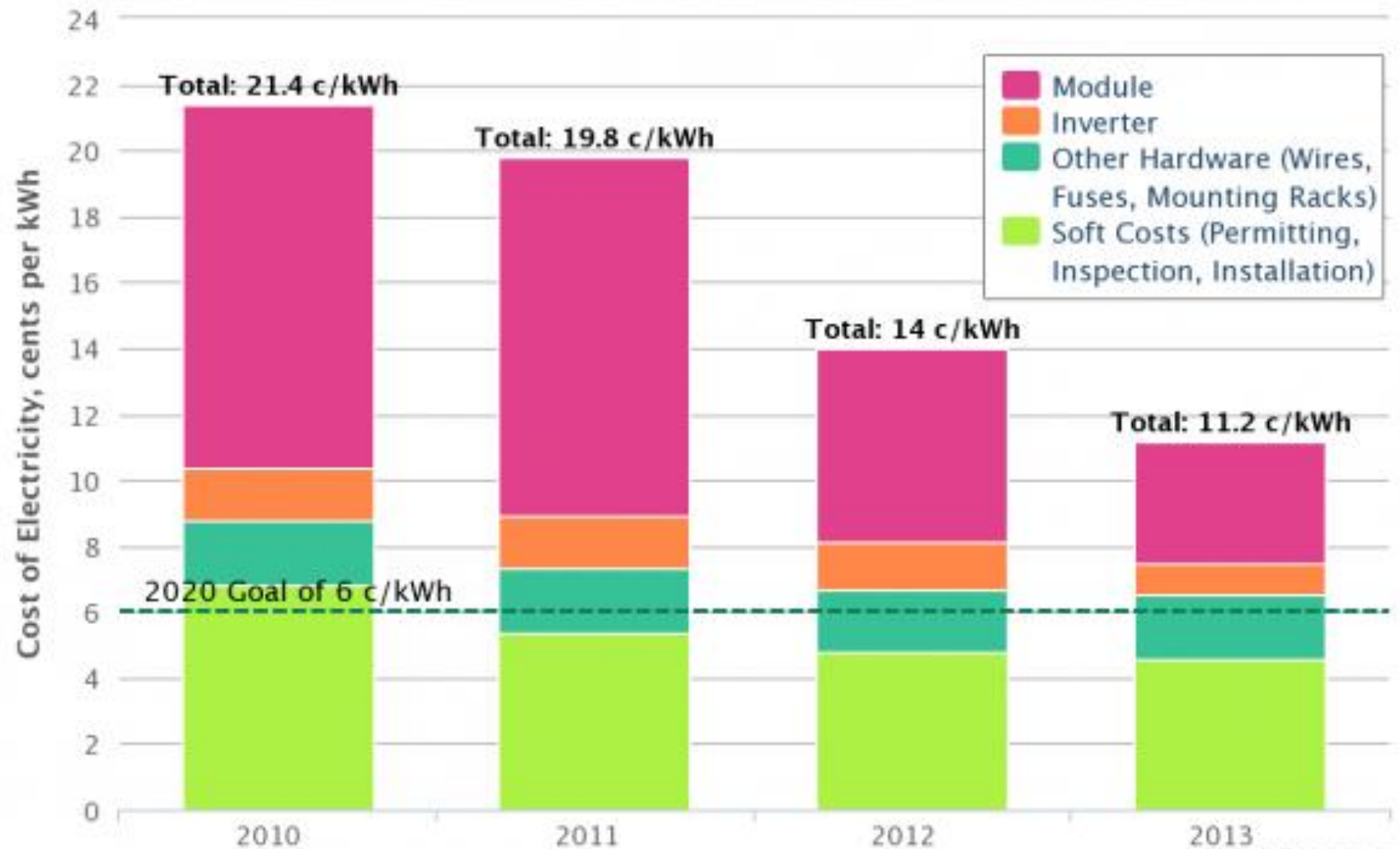


Unit cost of energy

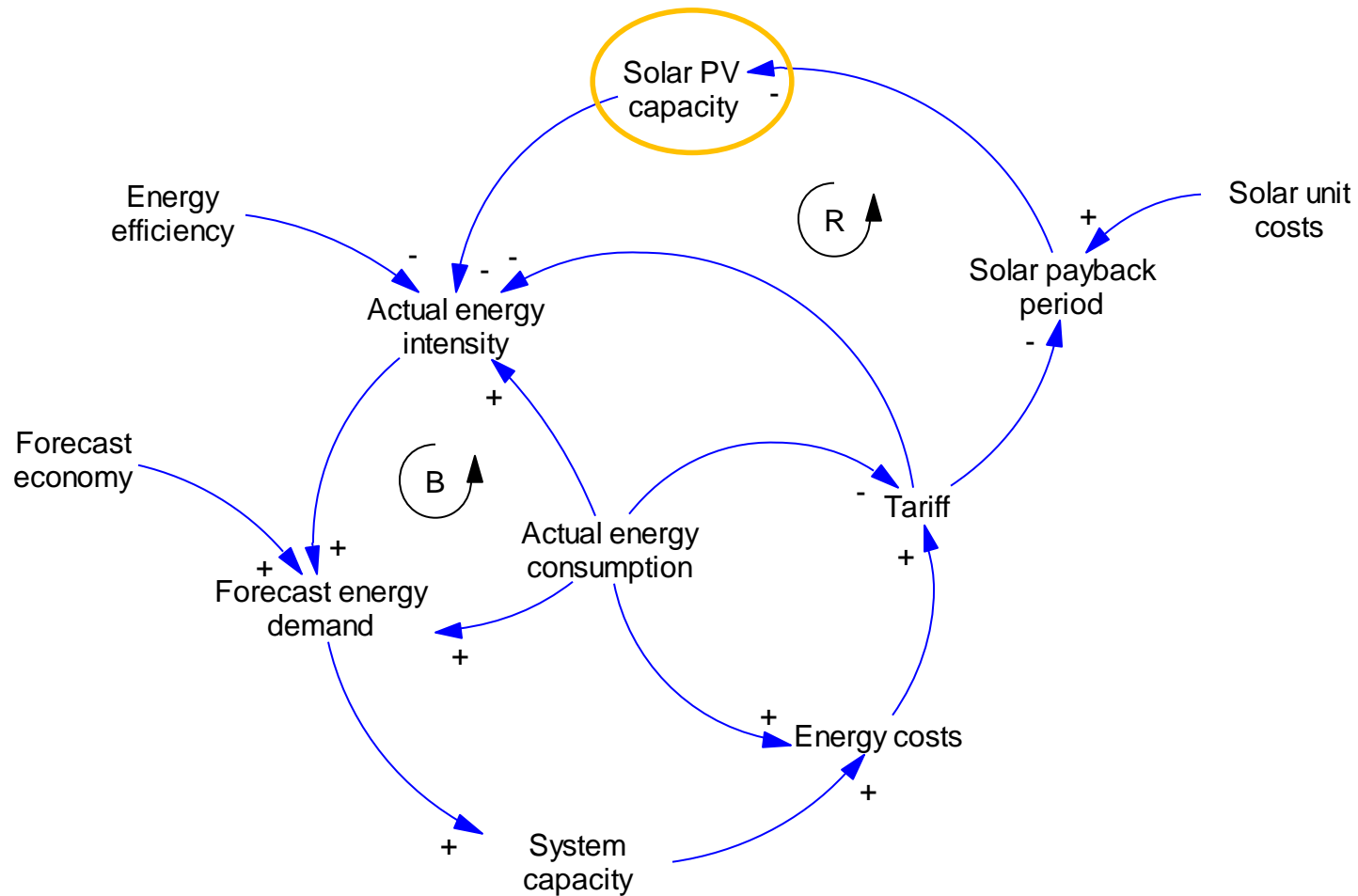
- Rising unit costs are an inevitable consequence of energy efficiency in a system where:
 - Annual energy demand is falling more quickly than peak demand
 - There is a high proportion of costs fixed to peak capacity
 - There are delays in adjusting capacity
- So-called network “gold plating” just impacts the timing of price rises not the end result (assuming increasing demand in the long term)
- Ditto holding back tariff increases when costs are rising
- That is not to say that well structured tariffs (including time of use) won't ameliorate these factors

Add energy efficiency + solar

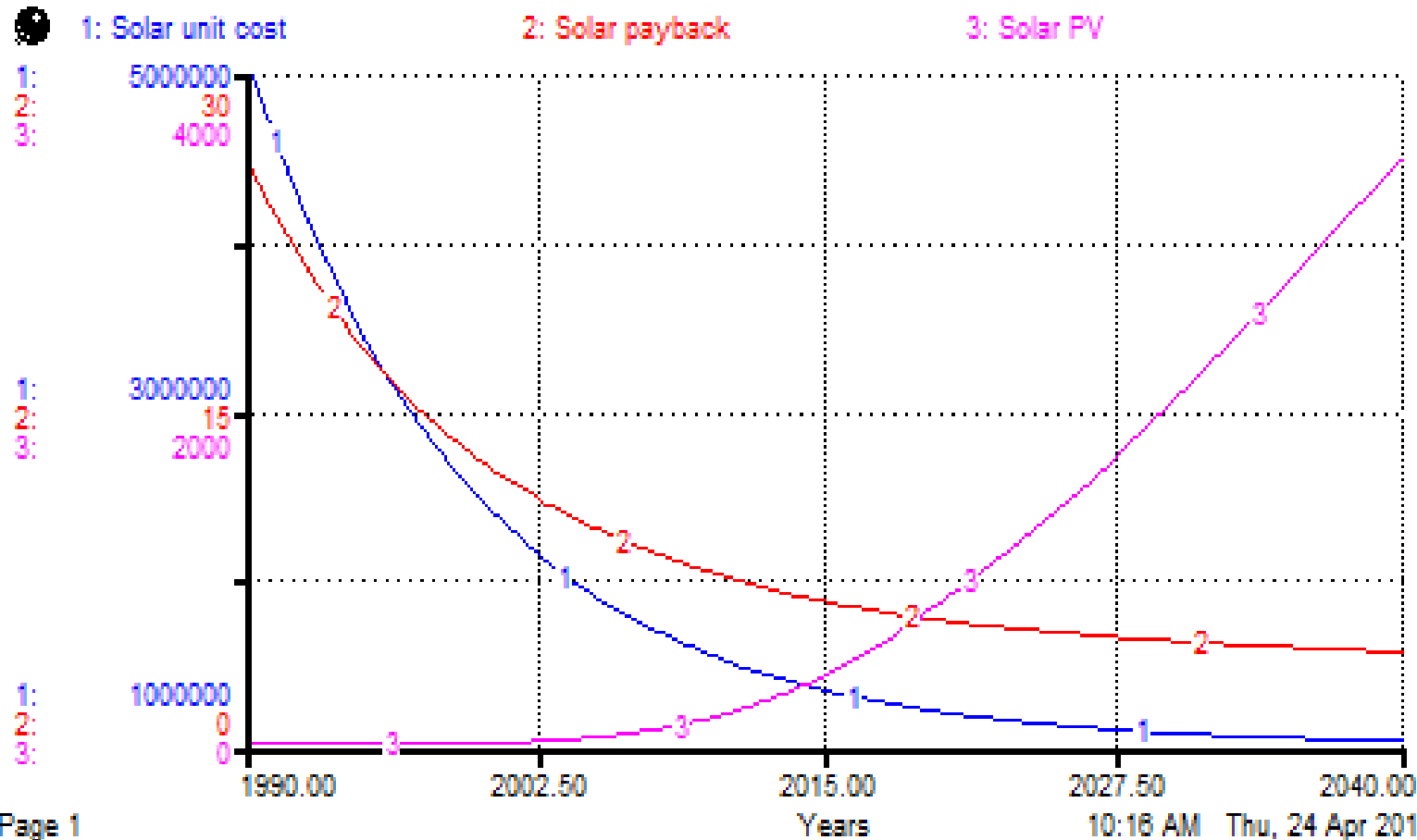
The Falling Price of Utility-Scale Solar Photovoltaic (PV) Projects



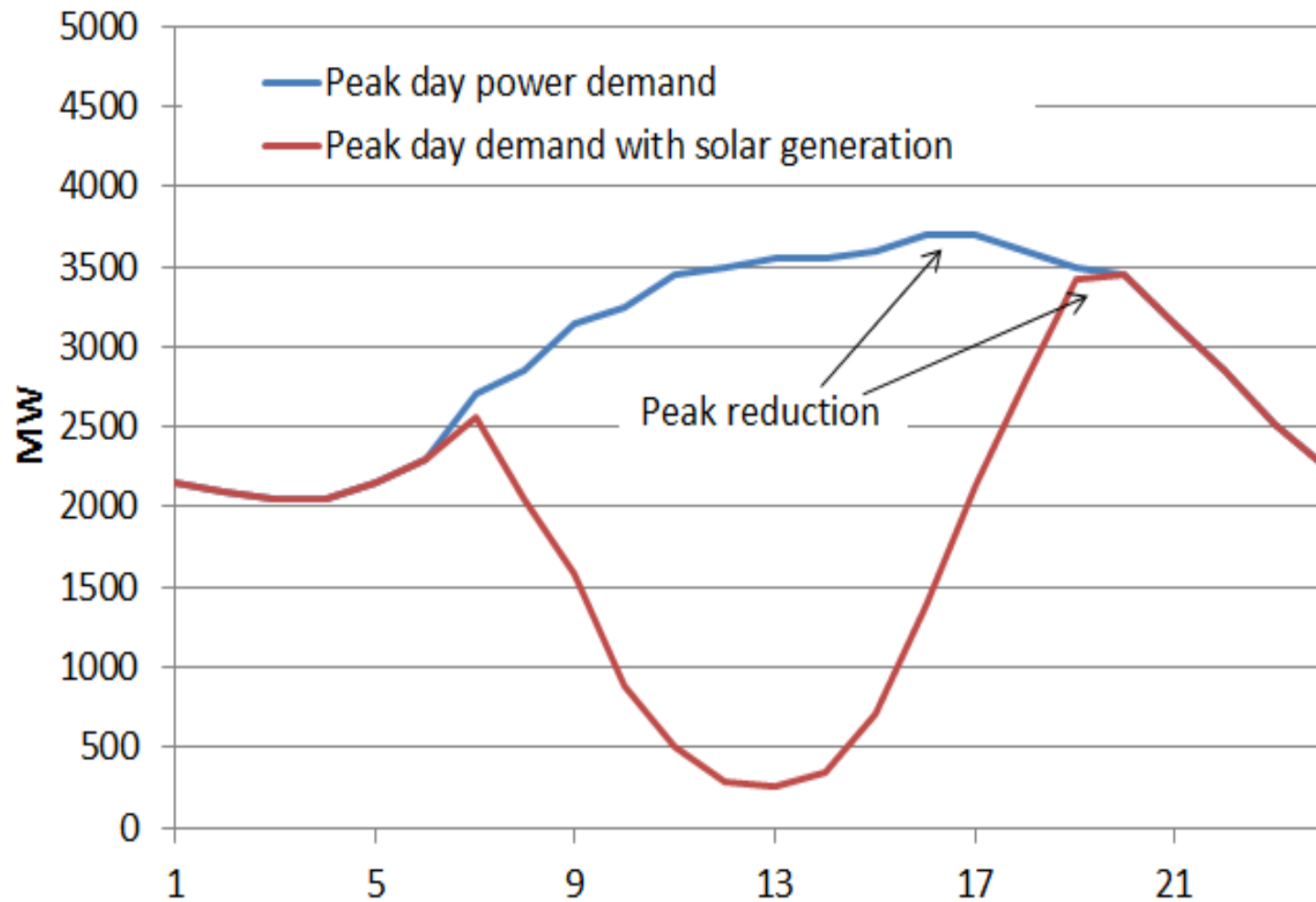
Adding solar to the model



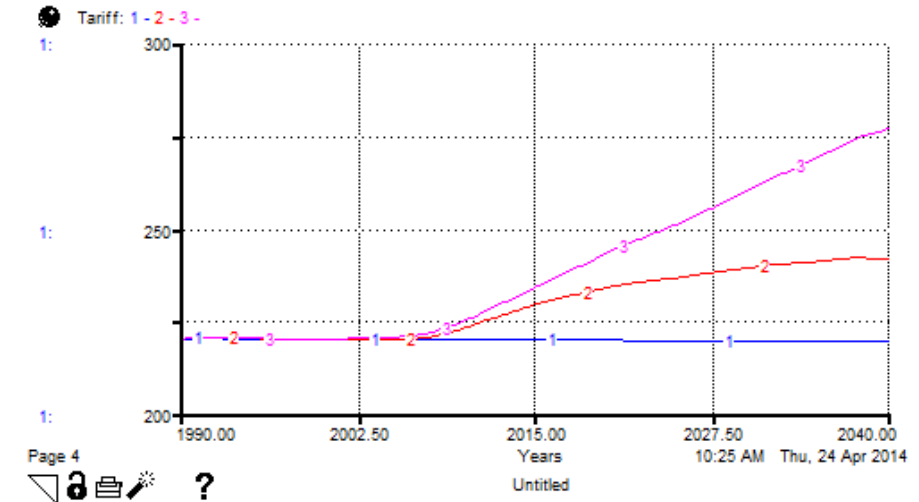
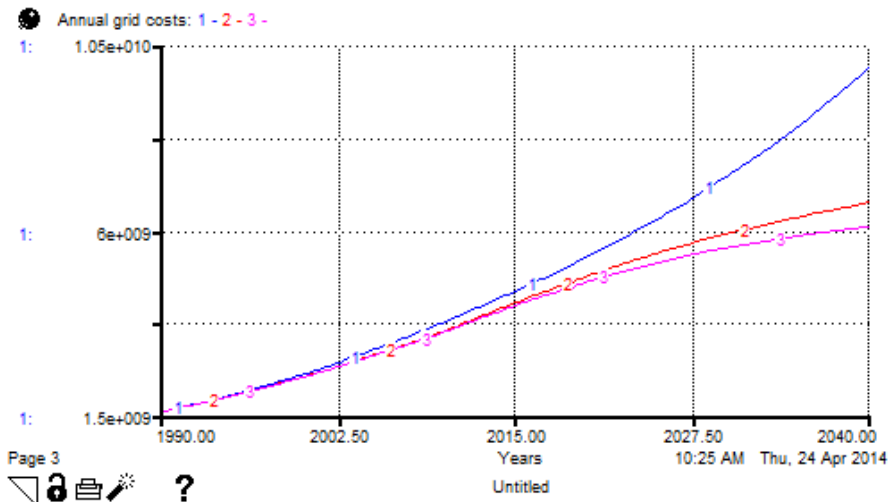
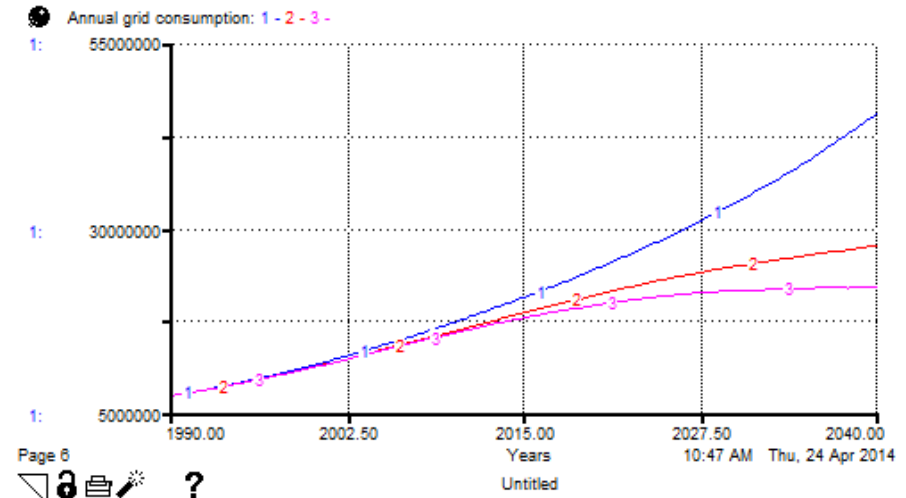
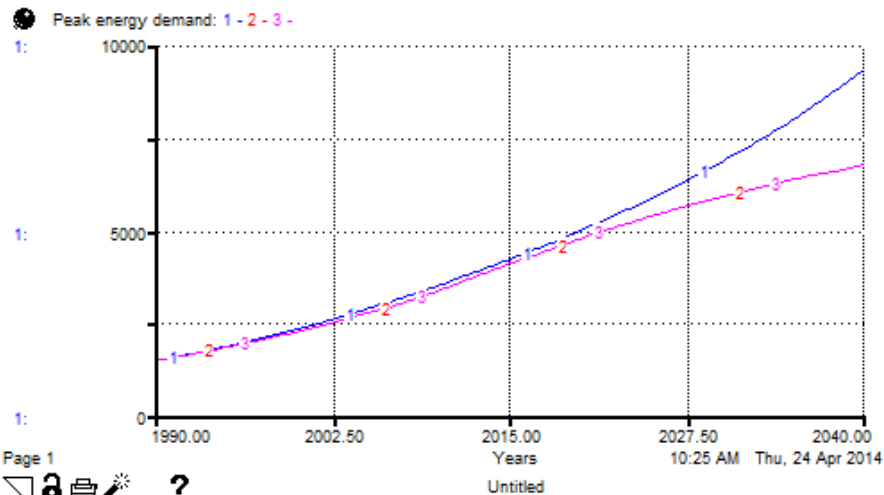
Solar take-up



Little peak demand benefit

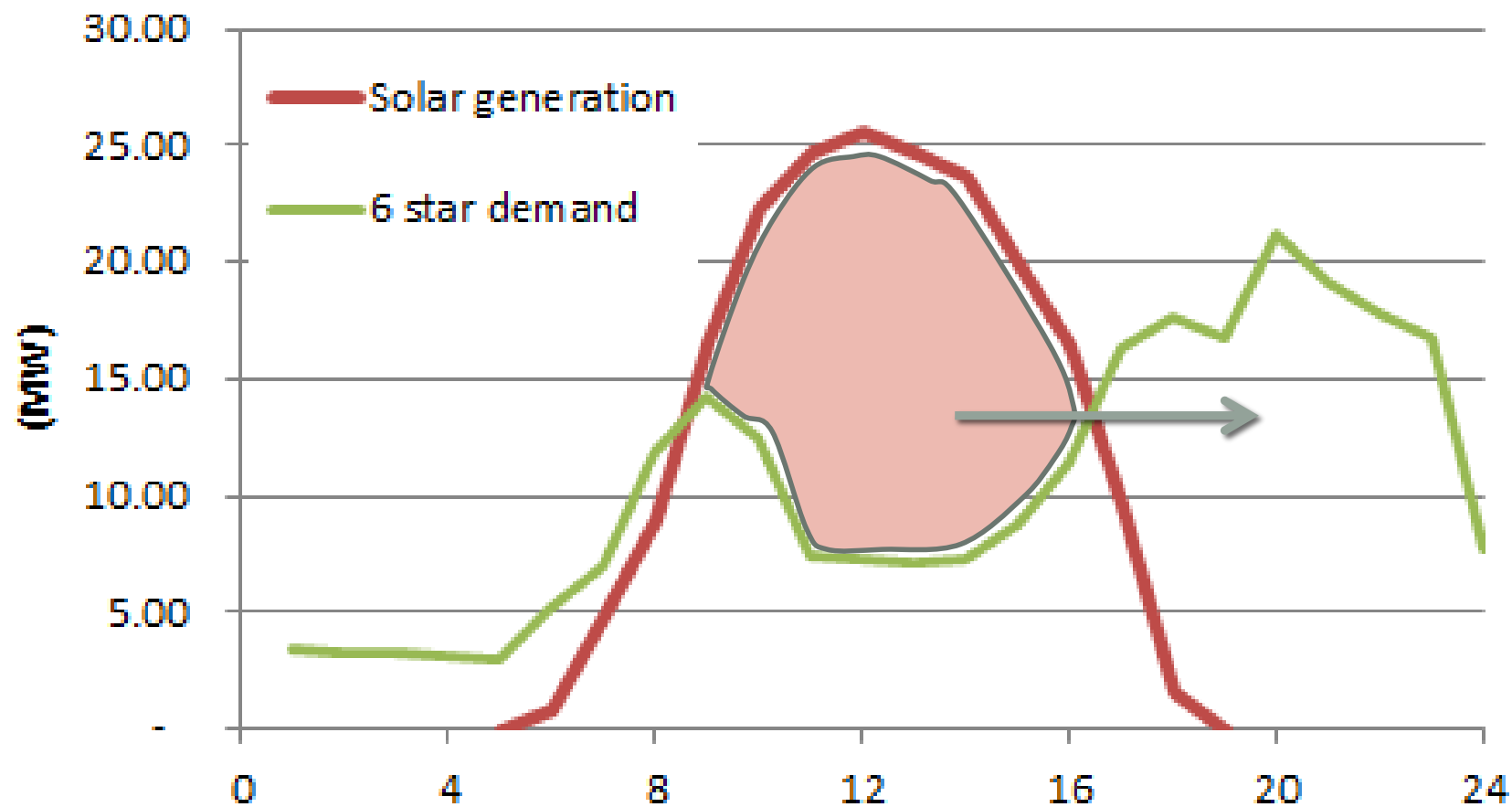


Adding solar to the mix ...

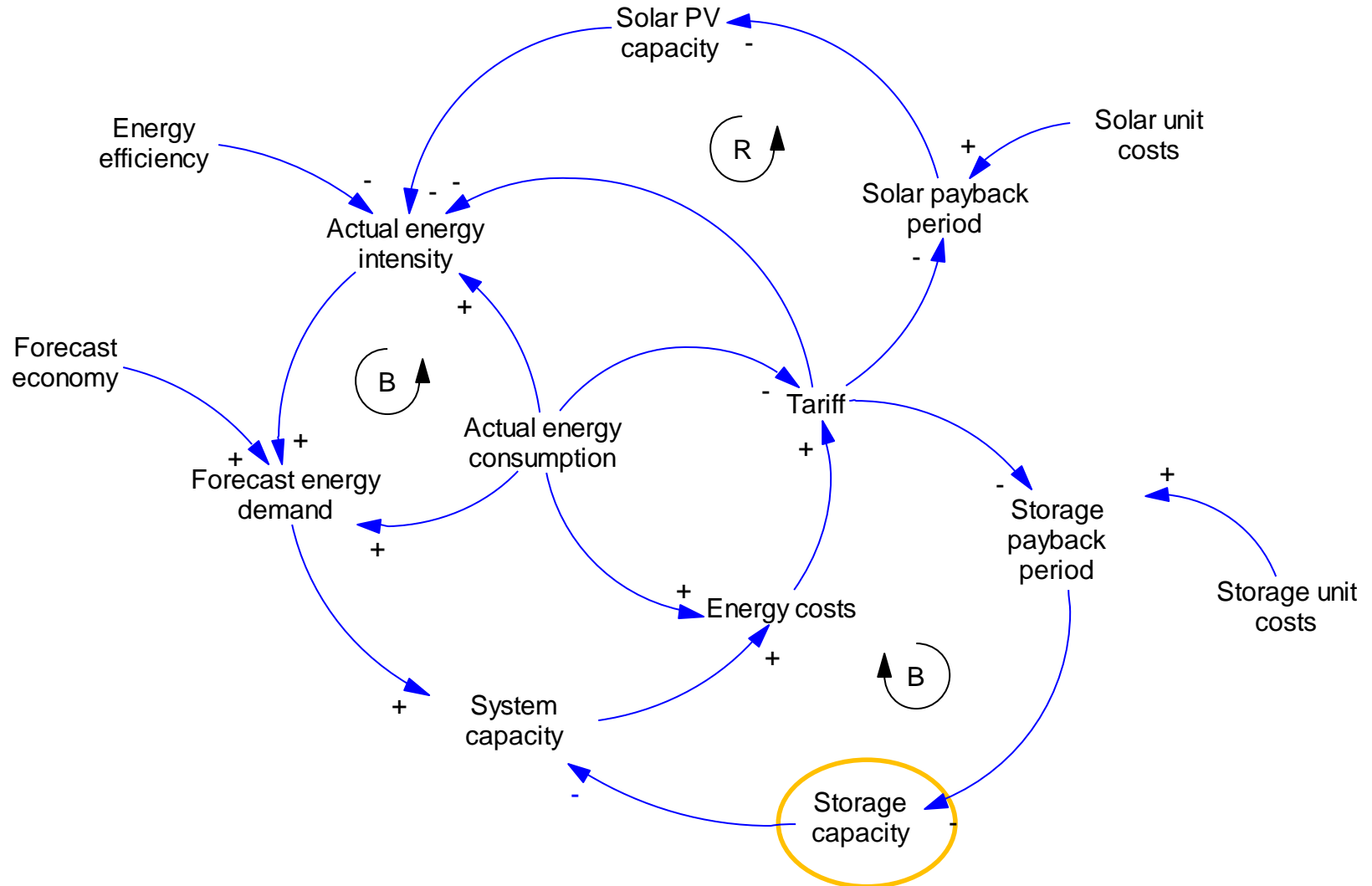


Add energy efficiency + solar + storage

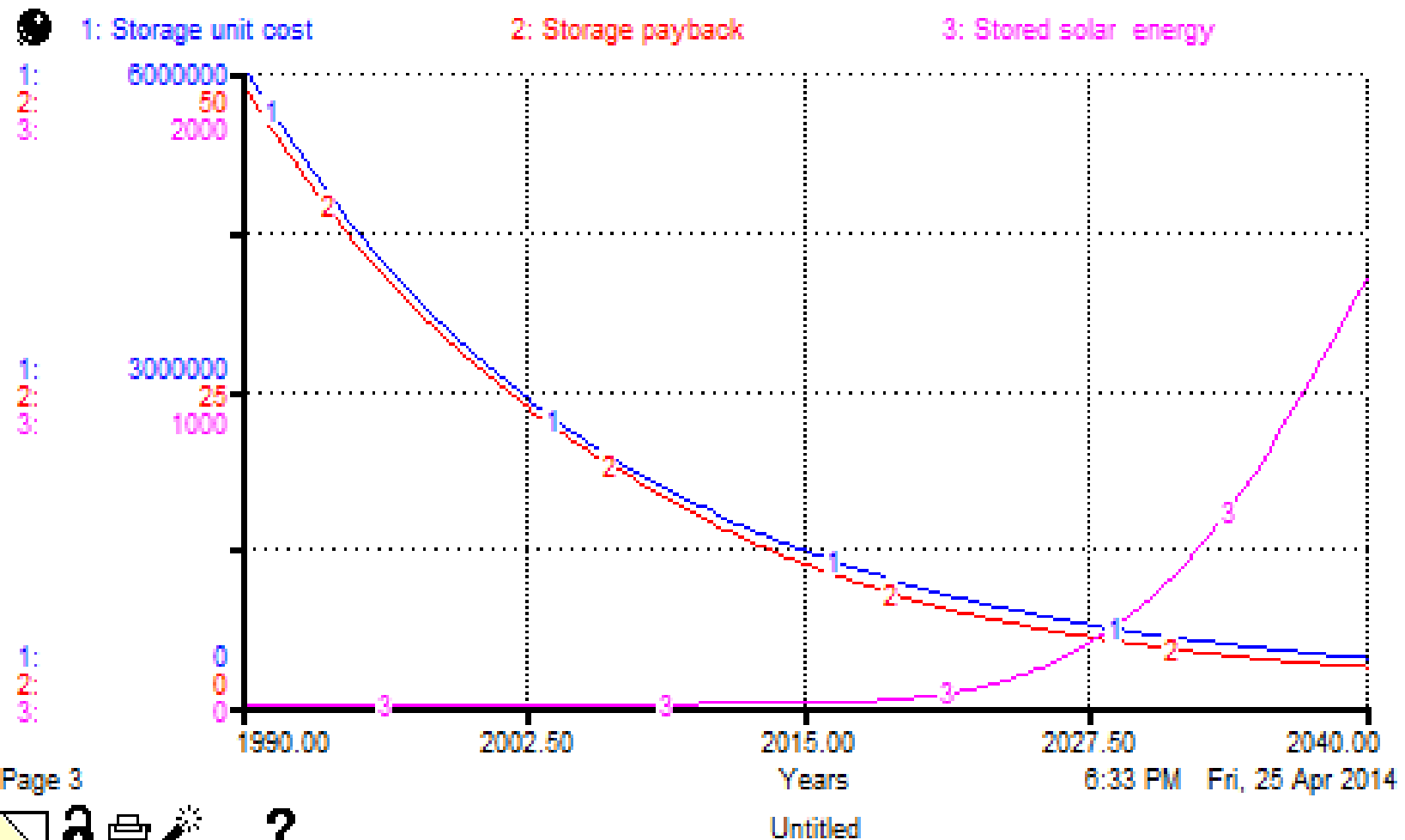
34 MW Solar PV



Adding storage to the model

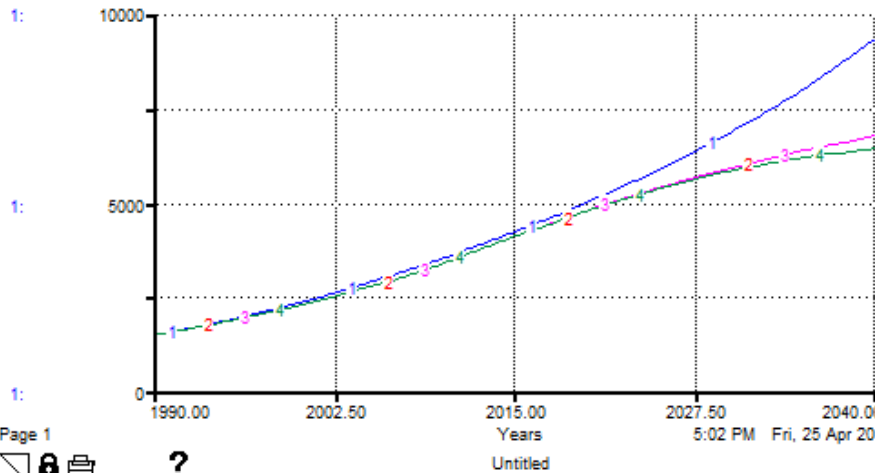


Storage take-up



Adding storage to the mix ...

● Peak energy demand: 1 - 2 - 3 - 4 -

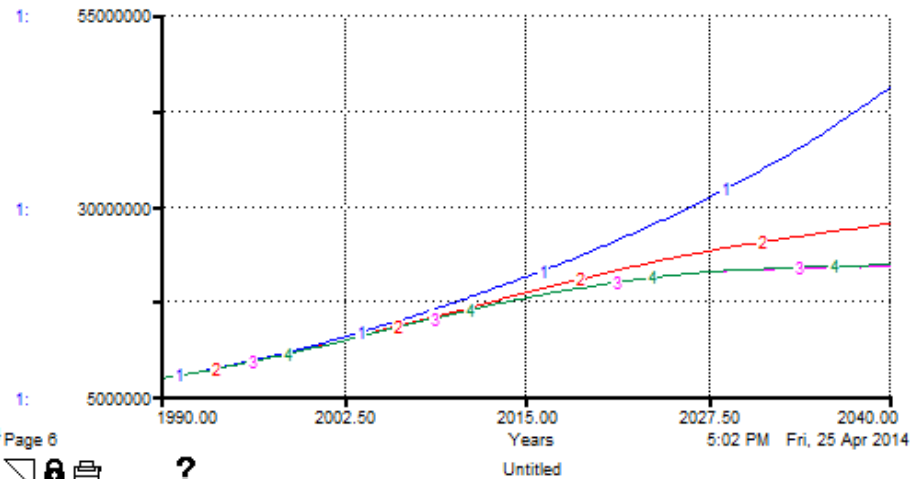


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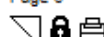


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● Annual grid consumption: 1 - 2 - 3 - 4 -

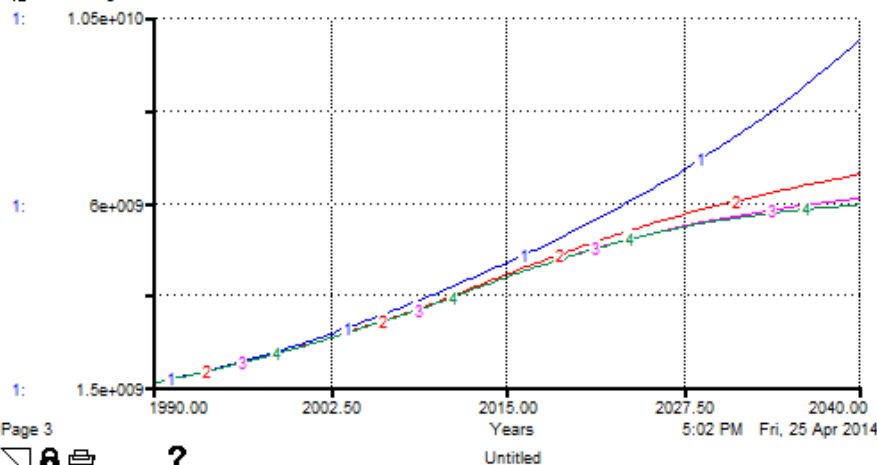


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● Annual grid costs: 1 - 2 - 3 - 4 -

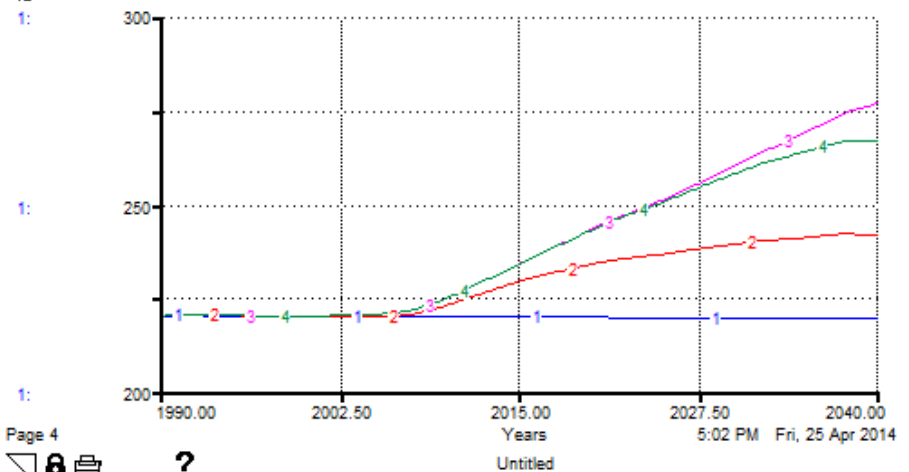


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● Tariff: 1 - 2 - 3 - 4 -

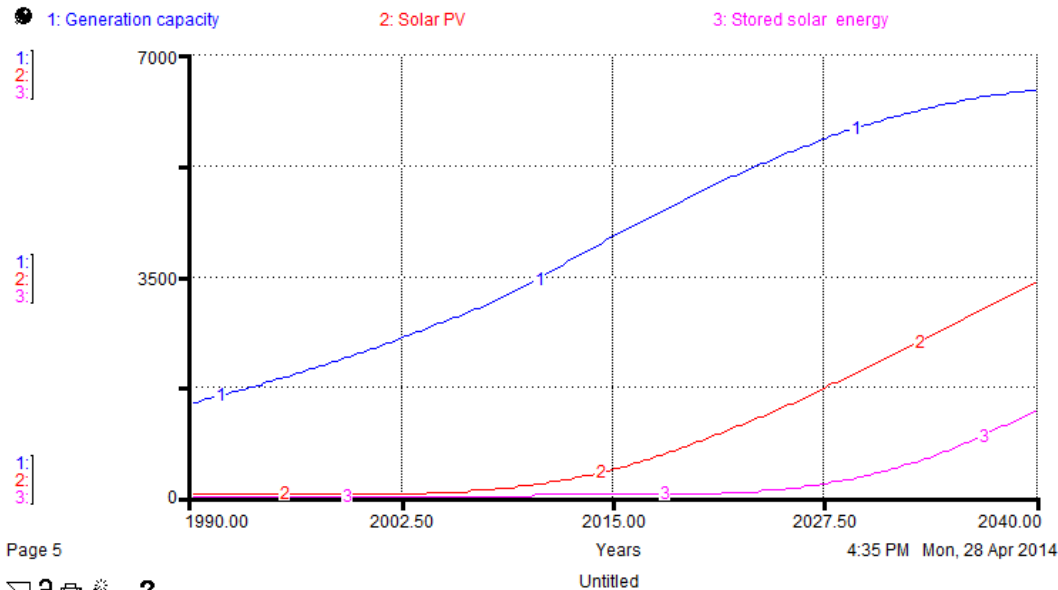


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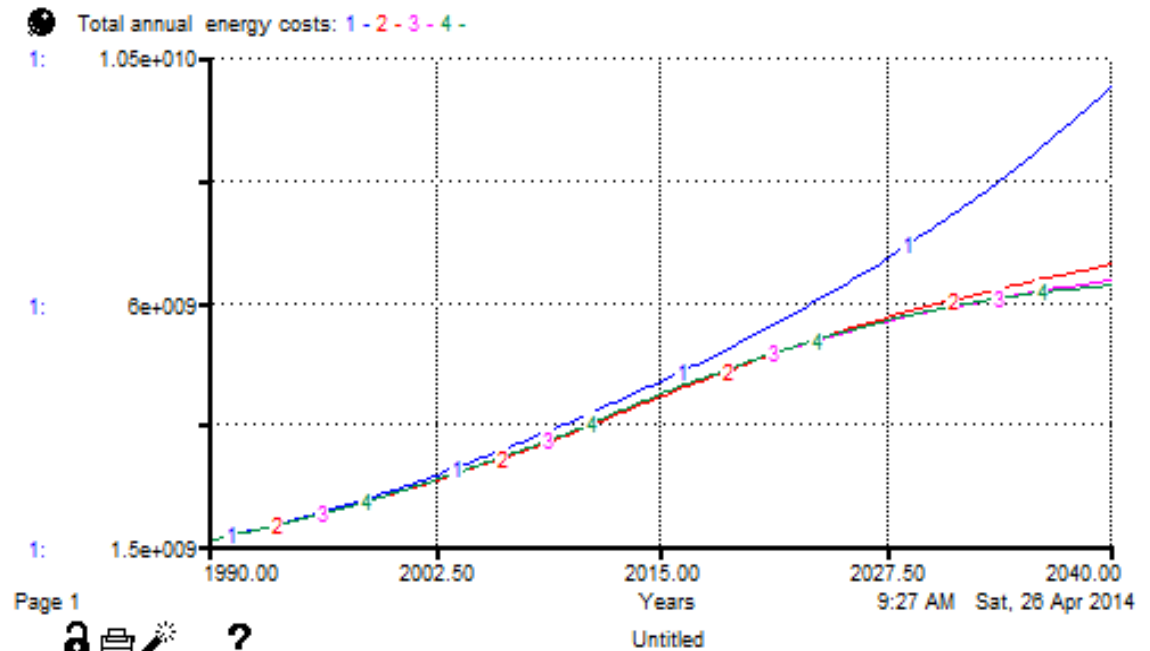
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The impact of all measures



Generation split

Annual costs



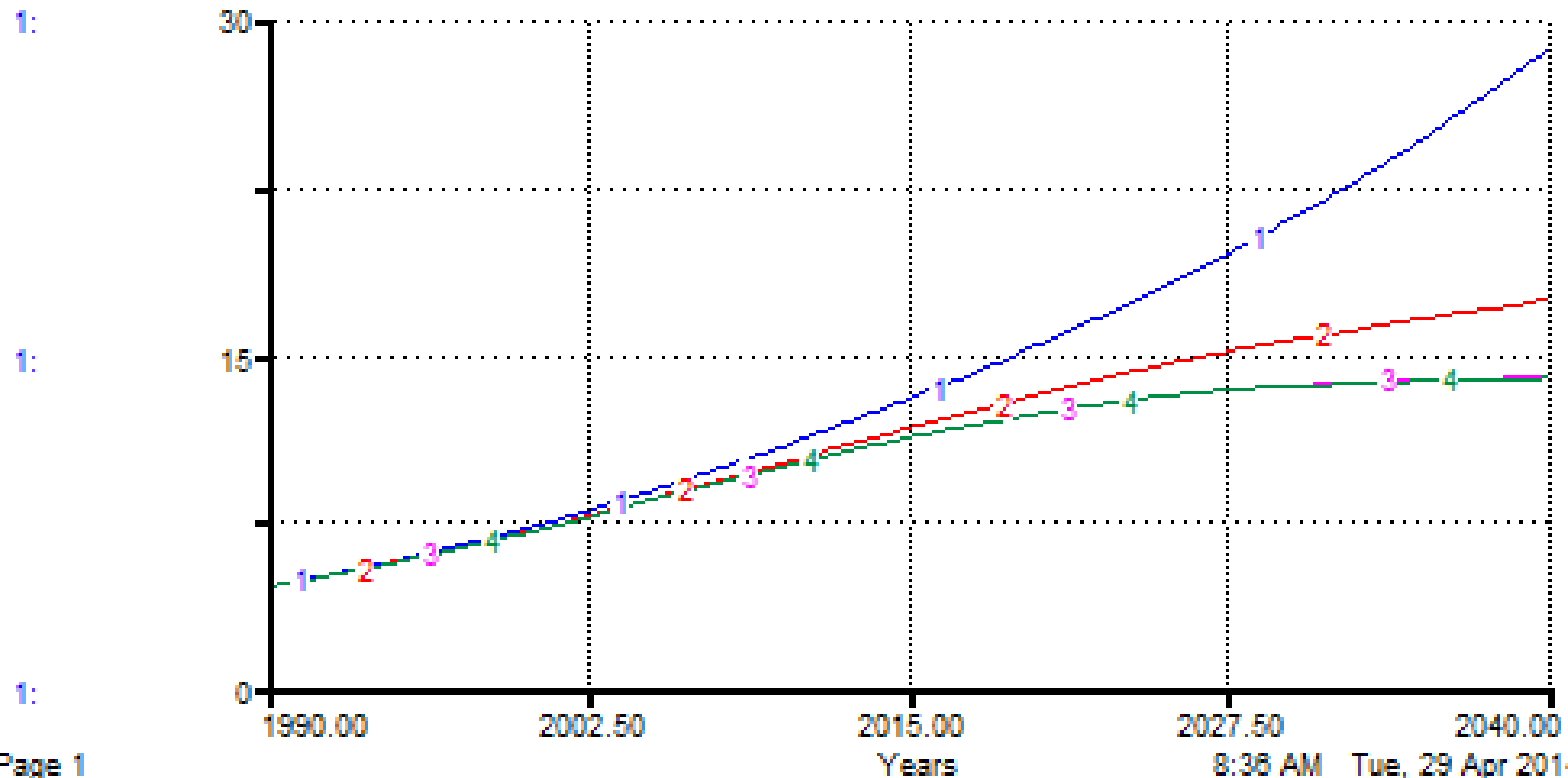
Winners and losers

	Annual consumption				Annual costs		
	Year 1	Year 10	% reduction		Year 1	Year 10	% reduction
A	50	50	0%		\$ 50	\$ 67	-35%
B	150	100	33%		\$ 150	\$ 135	10%
C	500	250	50%		\$ 500	\$ 337	33%
D	50	45	10%		\$ 50	\$ 61	-21%
	750	445	41%		\$ 750	\$ 600	20%
Grid cost	\$ 750	\$ 600	20%				
Tariff	\$ 1.00	\$ 1.35	-35%				

Improving energy efficiency of existing premises will increase overall system efficiency and reduce cost disparities

Greenhouse emissions

Annual greenhouse emissions: 1 - 2 - 3 - 4 -



Wait there's more

Add energy efficiency + solar + storage +
geothermal energy

Geothermal energy

- As a thermal energy source
- Avoid capital cost of plant for space heating / hot water / space cooling
- Add capital cost of a geothermal bore, absorption chillers and cooling towers
- Add capital cost of a thermal network to distribute the thermal energy
- All up saving and major demand reduction
- Savings to buildings – savings to energy system
- Zero emissions

And another thing

Fossil fuel dependence

- Analysis is in \$2013 – no escalation for fuel costs
- Infrastructure built now will last into the 2nd half of the 21st century
- Can we afford to lock in dependence to fossil fuels bearing in mind:
 - Global warming
 - Depletion
- Both will add to fuel costs increasingly over the century

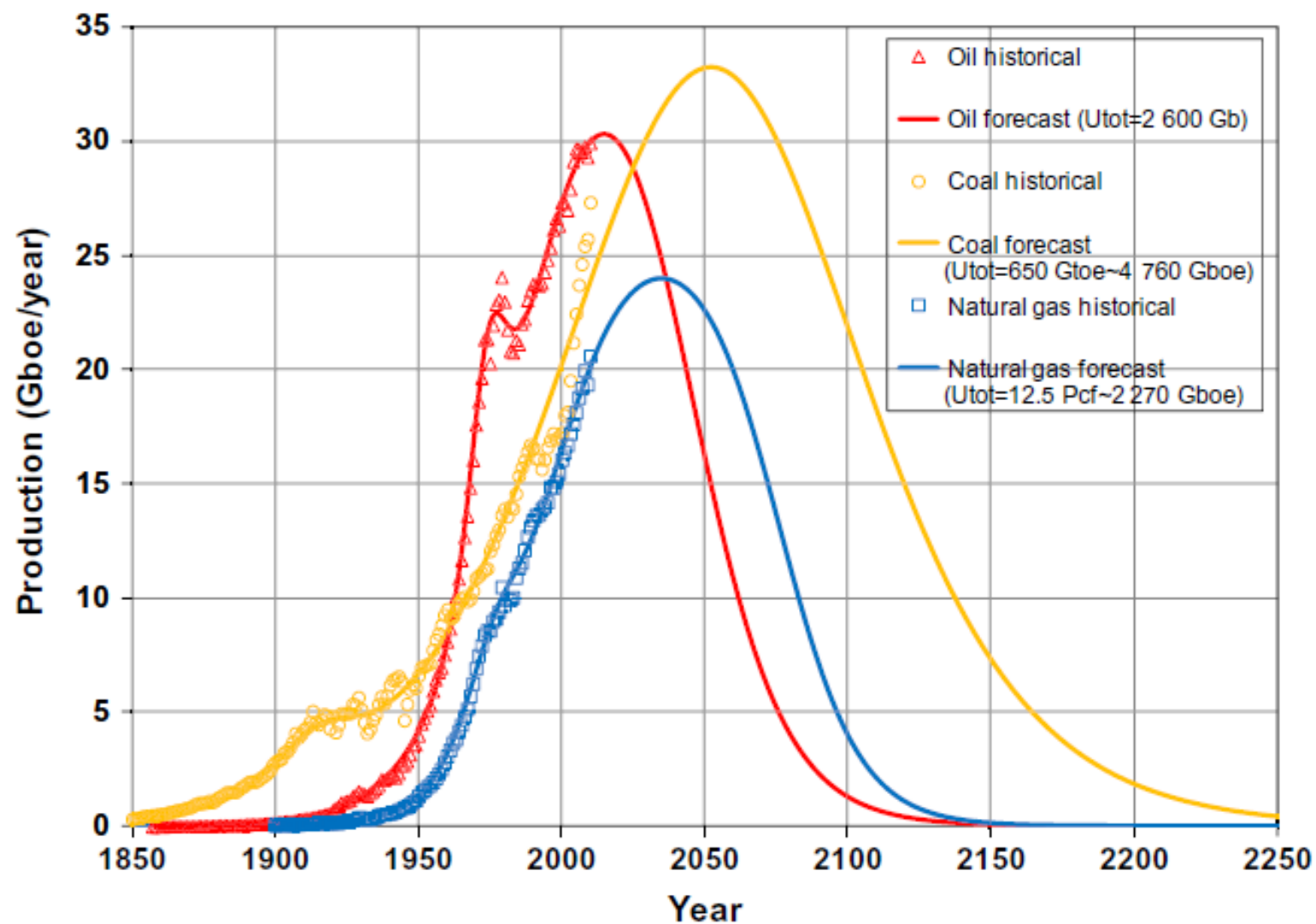


Fig. 16. Comparison of fossil fuel forecasts calculated for intermediate Ultimate scenarios.

Take home message

- Continue to reduce demand and add renewables, recognising that...
- Tariff increases are an inevitable consequence of energy efficiency with present network structure and pricing
- Total economic cost of service is more important than unit price but watch for inequities
- Fossil fuels are a road to nowhere
- Solar is inevitable – get over it
- Storage can fix the peak problem – costs will reduce rapidly
- Remove “peaky” demand by using geothermal energy in new development for heating and cooling

What to do with the grid

- Develop a real energy policy cognisant of the realities of energy efficiency, renewables, climate change and economic risk / benefit
- Decentralise generation closer to point of energy use for new development
- Re-envision the grid as an electricity circulation system rather than delivery from Point A to B
- Recognise that Western Power will need to be funded to make the transition

Q&A Discussion
