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Power to Ontario.
On Demand.

# Ramp Impacts on EDAC

EDAC Technical Support Group
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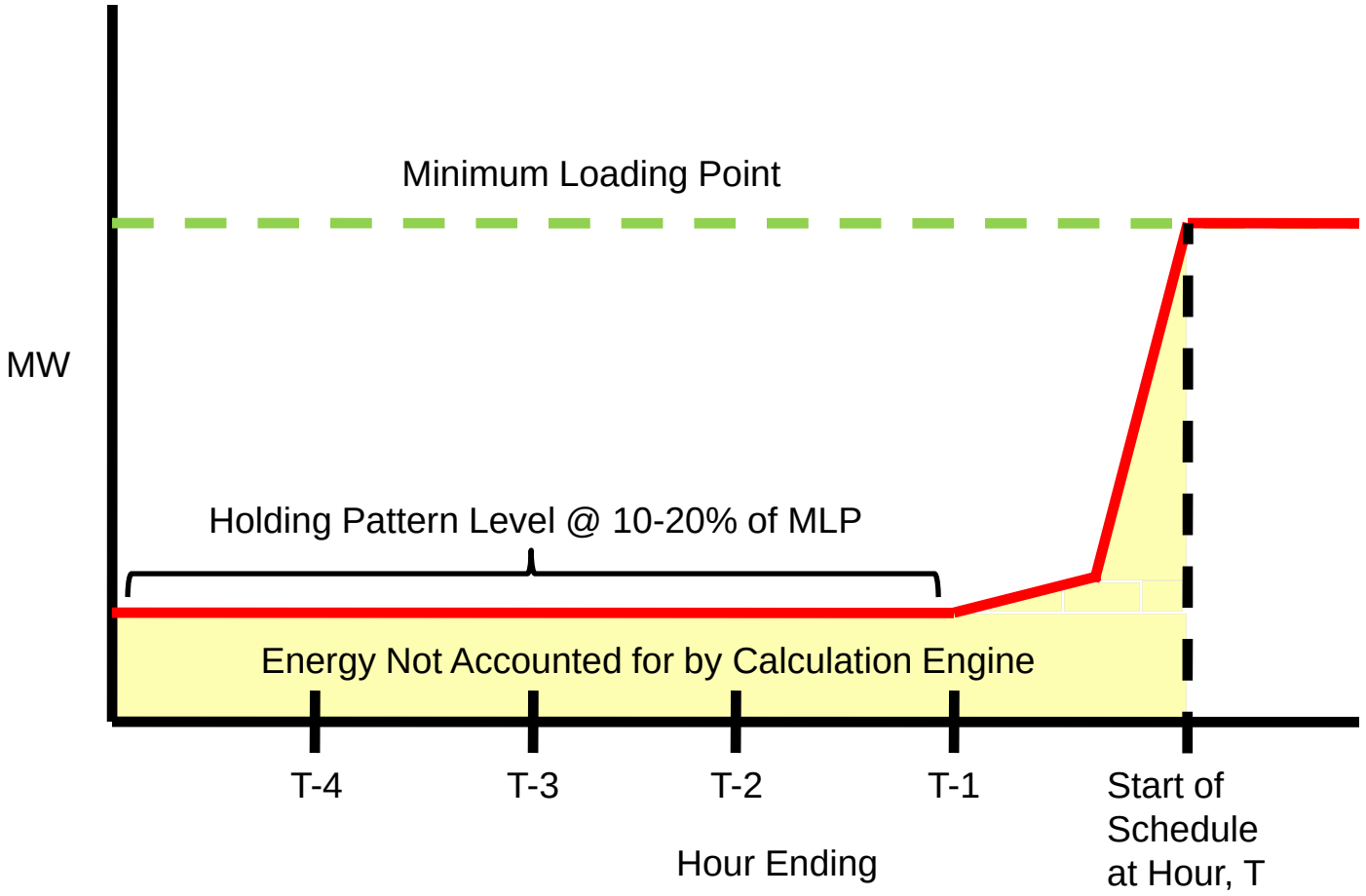
# Accounting of Energy From Ramping In EDAC

- The current optimization engine design ignores the energy injected into the grid while a generator ramps up to its minimum loading point from synchronization
- Is this unaccounted energy material enough adversely prejudice commitment?
- What are the financial implications to the market?

# Assumptions – Based on Conversations With CCU Participants

- Estimate of energy from ramping based on the start-up profile a typical CCU
  - CCU's generally have the slowest ramp amongst the generation fleet in Ontario
- When a CCU starts up, it ramps up to a 'holding pattern' profile of about 10-15% of its MLP
  - Depending on cold/warm start, the generator stays at this holding pattern for 2-4 hours
- After staying at this level, the CCU ramps up to MLP with a 'hockey stick' profile

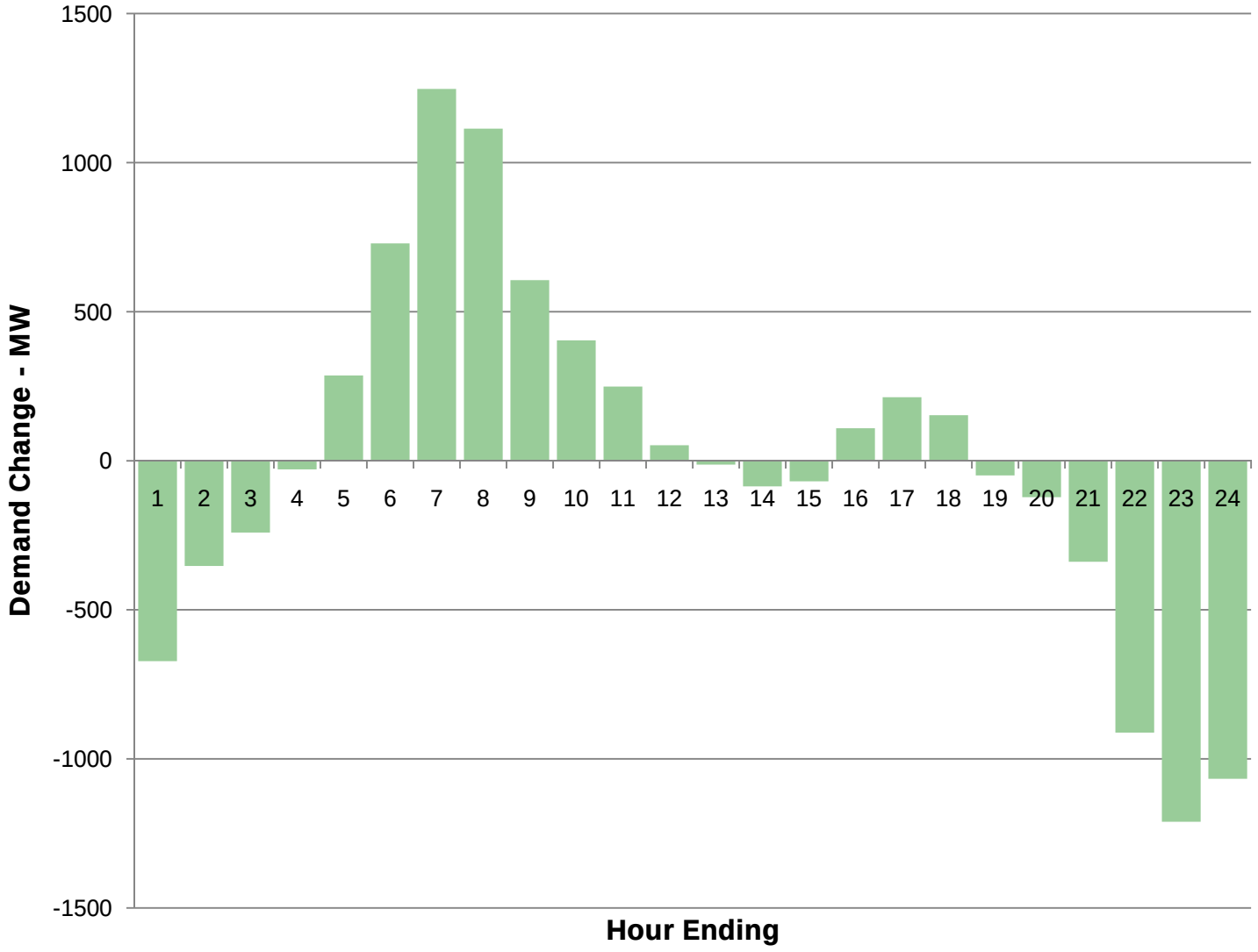
# Typical CCU Start-Up Profile



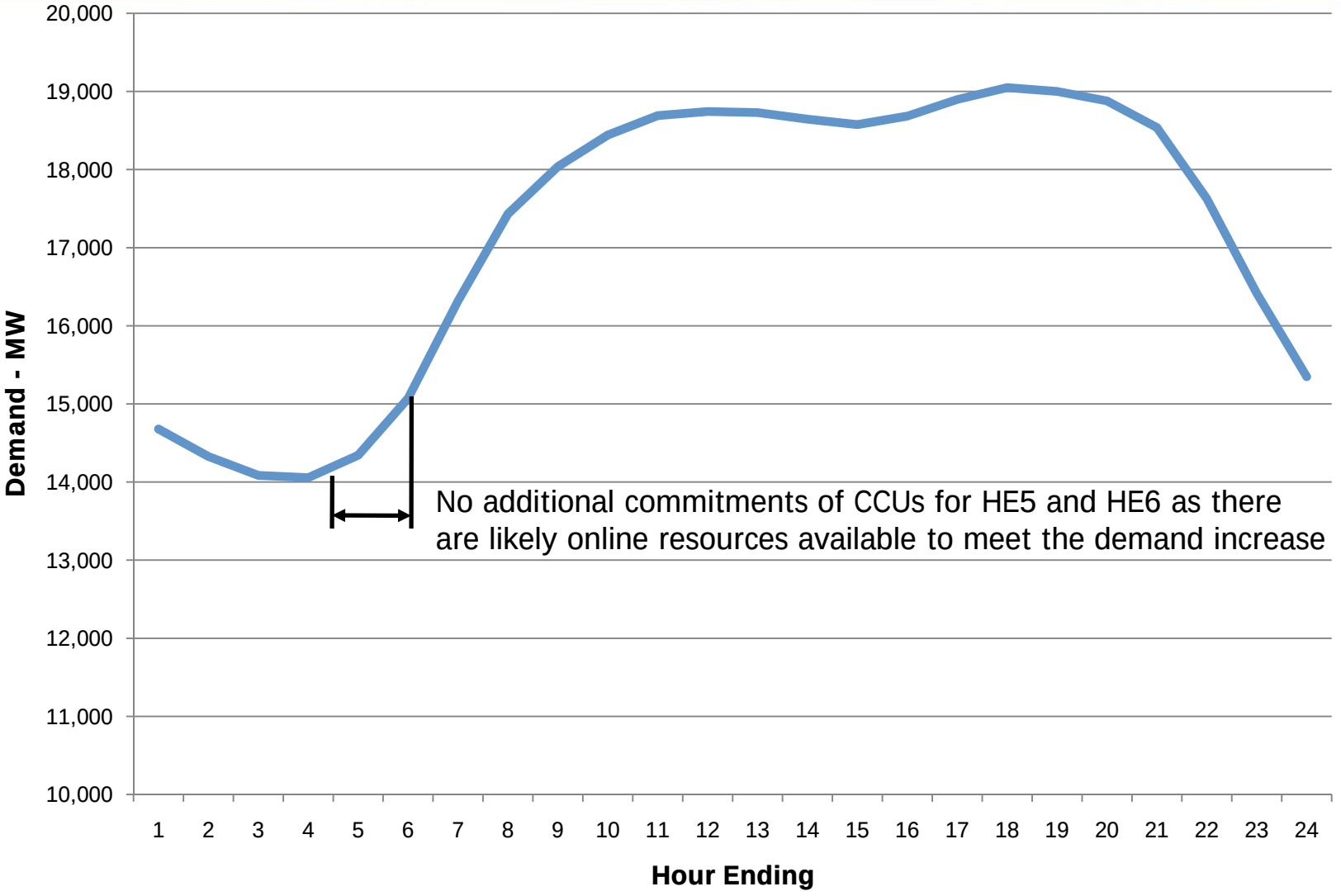
# When Would Ramping Energy Not Be Considered?

- It is only during times when demand increases would we need to consider the impact of ramping energy
- Most significant increases in demand occur between hours 6:00 to 7:00 and 7:00 to 8:00
- Historically (2006 – Oct 2008),
  - HE7 average increase is 1250 MW
  - HE8 average increase is 1100 MW
- The two most critical hours to consider for this analysis is commitment for HE7 and HE8

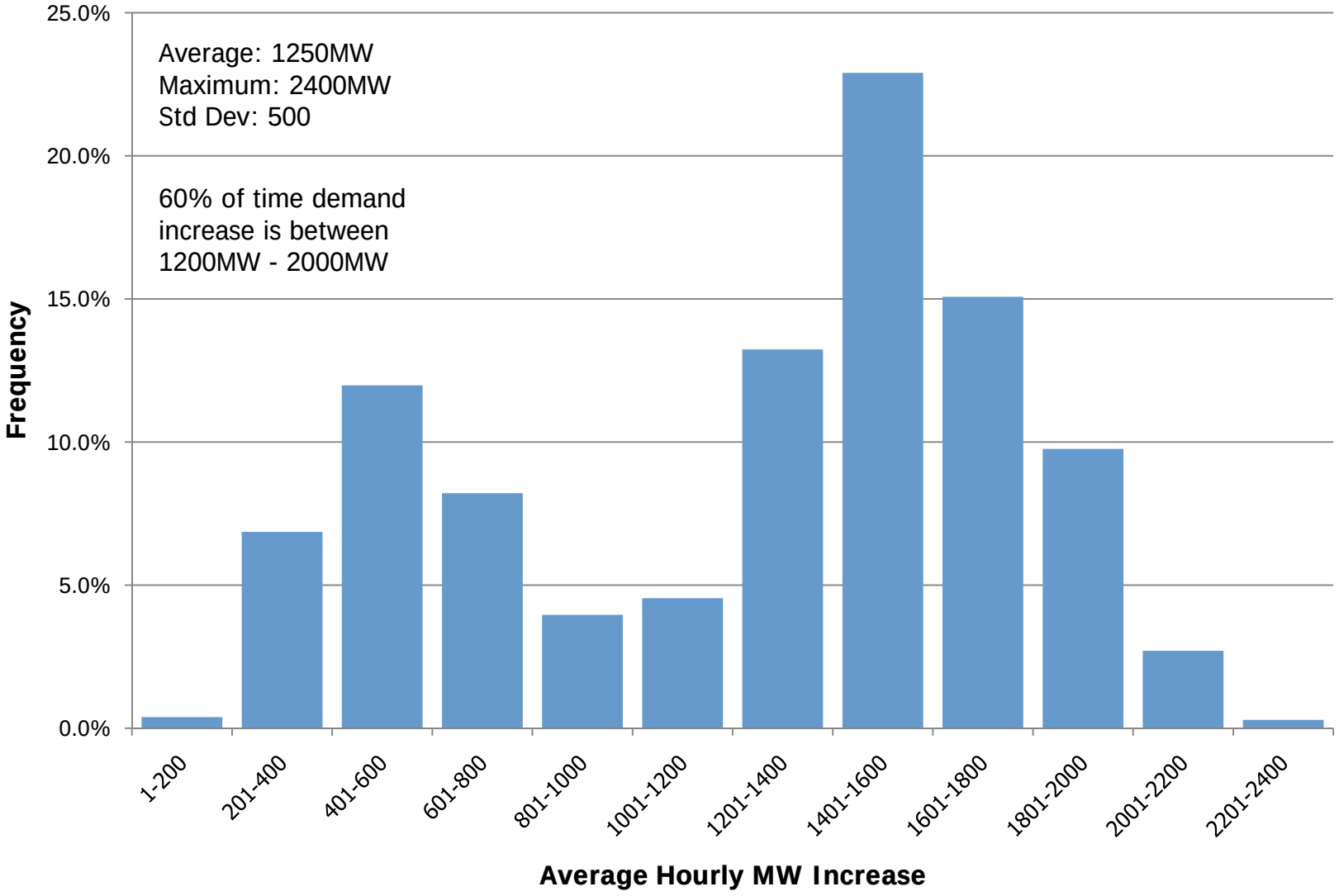
# Average Hour Demand Change 2006 – Oct 2008



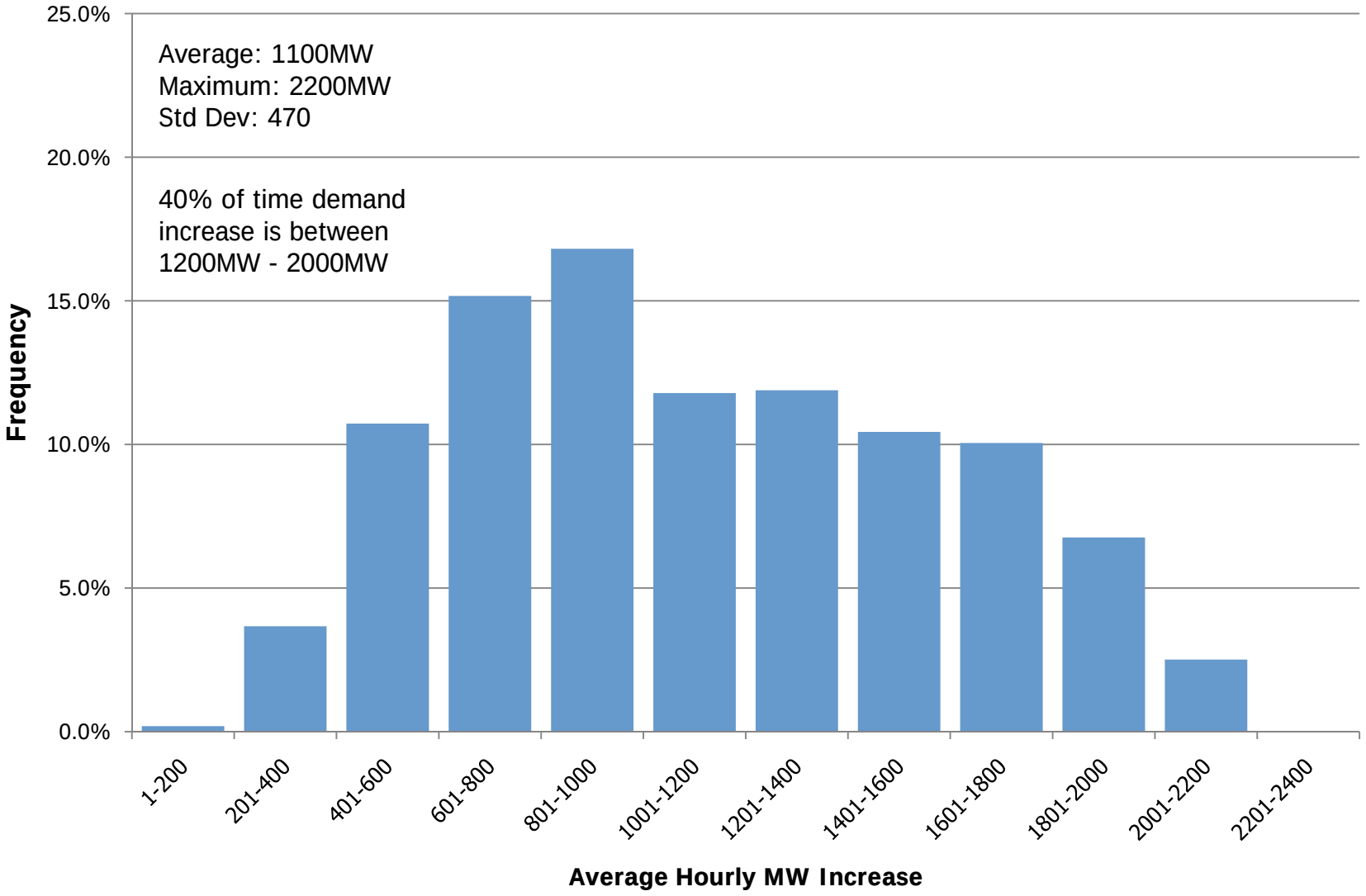
# Daily Demand Profile



# Demand Change in HE7



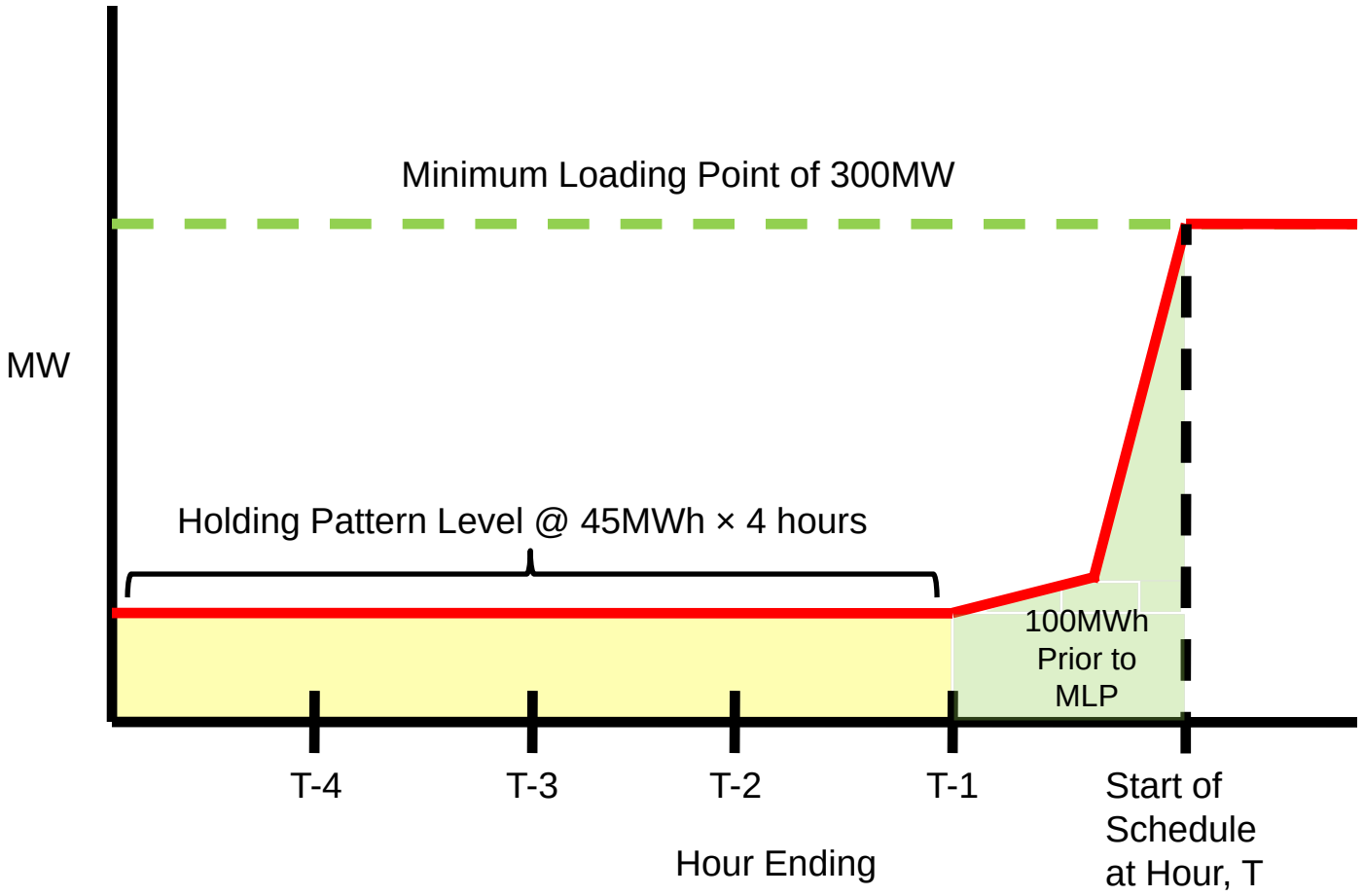
# Demand Change in HE8



# More Assumptions

- New generators in Ontario fleet will be predominantly CCUs
- Near future CCUs have capacities of 250MW – 1000MW
- To meet the demand increase of HE7 and HE8 we would commit additional CCUs
- For this analysis we consider hypothetical CCUs of 500MW with 300MW MLPs with the following estimates
  - Hourly energy injected during the holding pattern period is 15%×300MWh=45MWh, holding pattern will last for 4 hours
  - Energy injected in hour prior to commitment is 100MWh
  - Ramp from MLP is 8MW/minute

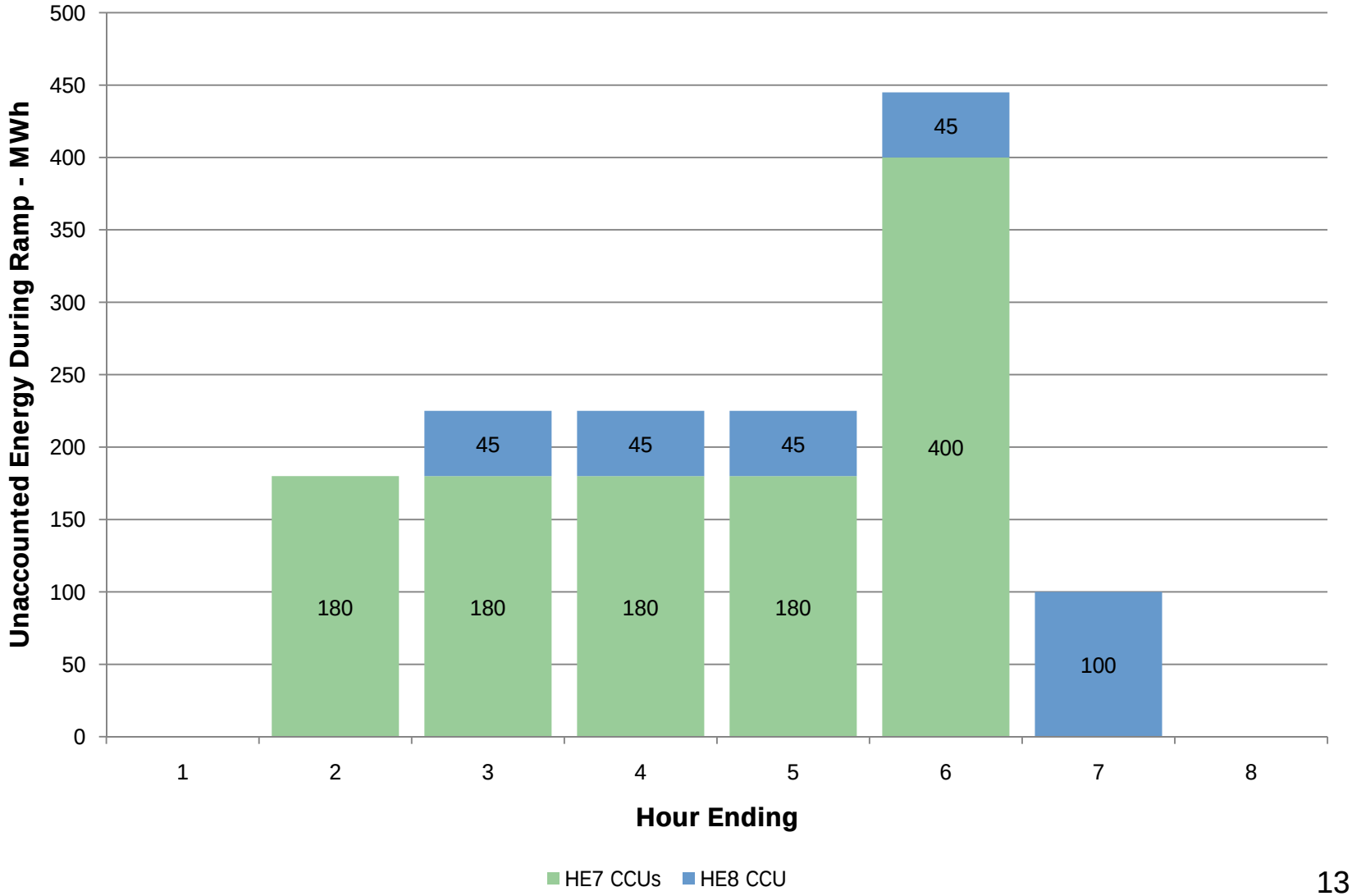
# Hypothetical CCU Start-Up Profile



# Estimate of Additional CCUs Committed for Demand Increase

- HE7, we need an additional 1200MW to meet demand
- HE8, we need another 1100MW to meet demand
- A very conservative estimate would be to commit 4 CCUs for HE7 providing 4×300MW=1200MW
- By HE8 the four CCUs would be producing at their maximum capacity totalling 2000MW, we would then need to commit another CCU to meet the HE8 demand increase

# Unaccounted Energy During Ramp



# Implications of Unaccounted Energy

- Could it lead to over-committing an extra non-quickstart?
  - Not likely, since HE2-HE6 are low priced hours, another larger non-quickstart would not be committed
- Could it lead to over-committing imports
  - Possibly – In particular to HE6 when there could be an excess of 400MW unaccounted for
  - How does this impact the market?

# Over-Commitment of Imports Impact to Market

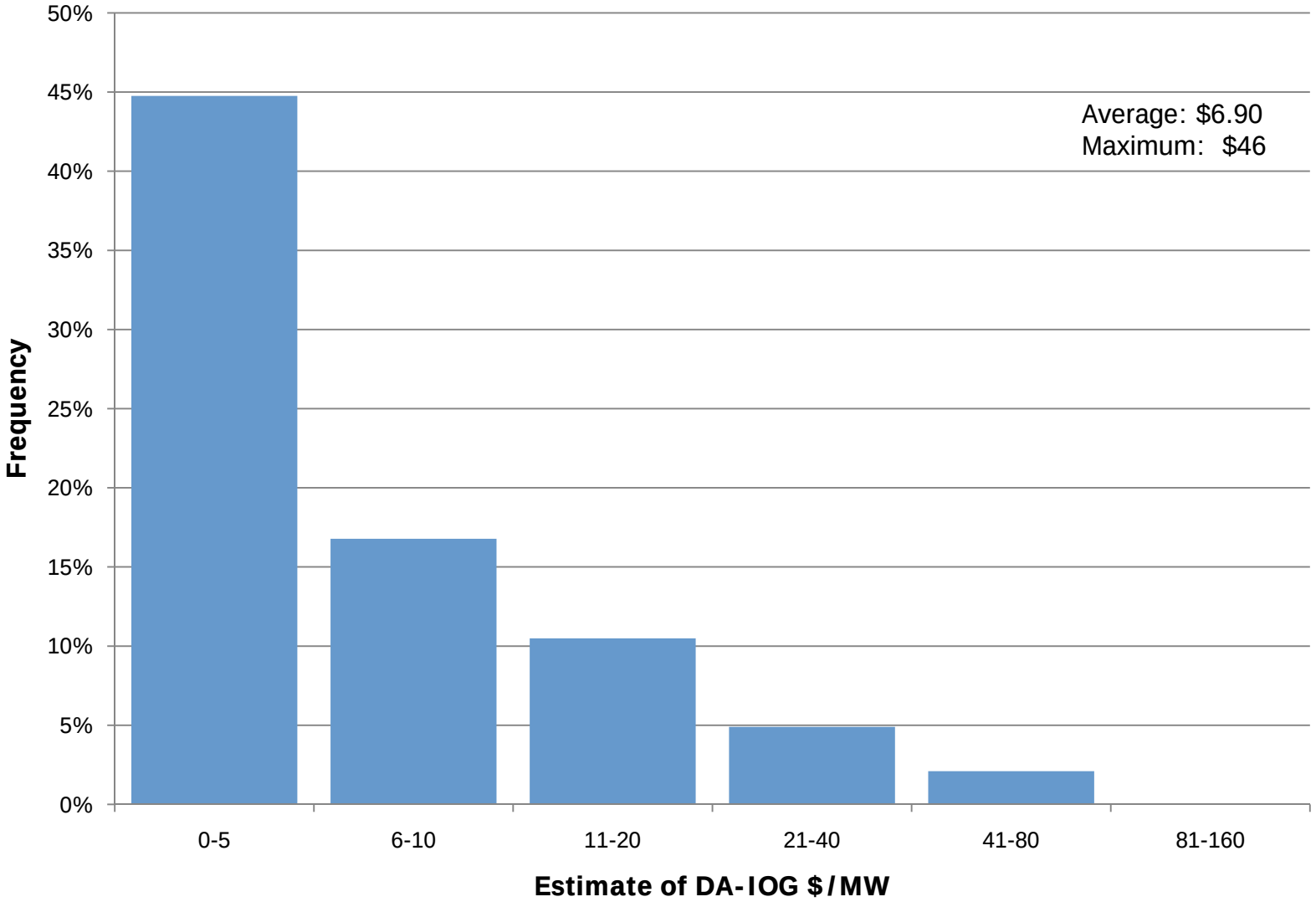
Overcommitment of imports could lead to:

- Price suppression – since committed imports are eligible for DA-IOG, they may offer in low in real-time to get scheduled and offset other more economical resources – likely to be low but difficult to estimate amount of suppression
- Increased DA-IOG payment
  - Most likely for HE6

# Estimate Increased DA-IOG Payment

- We could estimate this increase by making more conservative assumptions
  - Day-ahead offer of over-committed import is the PDoR price
  - DA-IOG per MW is the PDoR price minus HOEP
- For HE 6, the average difference between PDoR and HOEP when PDoR > HOEP is $6.90 (June 2006 – October 2008)
- On any given day, the increased DA-IOG paid would be $6.90/MW × 445MW x 60% = $1,842
  - Annually, this would be $672k

# Estimate of DA-IOG For HE6 (June '06 – Oct '08)



# Summary of Analysis

- Assessment of impacts due to ramping energy is based on very conservative assumptions – the numbers presented are upper bounds
- Unaccounted ramping energy would not likely cause over-commitment of larger non-quickstart units
- Over-commitment of imports could happen
- An estimate of the upper bound on the additional DA-IOG paid to over-committed imports is $672k annually

# Ramping Energy in EDAC Design

- The impacts from ramping energy are not material
- To date, no other ISO's optimization engine factors in this ramping energy in the commitment passes
- However, other ISO's do consider the ramping energy for scheduling
- We will implement option 3 to consider the ramping energy for scheduling in pass 3