ieso
Power to Ontario.
On Demand.

Issue #9: Peak versus Average - Preliminary Efficiency Analysis Results

MPWG – February 7, 2008

Agenda

- Review of Issue
- Proposal
- Efficiency analysis description, assumptions and examples
- Descriptive statistics for the sample
- Preliminary results
- Summary
- Next steps

Issue

- Pre-dispatch process is based on hourly resolution
- Hourly scheduling requires the use of a single forecast demand value for the hour
  - IESO currently uses peak demand forecast to ensure adequate resources to meet peak
- Will always be possibility of real-time inefficiencies with any pre-dispatch hourly forecast

Hypothesis: using average demand forecast may reduce inefficiencies associated with using a single hourly value

Proposal

- Efficiency analysis conducted in two phases:
  - Phase 1: Assume no change in export bids, i.e. existing export bids represent true value
  - Phase 2: Estimate export demand curve and incorporate response into simulations
- Once the efficiency analysis is complete, will conduct:
  - Reliability impact analysis, and
  - Cost-benefit analysis (including wealth transfers)

Efficiency Analysis (Phase 1)

- Estimate change in total surplus of meeting real-time demand using average demand forecast in pre-dispatch
- Change in total surplus equivalent to change in avoided cost of imports + change in export surplus – increase in domestic production costs

Efficiency Analysis Assumptions (Phase 1)

- No change in Ontario demand
- Generator offers are representative of production costs
- Import offers are representative of the opportunity cost of providing energy to Ontario
- No change in offers/bids of generators, imports, exports, dispatchable loads

Data Selection

- Sample consists of one week of data from each month in 2006
- Steps for data selection:
  - Eliminated weeks with holidays
  - Selected the weeks in which summer (Aug) and winter (Jan) peaks occurred
  - Randomly selected 1 week from remaining 10 months

WEEKS SELECTED FOR SIMULATION

2006	Days (Sun-Sat)
Jan	15 - 21
Feb	5 - 11
Mar	19 - 25
Apr	2 - 8
May	7 - 13
Jun	18 - 24
Jul	16 - 22
Aug	(Jul 30 - Aug 5)
Sep	10 - 16
Oct	15 - 21
Nov	19 - 25
Dec	2 - 8

Descriptive Statistics for the Sample

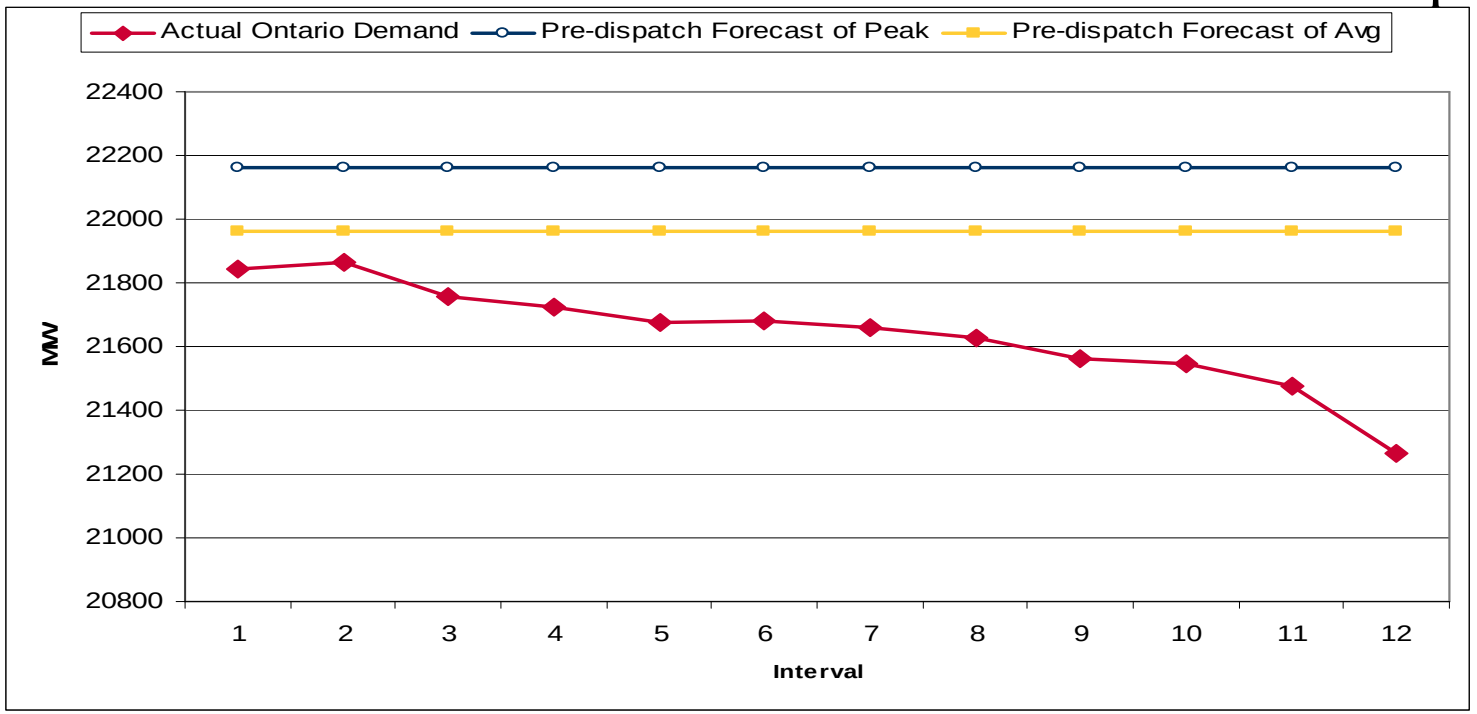
- Approximately 24,000 intervals in the sample
- On average, pre-dispatch peak demand forecast is:
  - 31 MW greater than actual peak demand, and
  - 333 MW greater than actual average demand
- On average, pre-dispatch average demand forecast is:
  - 306 MW less than actual peak demand, and
  - 4 MW less than actual average demand

Types of Observed Outcomes

1) In some hours, actual demand less than both peak and average forecasts in all intervals
2) In some hours, actual demand greater than both peak and average forecasts in all intervals
3) In some hours, actual demand below peak forecast in all intervals and is sometimes above, sometimes below average forecast
4) In some hours, actual demand crosses both peak and average forecasts
5) In some hours, actual demand lies between peak and average forecasts
6) In some hours, actual demand sometimes above peak forecast, sometimes below but is above average forecast in all intervals

Outcome 1

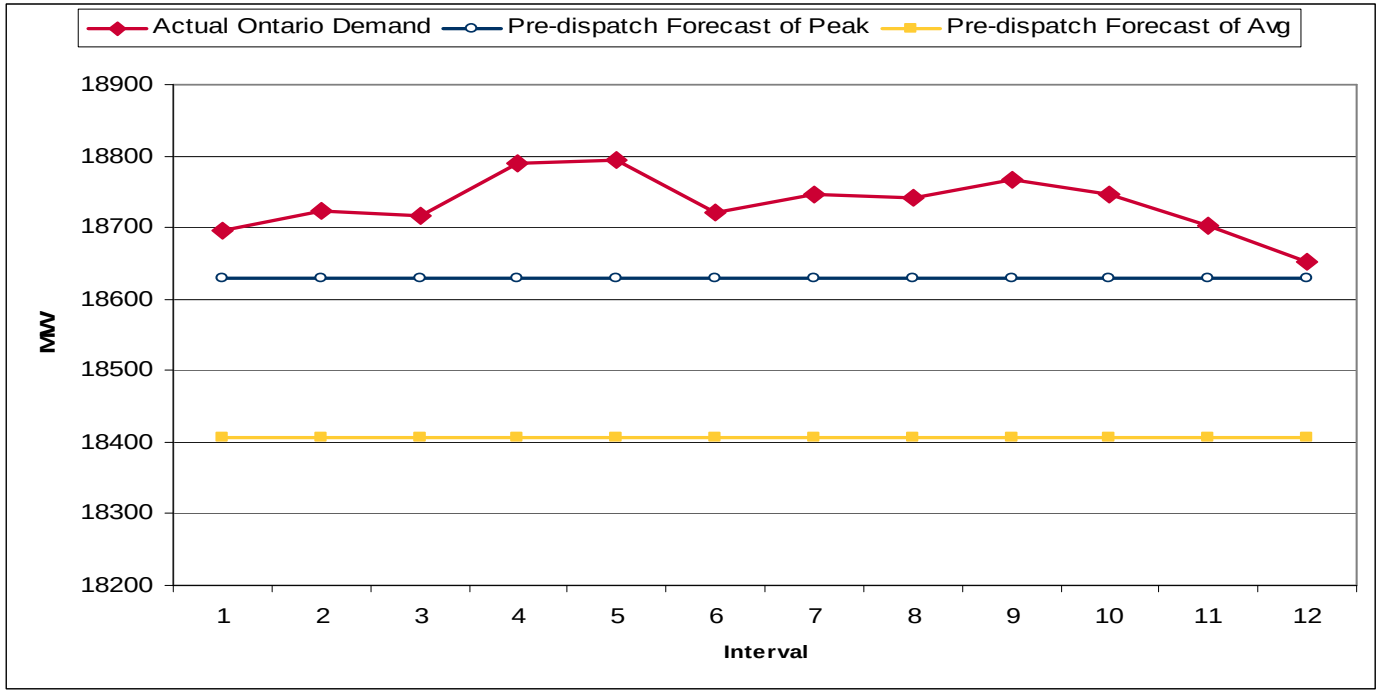
1) In all intervals, actual demand less than both peak and average pre-dispatch forecasts
   - This outcome observed 10% of time in the sample



Using average forecast usually more efficient in this case

Outcome 2

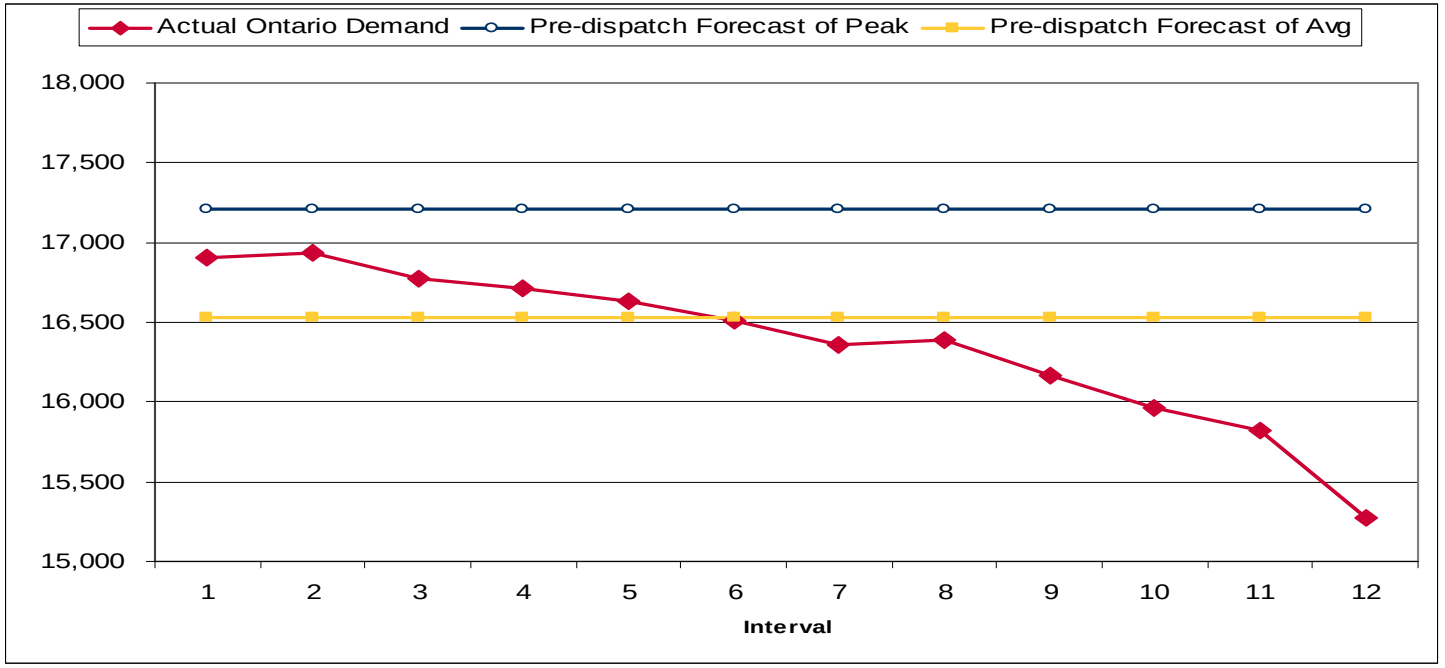
2) In all intervals, actual demand greater than both peak and average pre-dispatch forecasts
   - This outcome observed 5% of time in the sample



Using average forecast usually less efficient in this case

Outcome 3

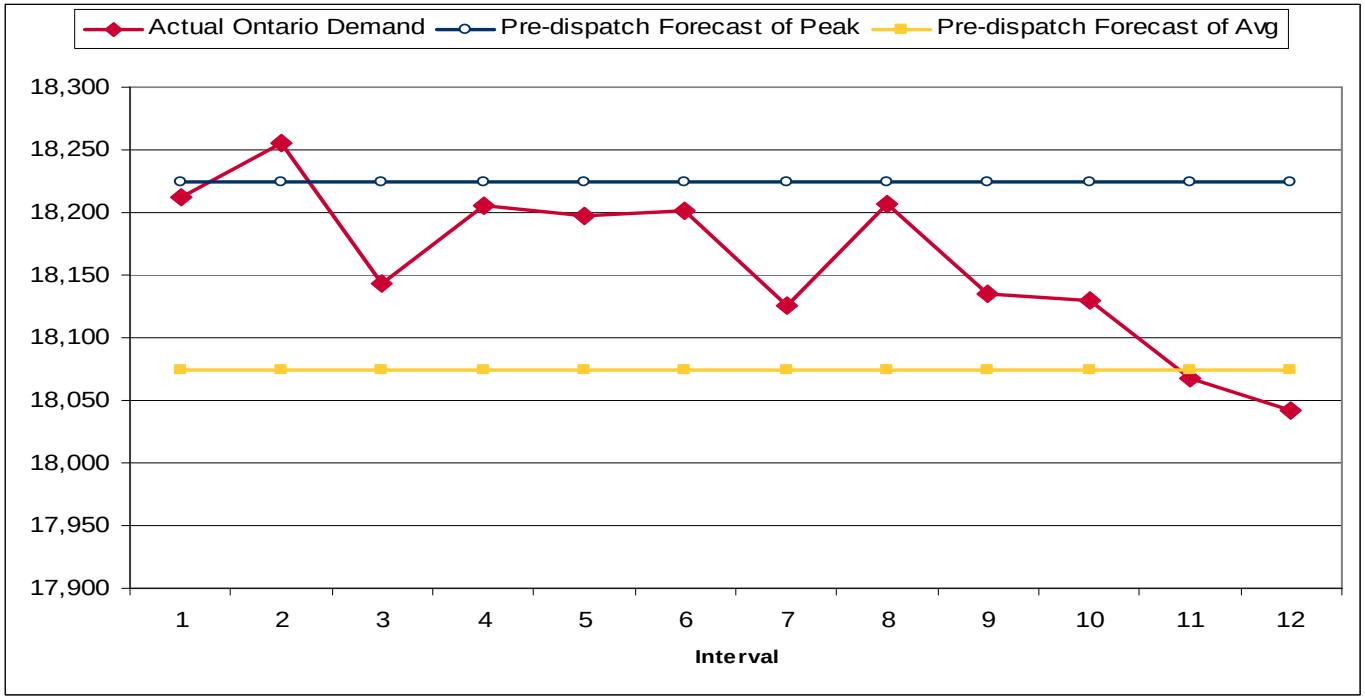
3) Actual demand below peak forecast in all intervals and is sometimes above, sometimes below average forecast
   - This outcome observed 42% of time in the sample



Using average forecast usually more efficient but sometimes less efficient

Outcome 4

4) Actual demand crosses both peak and average forecasts
   - This outcome observed 28% of time in the sample

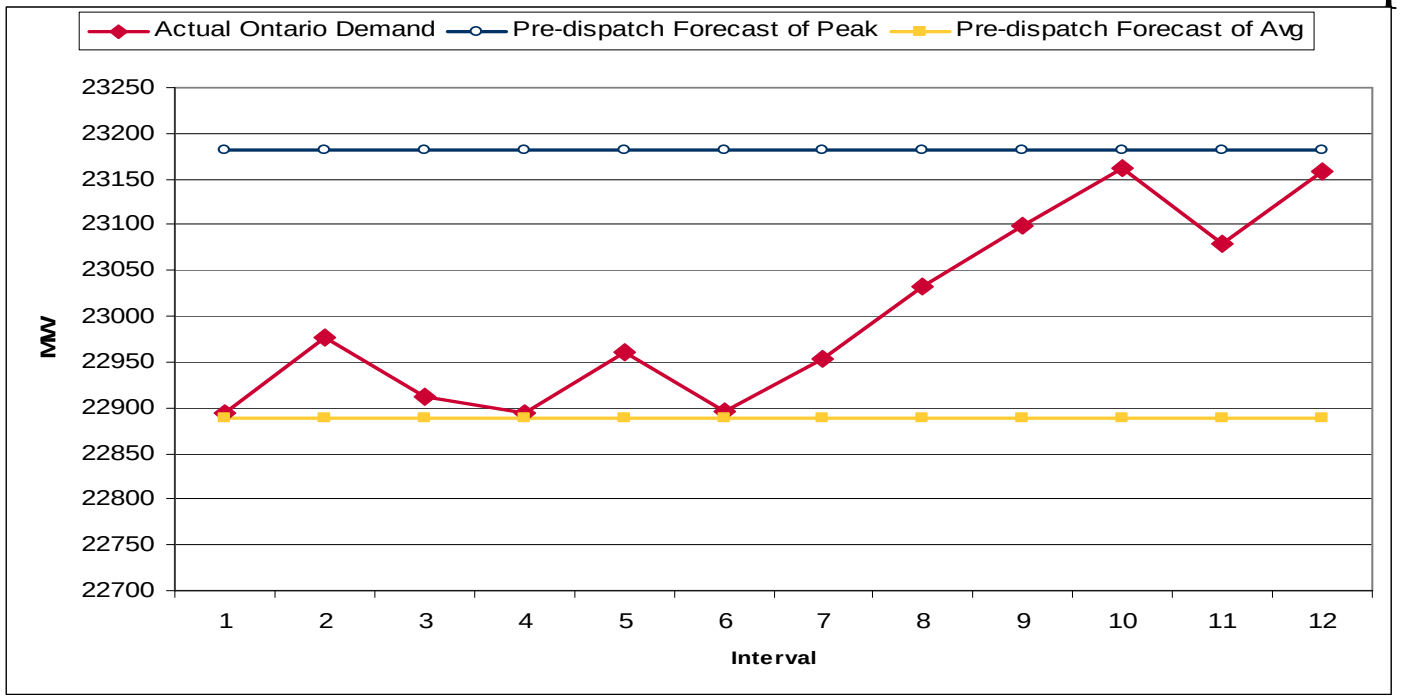


Using average forecast sometimes more efficient, sometimes less efficient

Outcome 5

5) In all intervals, average forecast < actual demand < peak forecast

– This outcome observed 4% of time in the sample

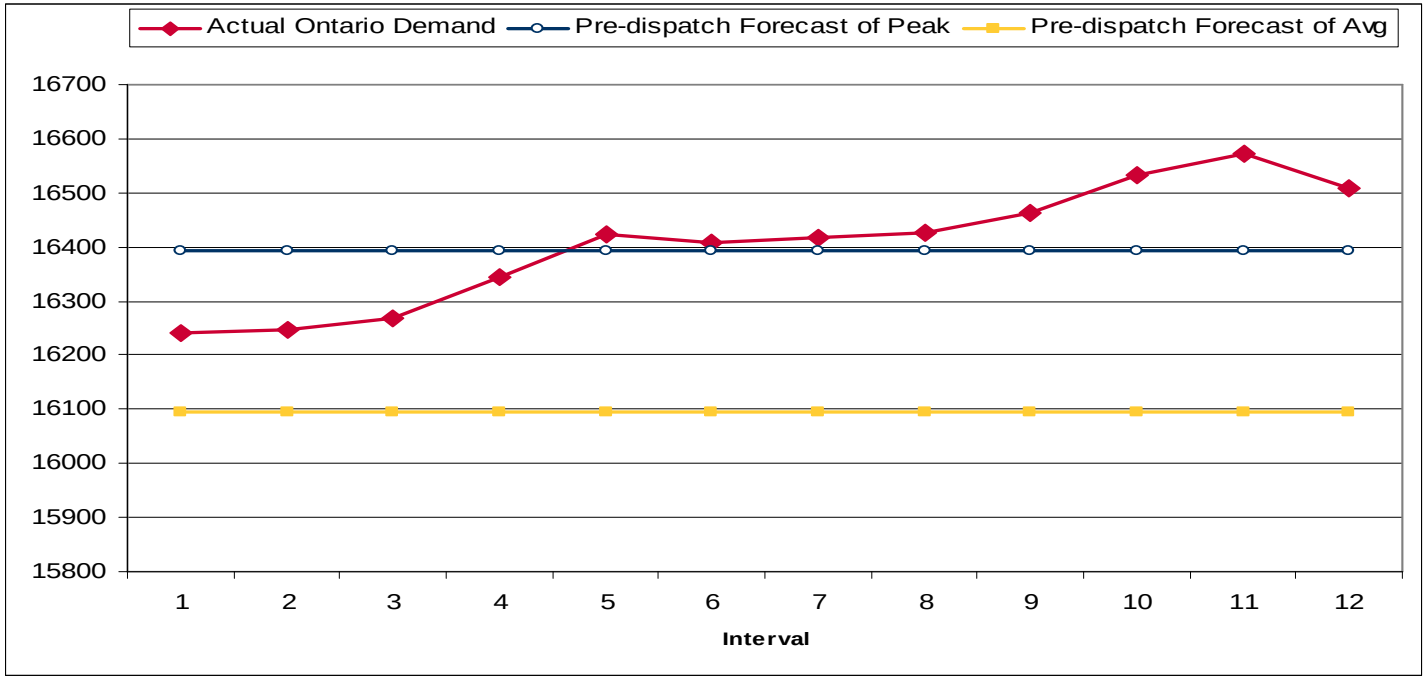


Using average forecast sometimes more efficient, sometimes less efficient

Outcome 6

6) Actual demand sometimes above peak fcst, sometimes below but always above avg fcst

- This outcome observed 11% of time in the sample

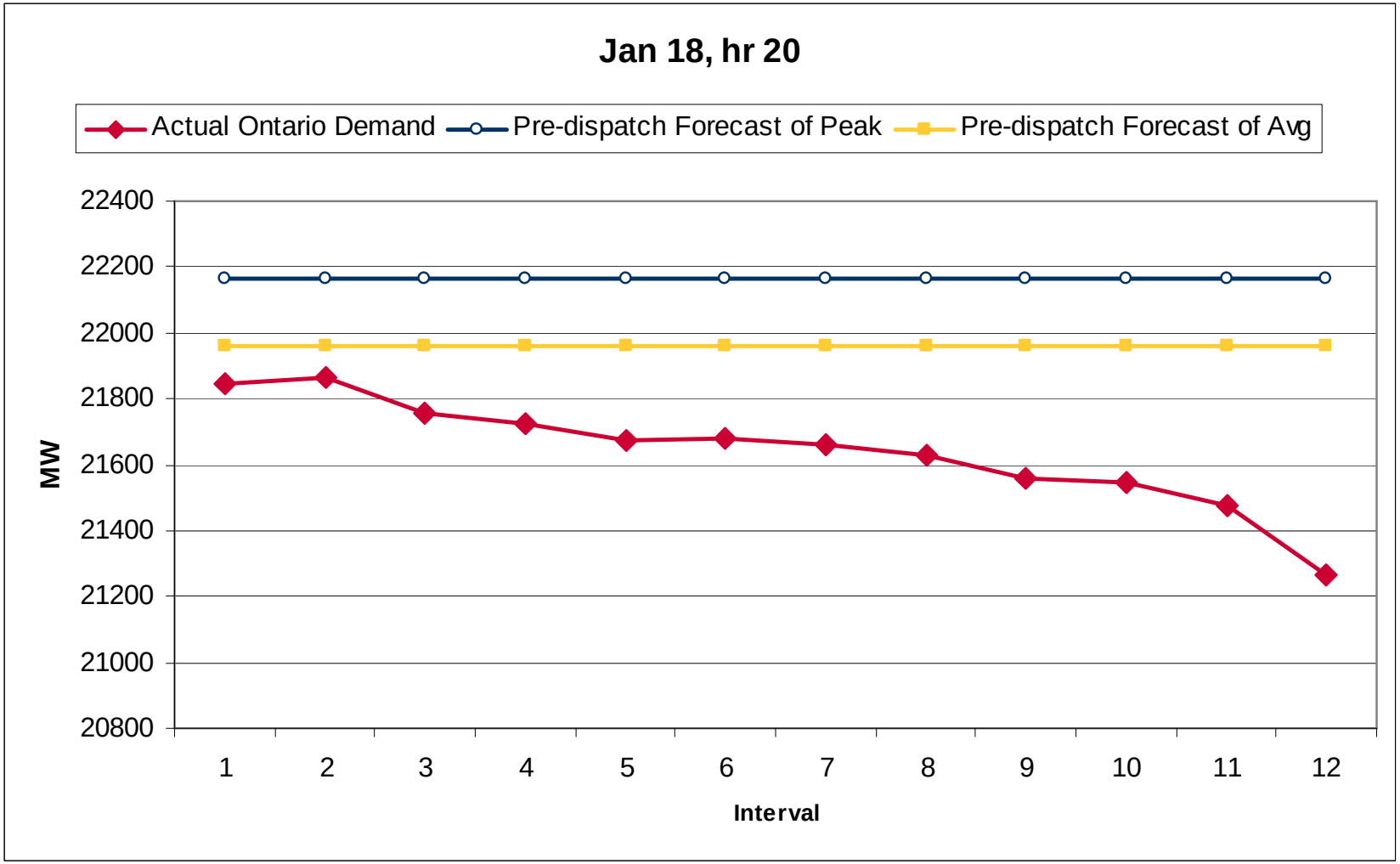


Using average forecast usually less efficient but sometimes more efficient

Selected Examples to Illustrate Observed Outcomes 1-3

- Example hours selected from sample to demonstrate some of the observed outcomes:
  1) Actual demand less than pre-dispatch forecast
  2) Actual demand greater than pre-dispatch forecast
  3) Actual demand below peak forecast in all intervals and is sometimes above, sometimes below average demand forecast

Example 1: Actual demand less than pre-dispatch forecast in all intervals



Example 1 – Impact on pre-dispatch schedule

- All else equal, a reduction in forecast demand has downward pressure on pre-dispatch price
  - Expect fewer imports and more exports to be scheduled
- For the hour used in this example, simulation using average demand forecast showed 175 MW decrease in imports and 25 MW increase in exports

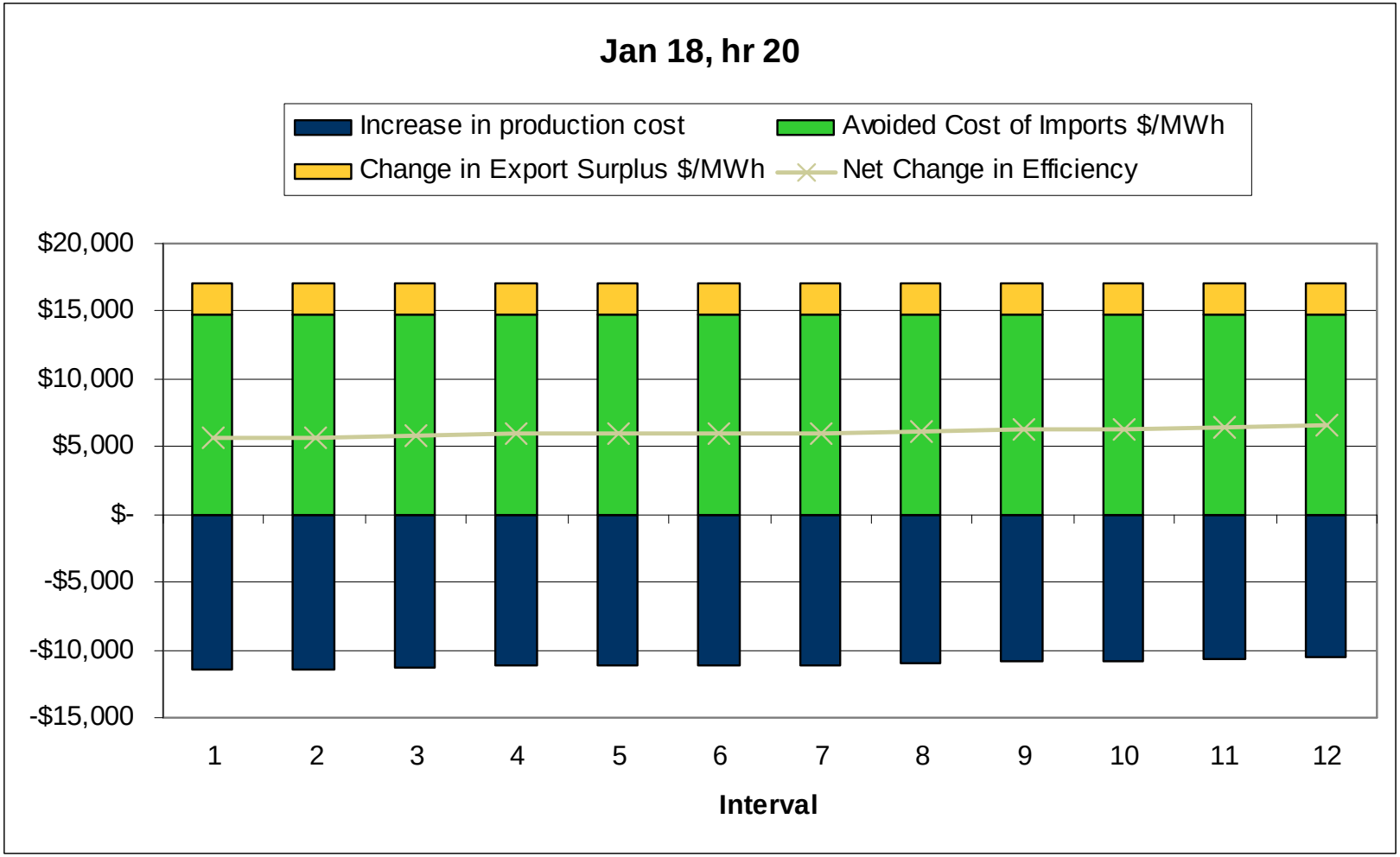
Example 1 – Estimate of Net Efficiency Impact

- 175 MW fewer imports ⇒ $14,766 of avoided import costs for the hour
- 25 MW additional exports ⇒ $2,350 increase in exporter surplus
- Additional domestic production costs incurred to meet demand ⇒ $11,052

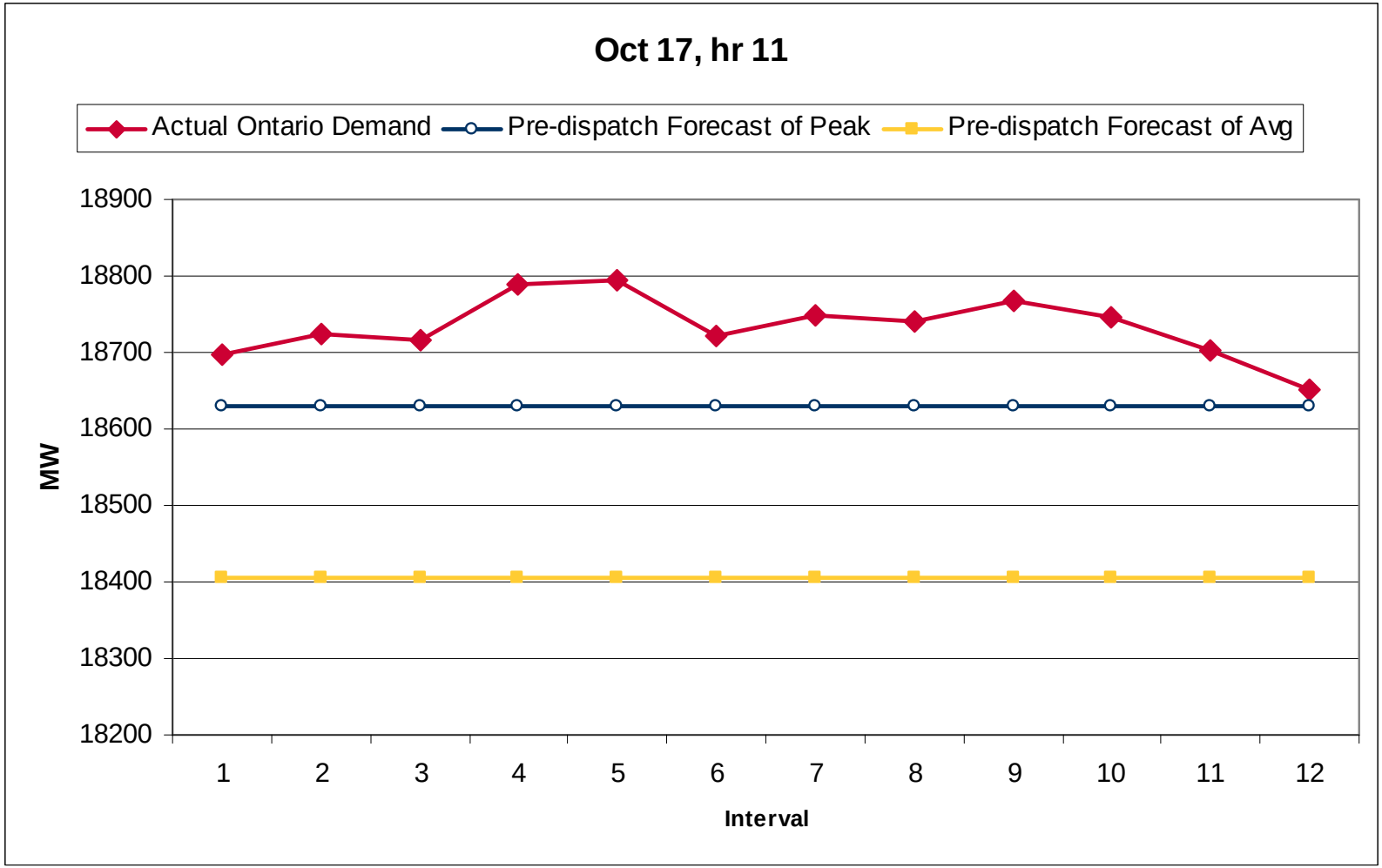
Net efficiency gain is $6,064 for the hour.

($14,766 + $2,350 – $11,052 = $6,064)

Example 1 – Estimate of Net Efficiency Impact



Example 2: Actual demand exceeds pre-dispatch forecast in all intervals



Example 2 – Impact on pre-dispatch schedule

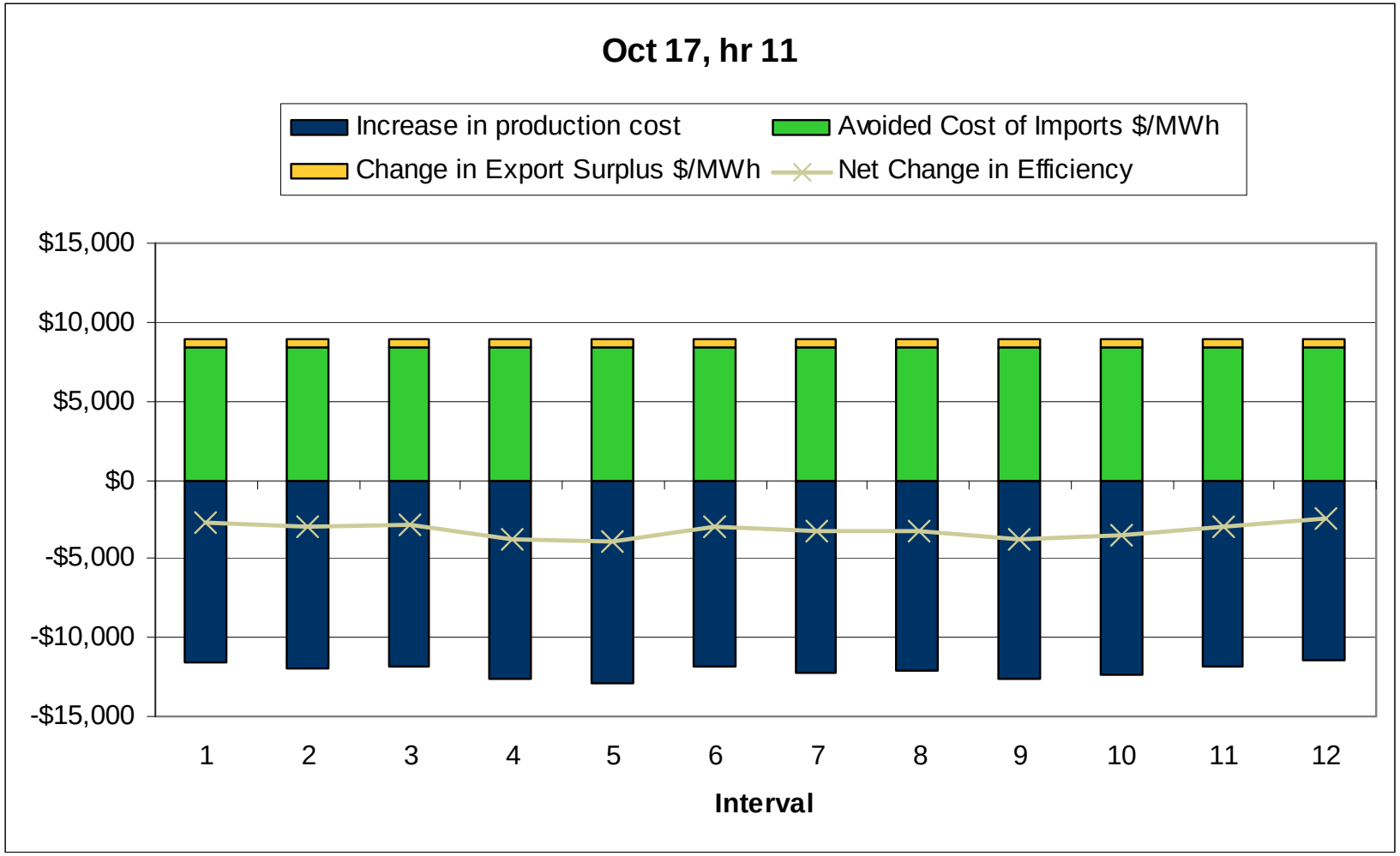
- All else equal, a reduction in forecast demand has downward pressure on pre-dispatch price
  - Expect fewer imports and more exports to be scheduled
- Simulation using average demand forecast showed 156 MW decrease in imports and 10 MW increase in exports

Example 2 – Estimate of Net Efficiency Impact

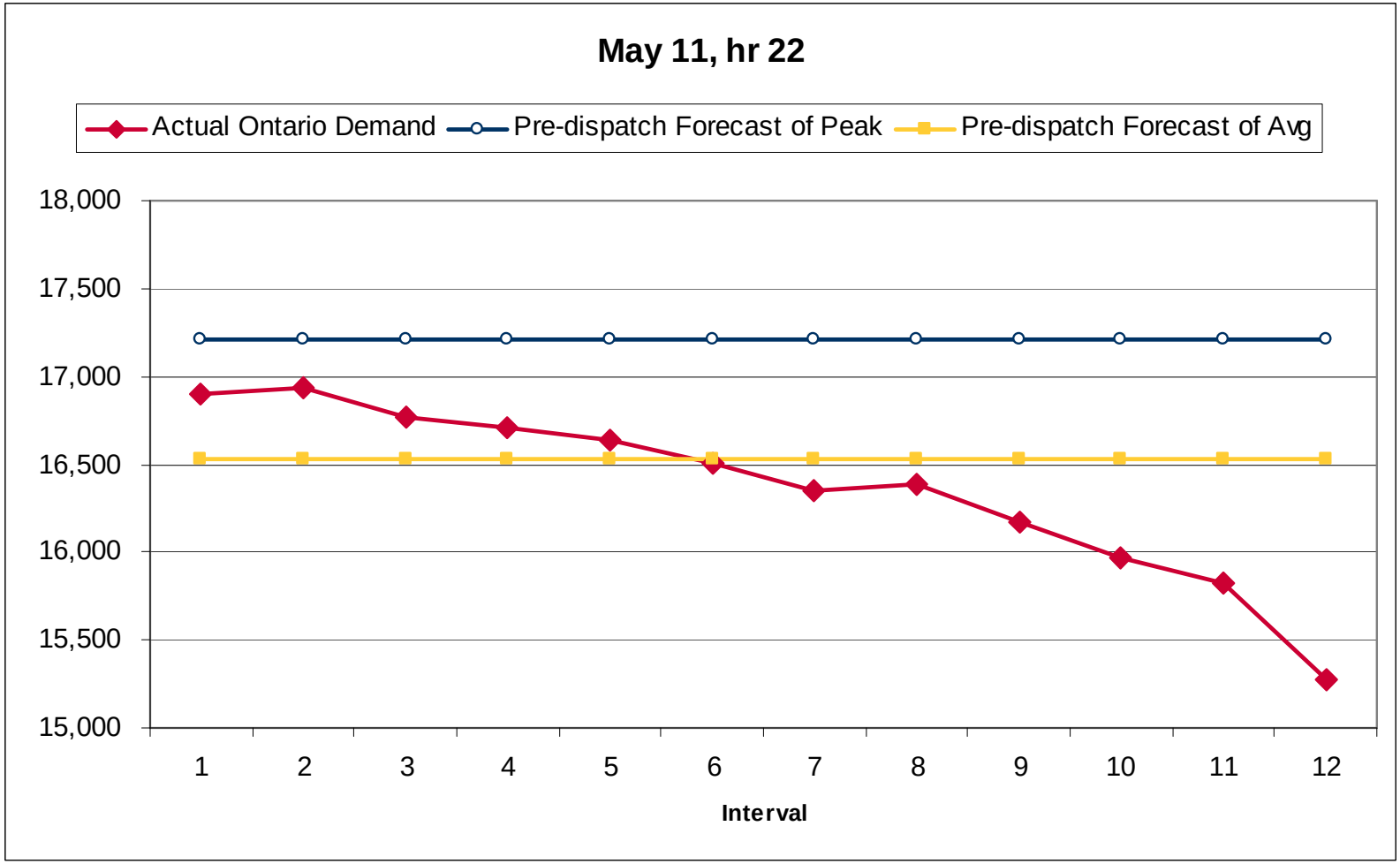
- 156 MW fewer imports ⇒ $8,377 of avoided import costs for the hour
- 10 MW additional exports ⇒ $543 increase in exporter surplus
- Additional domestic production costs incurred to meet demand ⇒ $12,113

Net efficiency loss is $3,193 for the hour.
($8,377 + $543 – $12,113 = - $3,193)

Example 2 – Estimate of Net Efficiency Impact



Example 3: Actual demand < peak forecast and crosses average demand forecast



Example 3 – Impact on pre-dispatch schedule

- All else equal, a reduction in forecast demand has downward pressure on pre-dispatch MCP
  - Expect fewer imports and more exports to be scheduled
- Simulation using average demand forecast showed 349 MW decrease in imports and 21 MW increase in exports

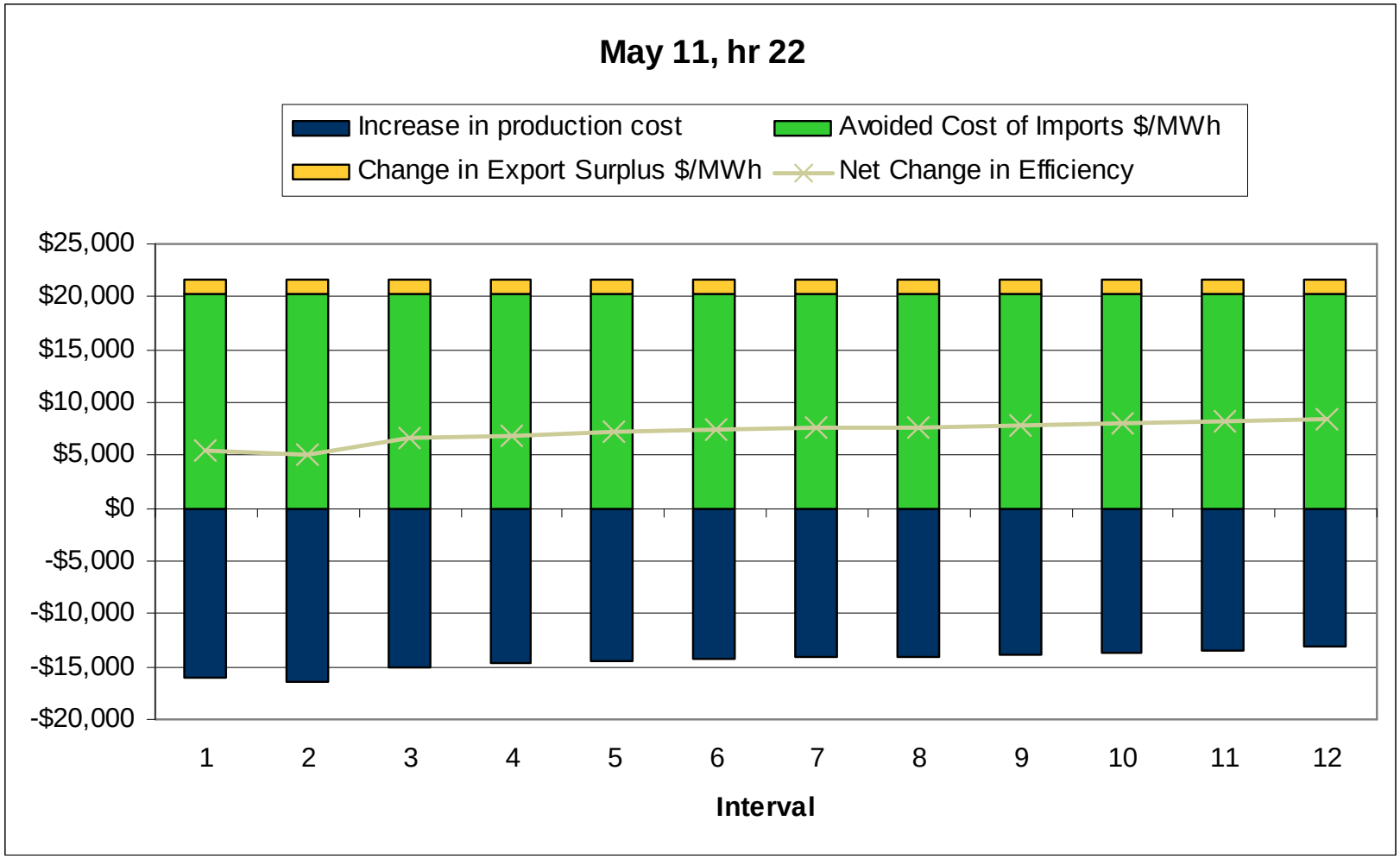
Example 3 – Estimate of Net Efficiency Impact

- 349 MW fewer imports ⇒ $20,171 of avoided import costs for the hour
- 21 MW increase in exports ⇒ $1,449 change in exporter surplus
- Additional domestic production costs incurred to meet demand ⇒ $14,420

Net efficiency gain is $7,200 for the hour.

($20,171 + $1,449 - $14,420 = $7,200)

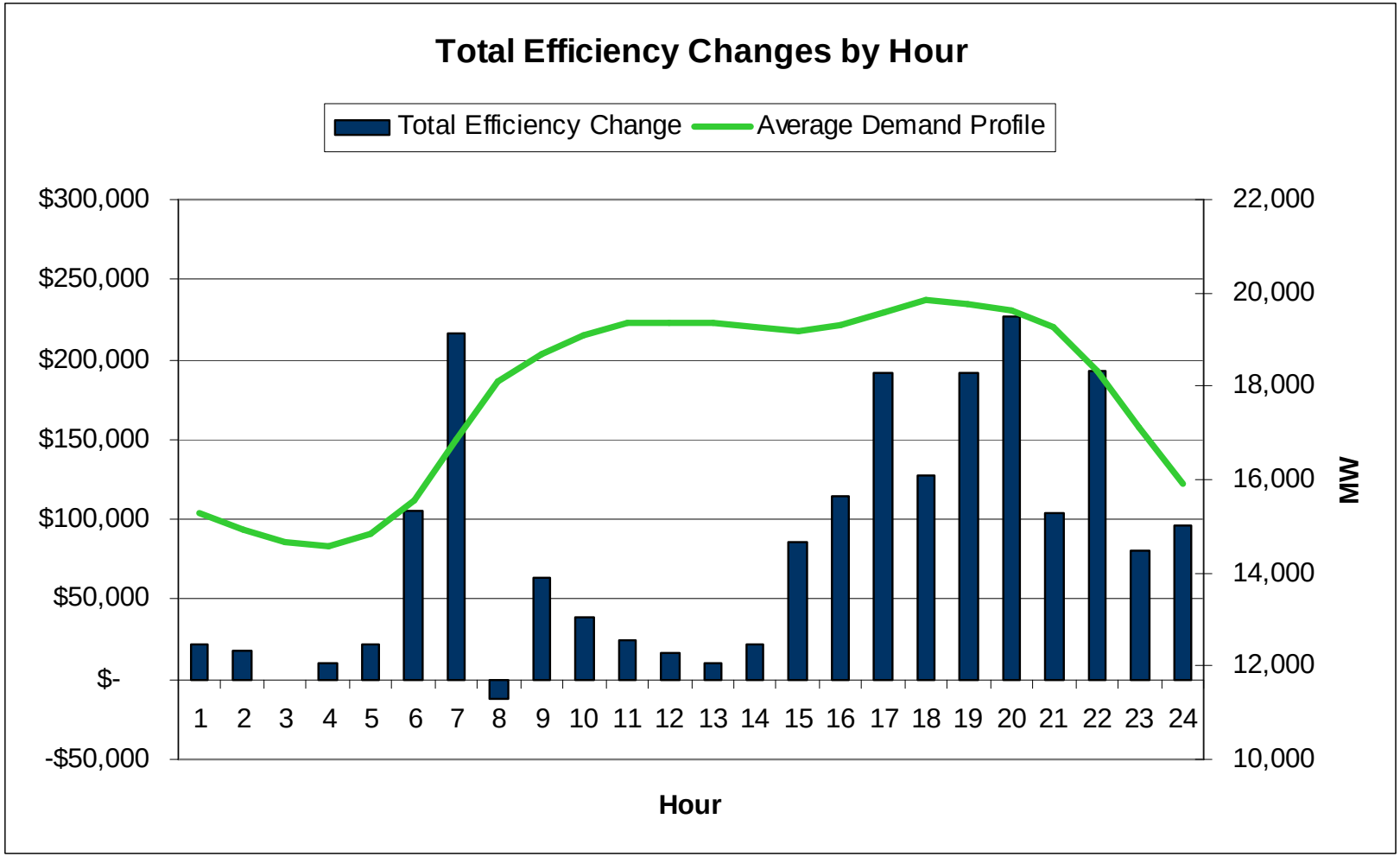
Example 3 – Estimate of Net Efficiency Impact



Preliminary Results: Total Efficiency Changes by Week ($ Million)

Week	Value of Avoided Imports (a)	Change in Export Surplus (b)	Production Cost Increases (c)	Net Efficiency Change (a) + (b) - (c)
Jan 15-21	1.84	0.09	1.81	0.12
Feb 5-11	1.15	0.05	1.02	0.18
Mar 19-25	1.43	0.15	1.31	0.27
Apr 2-8	0.49	0.08	0.49	0.08
May 7-13	0.64	0.06	0.58	0.12
Jun 18-24	1.59	0.02	1.51	0.10
Jul 16-22	2.06	0.13	2.01	0.18
Jul 30 – Aug 5	2.43	0.08	2.12	0.39
Sep 10-16	0.73	0.06	0.77	0.03
Oct 15-21	0.53	0.15	0.58	0.11
Nov 19-25	1.02	0.10	1.02	0.10
Dec 2-8	2.43	0.14	2.42	0.29
Total	**16.34**	**1.11**	**15.49**	1.97

Hourly Efficiency Gains/Losses



Summary

- Phase I of the efficiency analysis illustrates the dynamics of using an average forecast value
- Current estimate of efficiency gains may be an overstatement of true impact since the simulations do not include export response
- Efficiency gains appear to be greatest in hours where demand is ramping up/down

Next Steps

- Conduct Phase 2 of efficiency analysis (March '08)
  - Estimate export demand curve and incorporate response into simulations
- Once the efficiency analysis is complete, will conduct:
  - Reliability impact analysis, and
  - Cost-benefit analysis (including wealth transfers)