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Designing Electricity Network Tariffs to Promote Efficiency

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Insight in Economics™

Designing Network Tariffs to Promote Efficient Network Use and Investment

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Network tariffs should:

- Encourage optimal use of existing network infrastructure
- Signal the cost of new infrastructure capacity to users

Steps to Designing Network Tariffs

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Step 1	Analyse Network Expenditure	1. Analyse costs caused by electricity use, customer connection and changes network peak	2. Analyse drivers of future network costs	
Step 2	Identify Incremental Network Growth	1. Investigate changes in load profiles across the network	2. Compare historic and forecast network demands with existing capacity	
Step 3	Group Customers into Tariff Classes	1. Identify groups of customers with similar cost drivers	2. Consider practical challenges of providing targeted price signals	
Step 4	Estimate LRMC for each Tariff Class	1. Estimate avoided network costs from group if did not consume electricity	2. Estimate avoided network costs from group not being connected	3. Estimate LRMC applying AIC or perturbation method
Step 5	Develop Minimum Network LRMC Based Tariffs	1. Identify charging parameter (ie, kWh, kVa, peak/off-peak, etc)	2. Translate LRMC to charging parameter	
Step 6	Develop Mark-ups for Tariffs to Recover Total Costs	1. Determine total costs to recover from tariff class	2. Estimate revenue from LRMC tariffs	3. Develop mark-ups to tariffs to recover revenue while promoting efficient network use

Approach to the Case Studies

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Two parts to the case study analysis:

- Illustrate alternative methodologies for estimating LRMC
- Illustrate possible bill implications of alternative tariff structures to promote more efficient outcomes

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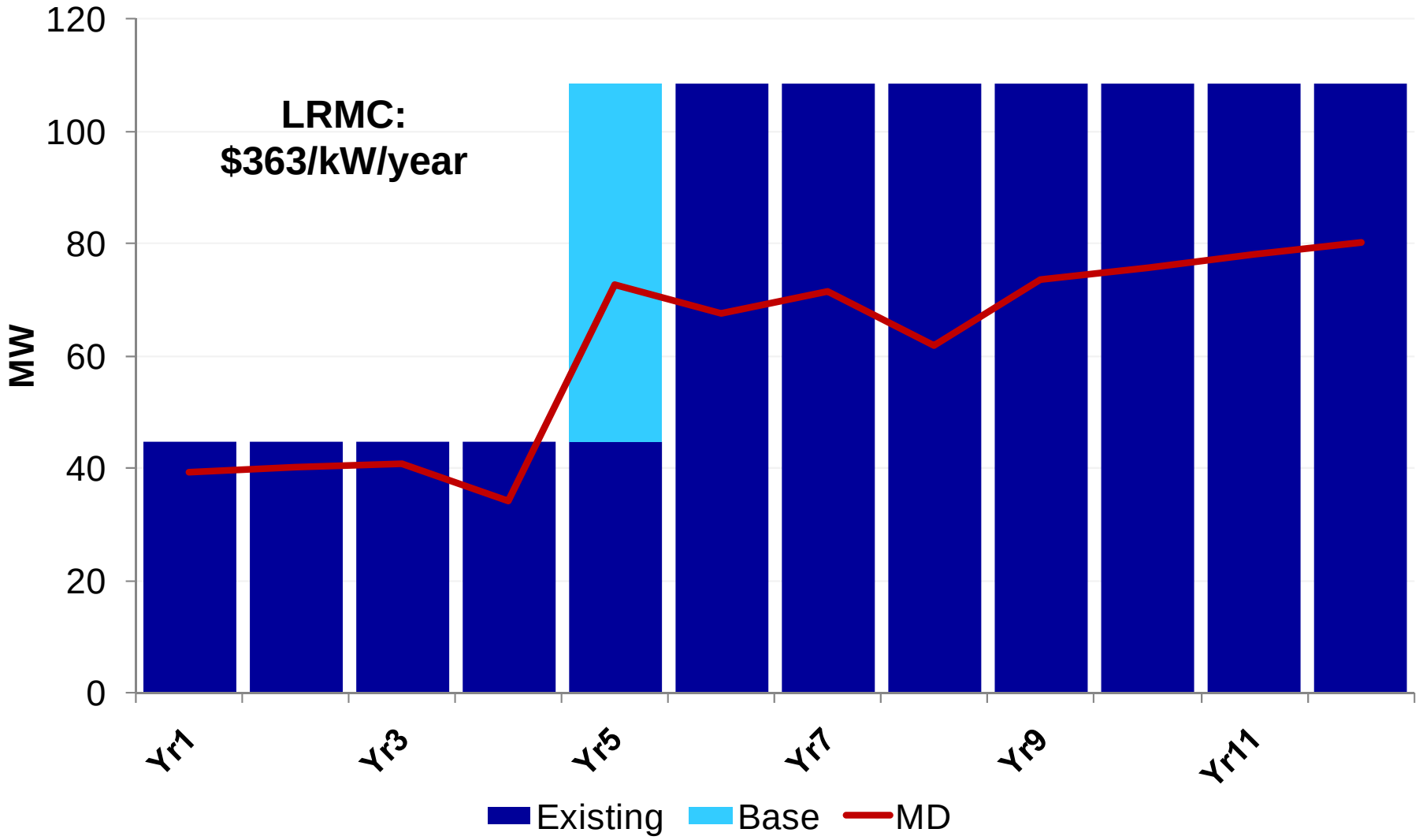
Alternative Methodologies for Estimating Network LRMC

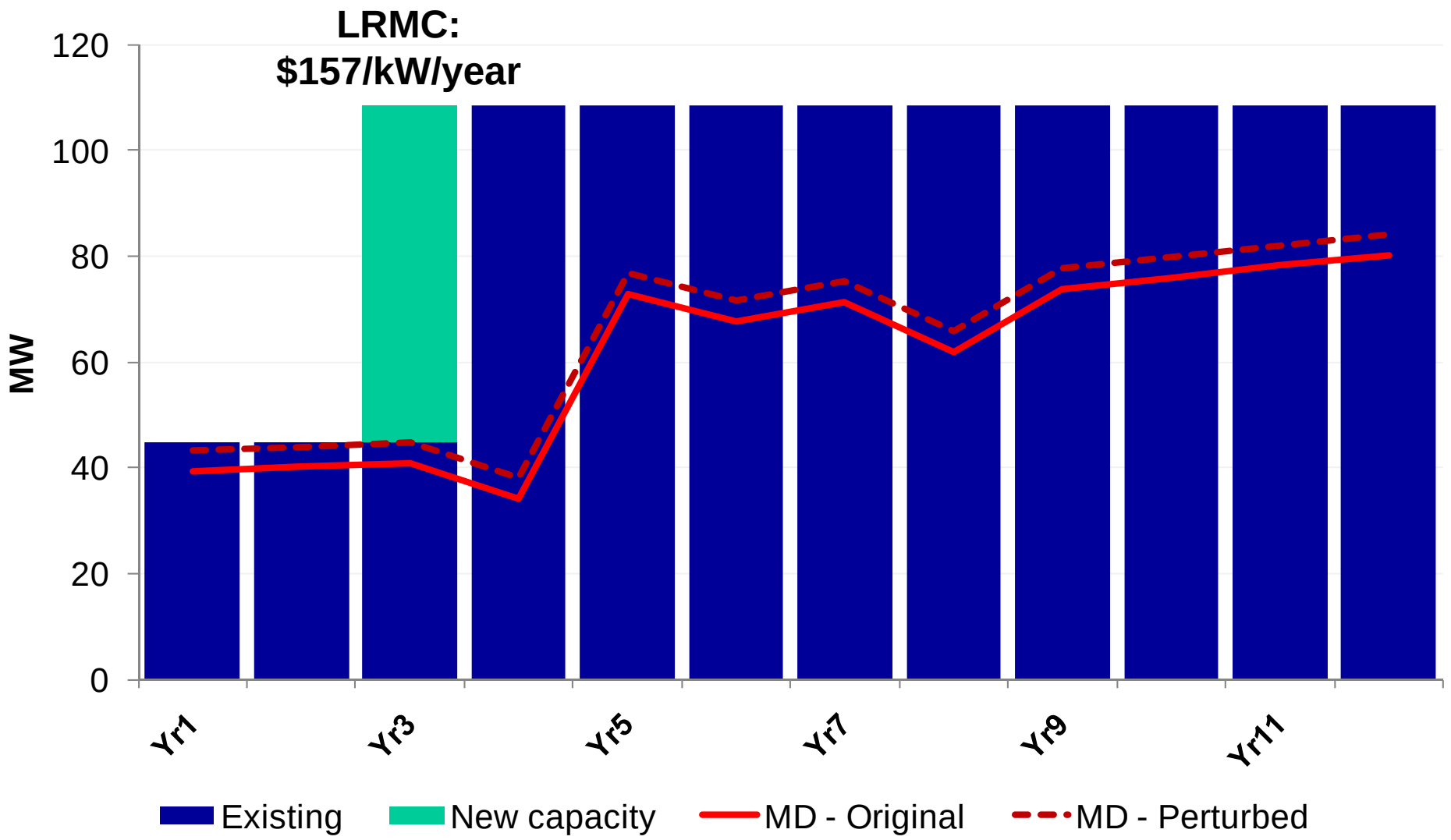
Case Study 1: Kogarah Zone Substation

- Proposed establishment of a new zone substation to address zone substation capacity concerns in the St George Area
- Kogarah to replace Carlton zone substation (44.6 MW capacity summer), where load forecast to exceed in summer 2007/08
- Load growth being driving by commercial and residential infill
- 32 MW of demand reduction required to avoid investment
- Total project cost, $59.3m

Kogarah AIC Augmentation Profile



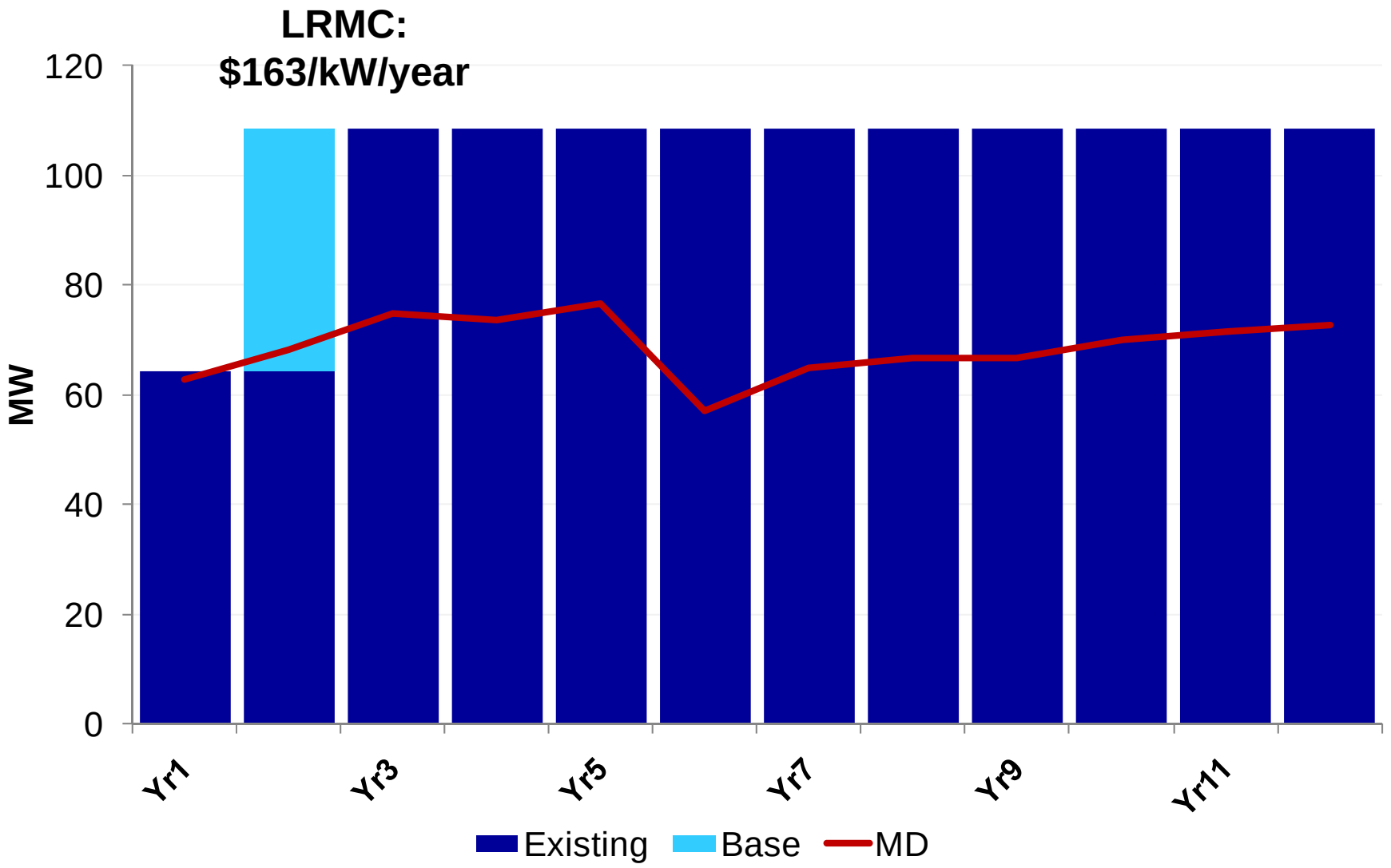
Kogarah Perturbation Augmentation Profile



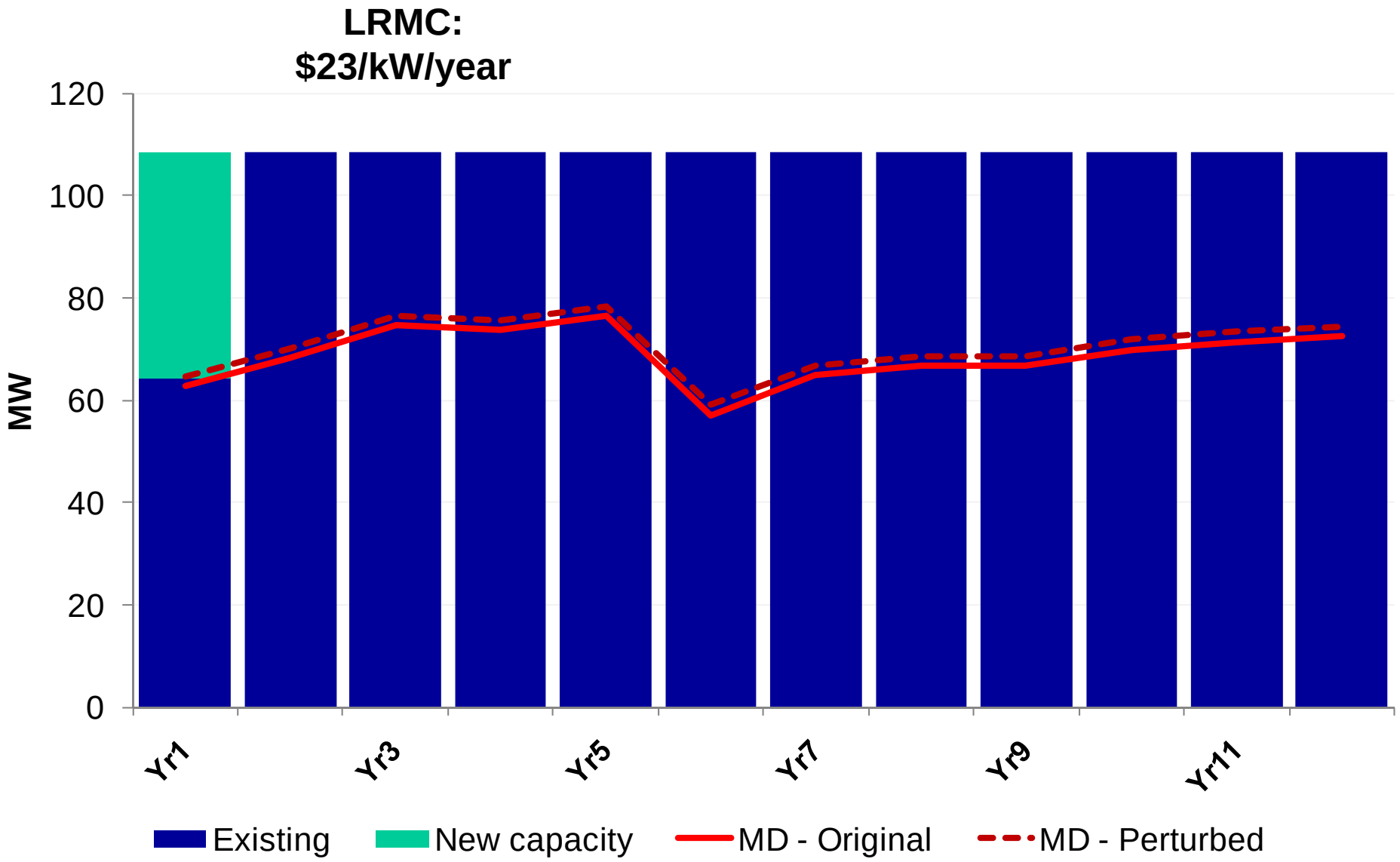
Case Study 2: Hornsby Zone Substation Upgrade

- Proposed zone substation upgrade to install an additional transformer, to meet anticipated load growth
- Current firm capacity at Hornsby of 64.3MW (summer)
- 7.6 MW of demand management needed to defer the investment by one year
- Total project cost, $7.4m

Hornsby AIC Augmentation Profile



Hornsby Perturbation Augmentation Profile



LRMC Methodology Conclusions

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- Average Incremental Cost (AIC) is a cost effective method for providing an estimate of LRMC at a network-wide, or bulk supply point level
- However, the AIC provides a poor signal about future augmentation costs, because of the averaging involved
- The perturbation methodology for estimating LRMC provides better signals about future augmentation costs. It is more appropriately applied at levels within the network where network augmentation is required
- The LRMC at a local level provides an estimate of the value of demand reductions, to inform the pricing strategy (ie, to provide incentives for customer initiated demand response) or to evaluate alternative demand response activities to avoid network augmentation costs

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Illustrative Customer Impacts of Tariff Structures that Promote More Efficient Outcomes

Network Tariff Structures to Promote Efficiency

- Inclining/declining block tariffs and flat usage tariffs provide poor signals about future network costs
- System peak capacity tariffs, and critical peak tariffs provide strong signals about future network costs
- Transitioning towards system peak capacity tariffs and/or critical peak tariffs will promote more efficient network investment, and likely lower network costs in the medium to long term

Illustrative Customer Impact Scenarios

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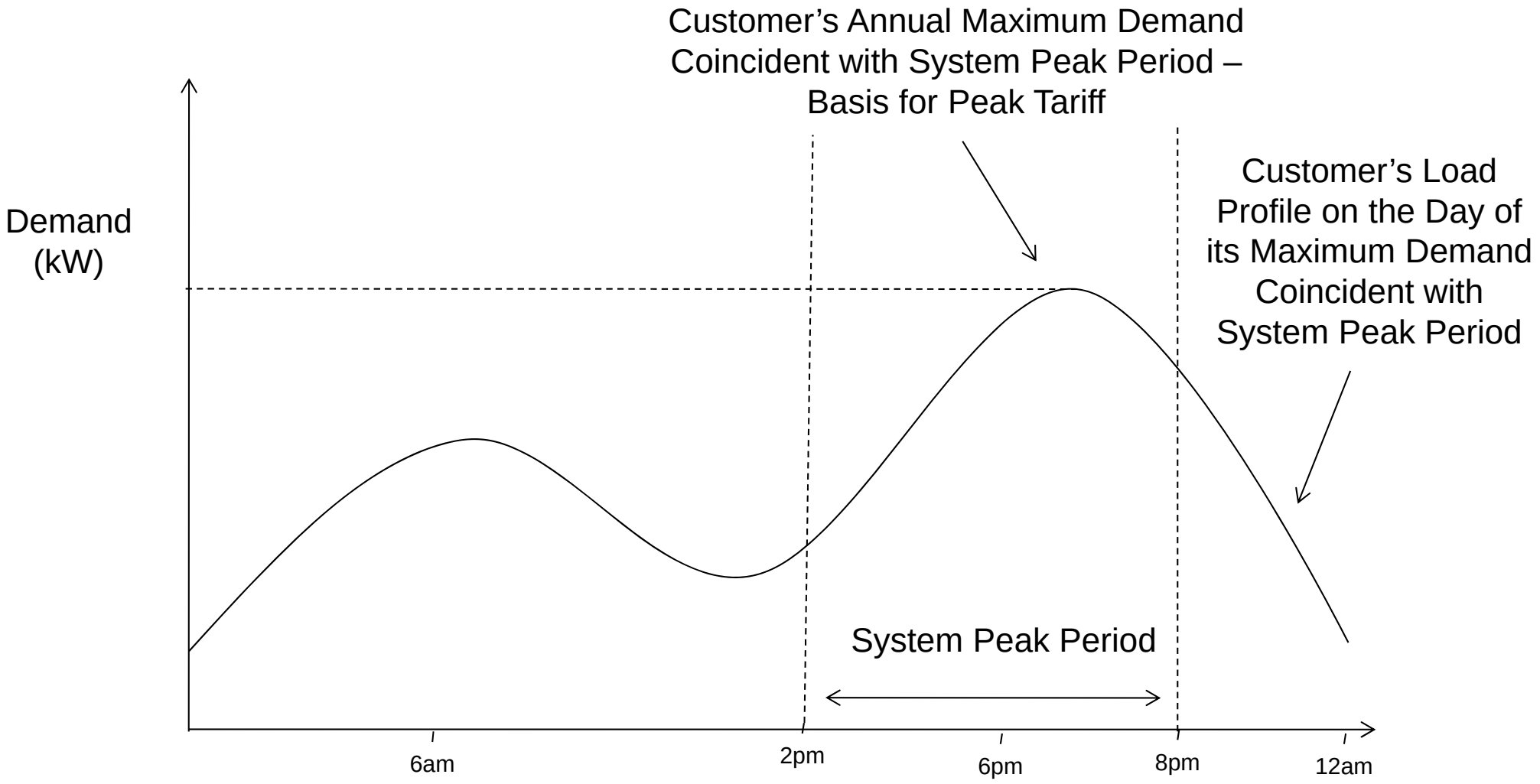
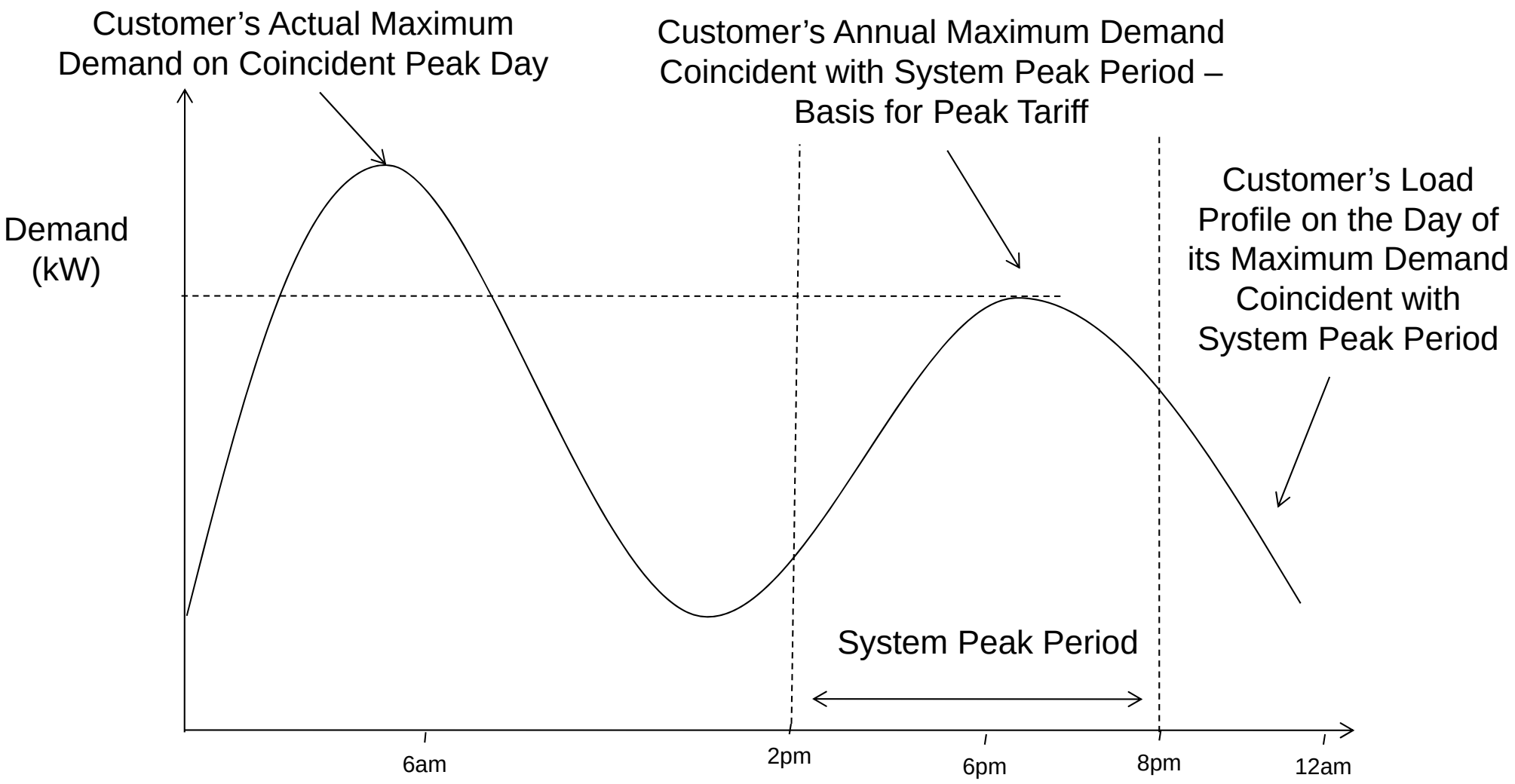
- Investigated potential bill changes for residential and commercial customers (200 customers) of alternative tariff structures, in the short and medium term
- For the purposes of illustration:
  - Usage/capacity tariff set equal to LRMC ($160/kW)
  - Residual costs recovered by:
    - 100% fixed tariff;
    - 50% fixed tariff, 50% mark-up on usage tariff;
    - 100% mark-up on usage tariff
  - Own price elasticity of electricity consumption and demand of -0.05
  - Cross price elasticity of substitution between peak/off peak of -0.025
- In the short term, tariffs are set to recover revenue equal to current tariffs, absent demand response
- In the medium term, tariffs are set to recover network costs, taking into account avoided costs

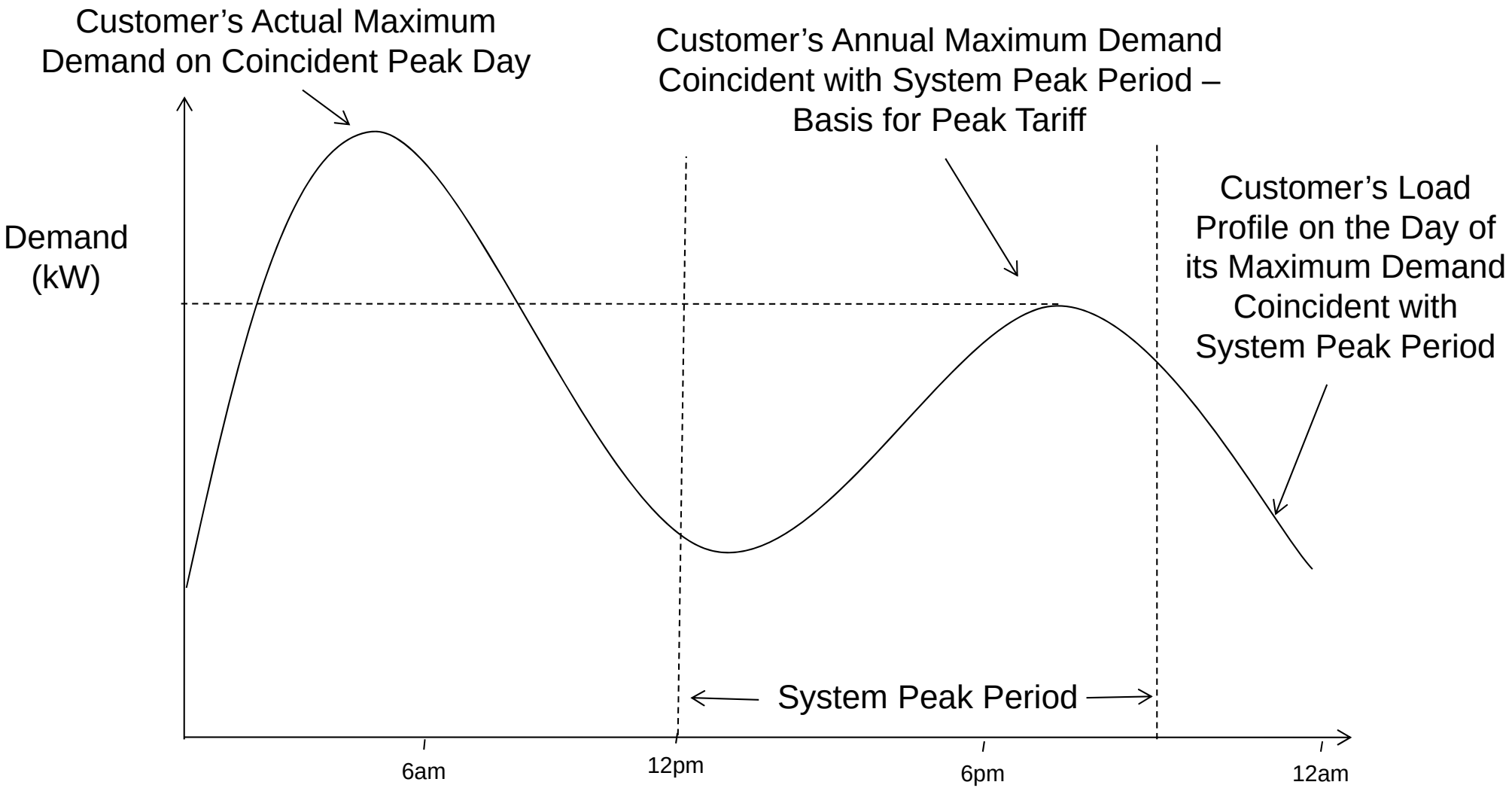
Illustrative Peak Capacity Charge – Example Customer 1



Illustrative Peak Capacity Charge – Example Customer 2



Illustrative Peak Capacity Charge – Example Customer 2



Residential Peak Capacity Illustrative Retail Tariffs

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	Fixed ($/day)	Usage ($/kWh)
Current Tariff	$0.70	$0.259

100% Usage Residual Cost Recovery	Fixed ($/day)	Usage ($/kWh)	Peak Capacity ($/kW)
Short-Term Tariff (no demand response)	$0.300	$0.255	$32
Medium-Term Tariff (with demand response)	$0.300	$0.248	$32

NB: Peak Capacity Tariff charged on customer's actual annual maximum demand occurring between 2 pm and 8 pm on weekdays.

Peak Capacity Illustrative Average Bill Impact

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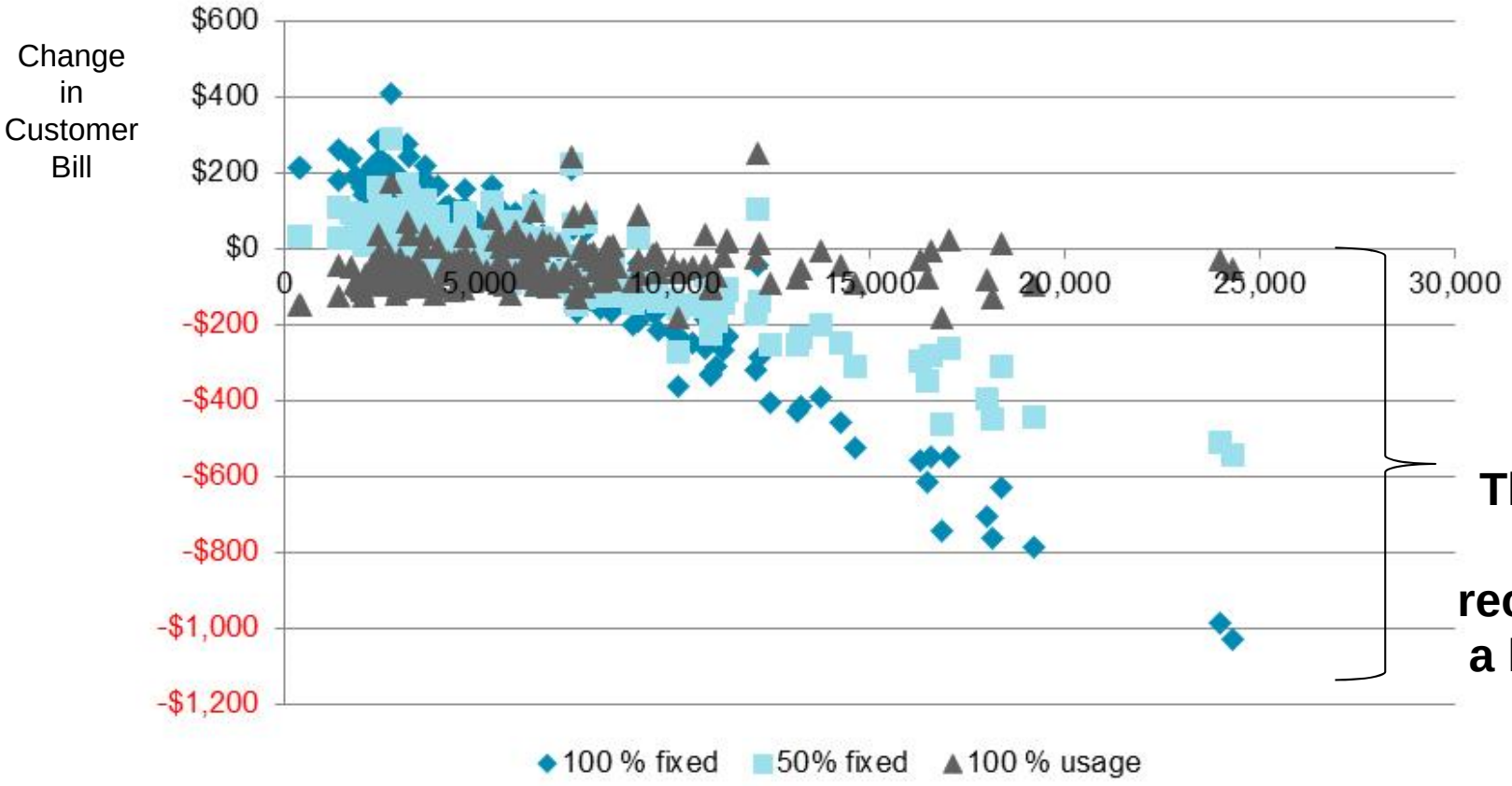
100% Usage Residual Cost Recovery	Average Bill ($/year)	Proportion with Higher Bill (%)	Proportion with Lower Bill (%)
Current Tariff	$1,832	-	-
Short-Term Tariff (no demand response)	$1,832	43%	58%
Medium-Term Tariff (with demand response)	$1,789	19%	81%

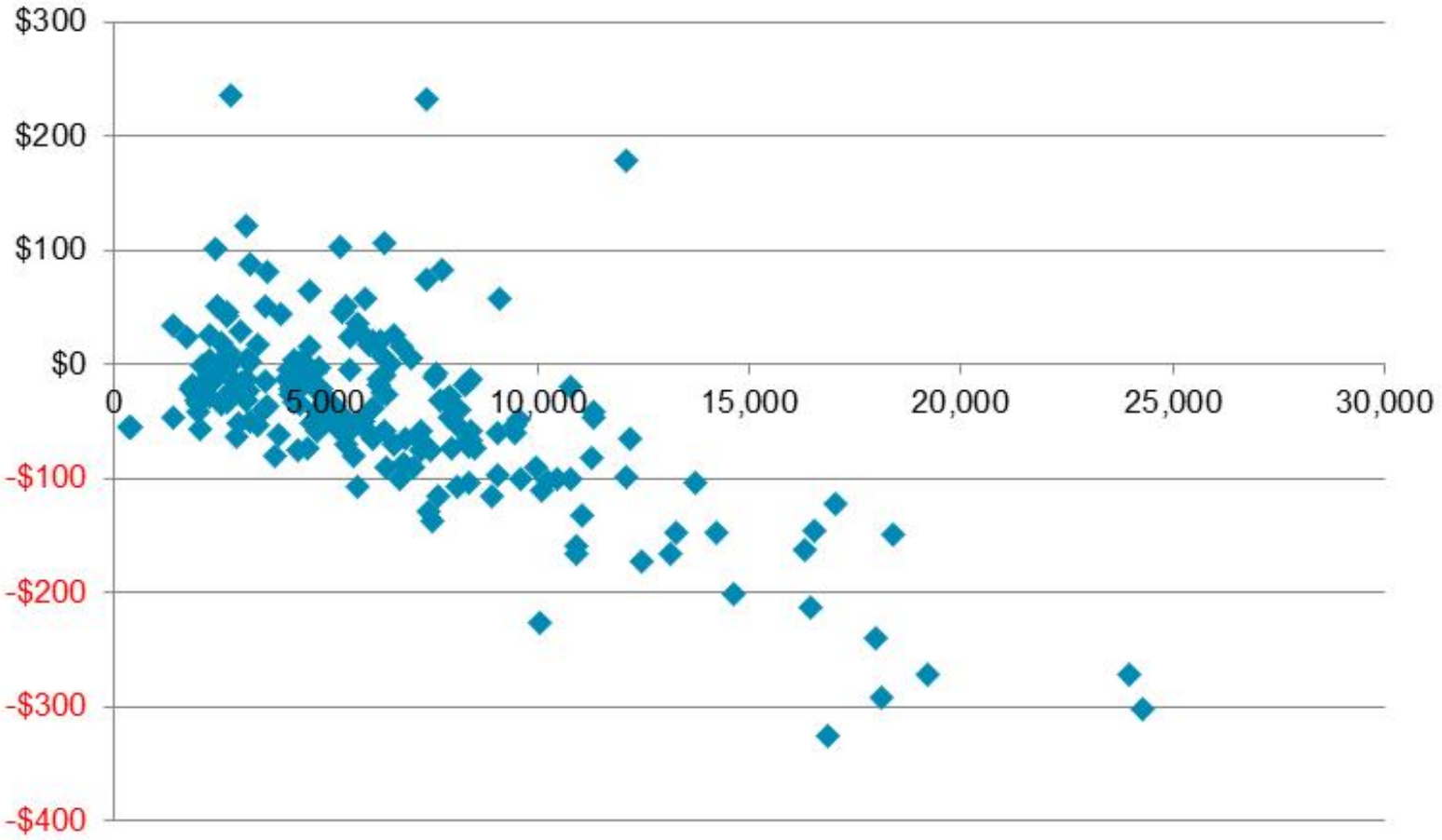
Residential Retail Bill Impact by Usage – Fixed Peak Capacity – Medium Term



Approach to Residual Cost Recovery

The approach to residual cost recovery can have a large impact on bill outcomes

Approach to Residual Cost Recovery Can Have a Significant Impact on Customer Bill Outcomes



Residential Critical Peak Illustrative Retail Tariffs

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	Fixed ($/day)	Usage ($/kWh)
Current Tariff	$0.70	$0.259

100% Usage Residual Cost Recovery	Fixed ($/day)	Flat Usage ($/kWh)	Critical Peak Tariff ($/kWh)
Short-Term Tariff (no demand response)	$0.30	$0.225	$13.56
Medium-Term Tariff (with demand response)	$0.30	$0.225	$13.56

NB: Critical Peak Tariff is called 3 times a year, 4 hour duration on the three max demand days.

Critical Peak Illustrative Average Residential Bill Impact

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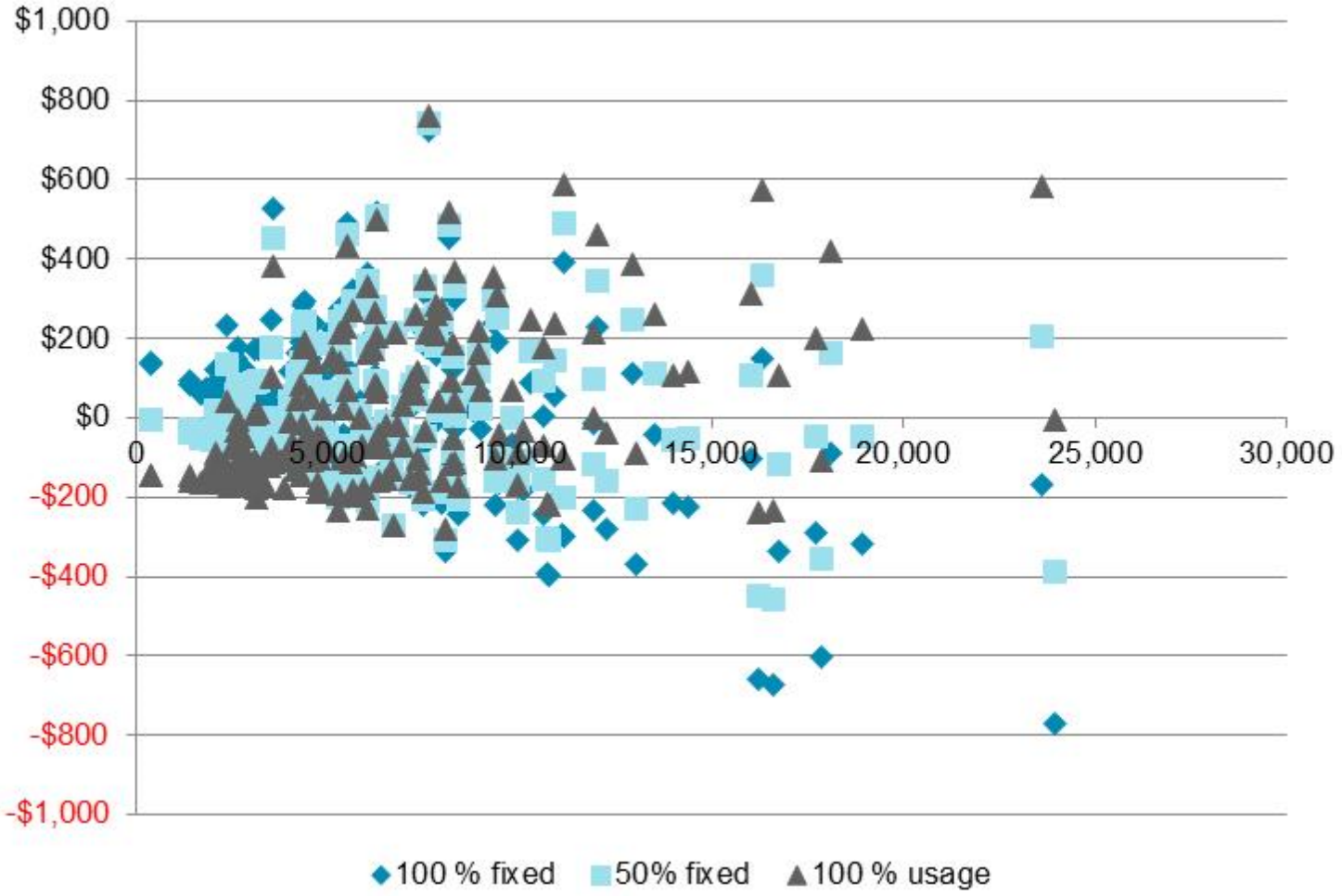
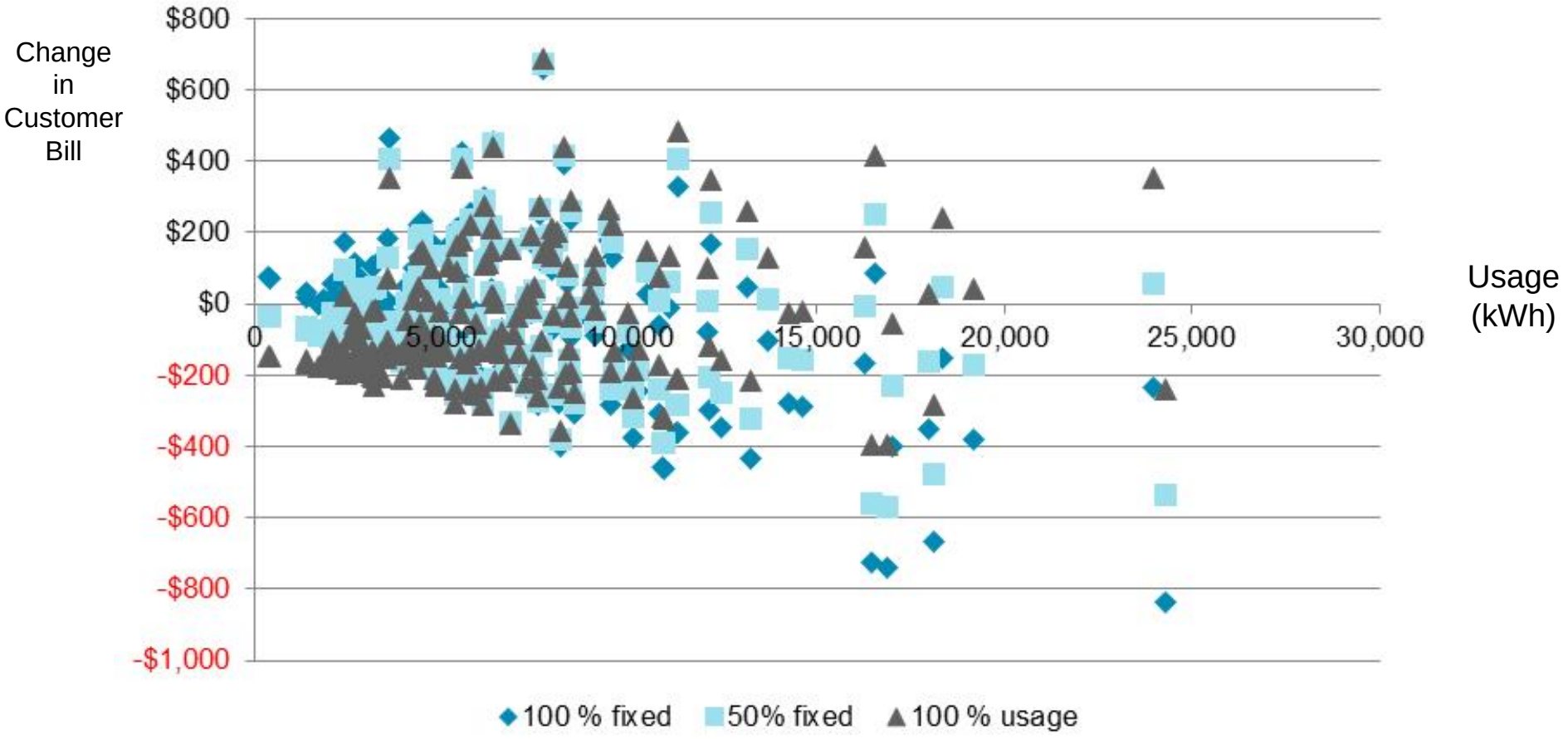
100% Usage Residual Cost Recovery	Average Bill ($/year)	Proportion with Higher Bill (%)	Proportion with Lower Bill (%)
Current Tariff	$1,832	-	-
Short-Term Tariff (no demand response)	$1,832	38%	62%
Medium-Term Tariff (with demand response)	$1,776	31%	69%

Residential Retail Bill Impact by Usage – Critical Peak Tariff – Short Term



Approach to Residual Cost Recovery

Residential Retail Bill Impact by Usage – Critical Peak Tariff – Medium Term



Approach to Residual Cost Recovery

General Observations – Peak Capacity and Critical Peak Tariffs

- Peak Capacity Tariffs and Critical Peak Tariffs create the opportunity to lower bills for both residential and commercial customers in the medium term
- The bill impact is dependent on the relationship between customer consumption and maximum demand during peak periods
- The maximum benefit from these tariffs arises when they are targeted in locations within the network where future augmentation costs can be practically avoided through customers responding to price signals

Residential Flat Retail Tariffs

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	Fixed ($/day)	Usage ($/kWh)
Current Tariff	$0.70	$0.259

100% Usage Residual Cost Recovery	Fixed ($/day)	Usage ($/kWh)
Short-Term Tariff (no demand response)	$0.300	$0.283
Medium-Term Tariff (with demand response)	$0.300	$0.284

Flat Tariff Illustrative Average Bill Impact

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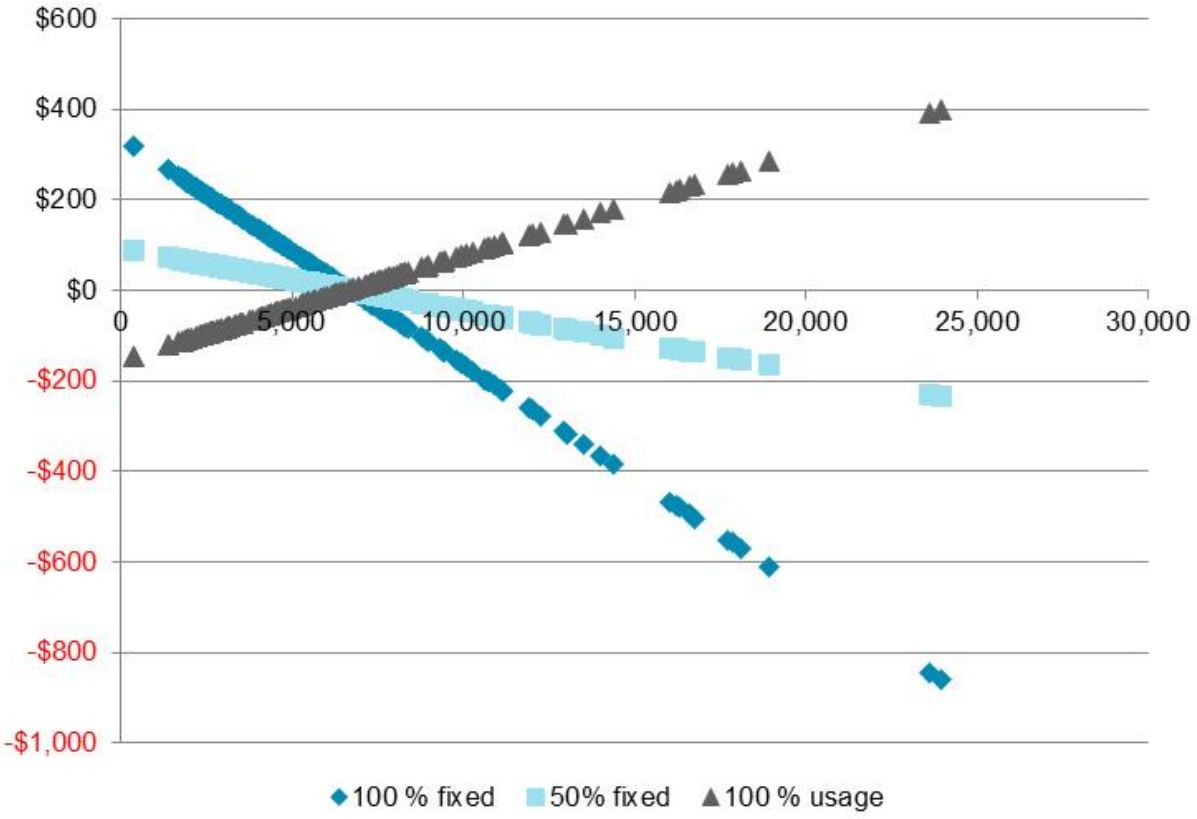
100% Usage Residual Cost Recovery	Average Bill ($/year)	Proportion with Higher Bill (%)	Proportion with Lower Bill (%)
Current Tariff	$1,832	-	-
Short-Term Tariff (no demand response)	$1,832	39%	61%
Medium-Term Tariff (with demand response)	$1,832	38%	62%

Residential Retail Bill Impact by Usage – Flat Tariff – Short and Medium Term



Approach to Residual Cost Recovery

Residential Time-Of-Use Retail Tariffs

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	Fixed ($/day)	Usage ($/kWh)
Current Tariff	$0.70	$0.259

100% Usage Residual Cost Recovery	Fixed ($/day)	Peak ($/kWh)	Shoulder ($/kWh)	Off-Peak Capacity ($/kWh)
Short-Term Tariff (no demand response)	$0.300	$0.314	$0.299	$0.264
Medium-Term Tariff (with demand response)	$0.300	$0.314	$0.299	$0.264

Time-Of-Use Illustrative Average Bill Impact

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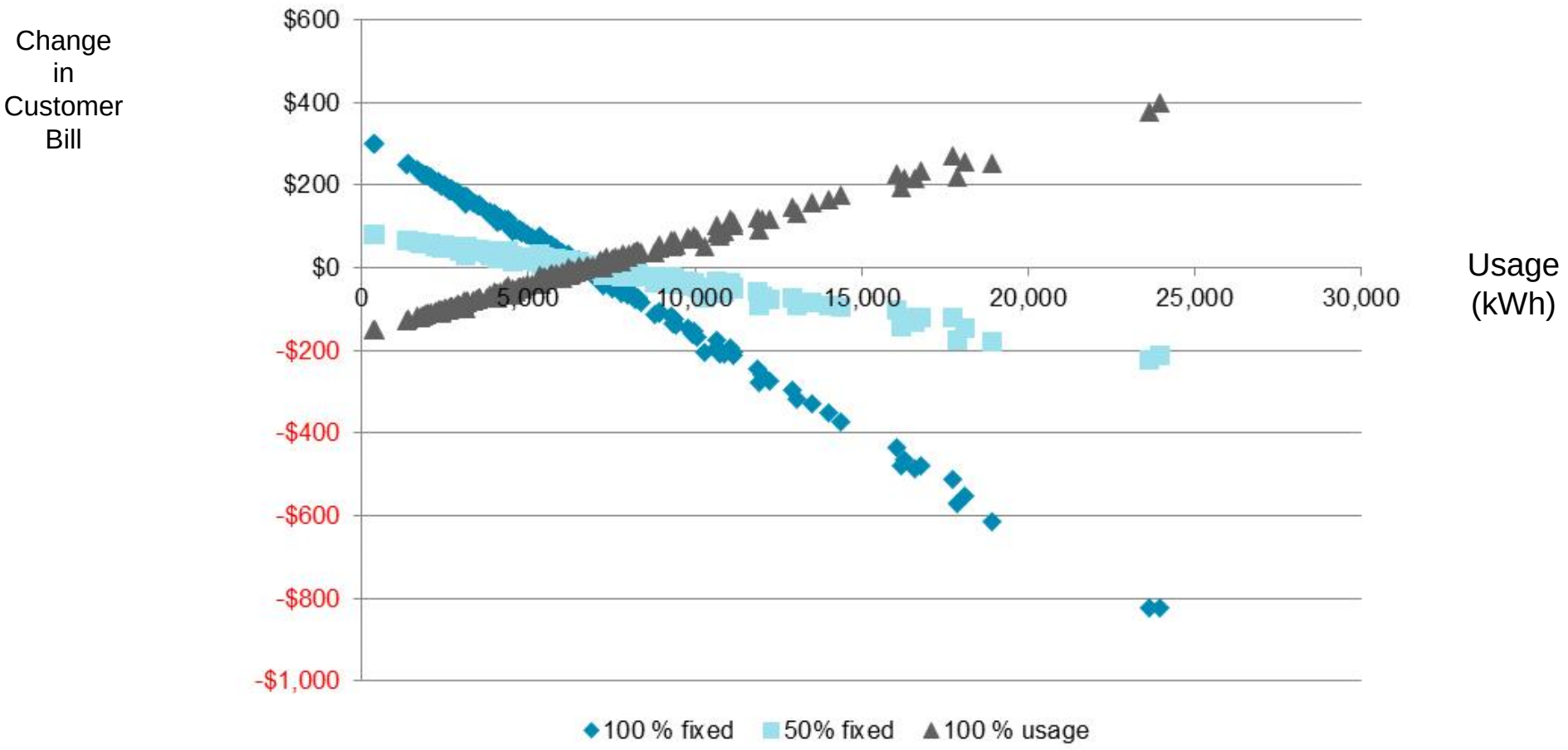
100% Usage Residual Cost Recovery	Average Bill ($/year)	Proportion with Higher Bill (%)	Proportion with Lower Bill (%)
Current Tariff	$1,832	-	-
Short-Term Tariff (no demand response)	$1,832	41%	59%
Medium-Term Tariff (with demand response)	$1,832	39%	61%

Residential Retail Bill Impact by Usage – Time-Of-Use Tariff – Short and Medium Term



Approach to Residual Cost Recovery

General Observations – Flat and Time-Of-Use Tariffs

- Current flat and time-of-use tariffs are generally higher than current estimates of network LRMC, and so setting equal to LRMC would generally lower flat usage or peak tariffs
- This leads to potentially higher demand during peak periods, increasing future network costs relative to current expectations
- Lower usage tariffs and higher fixed tariffs would increase bills for low usage customers and lower bills for high usage customers

General Observations

- To promote efficient network investment, price signals should be given to all consumers that use network infrastructure during peak periods and so contribute to the need for network investment
- Peak capacity and critical peak tariffs are the current best tariff options to signal network investment costs. They can be designed to lower customer bills in the medium term
- To promote efficient use of existing network infrastructure, a greater proportion of residual costs should be recovered through charges unrelated to use
- Peak capacity tariffs promote both efficient use and investment in network infrastructure

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