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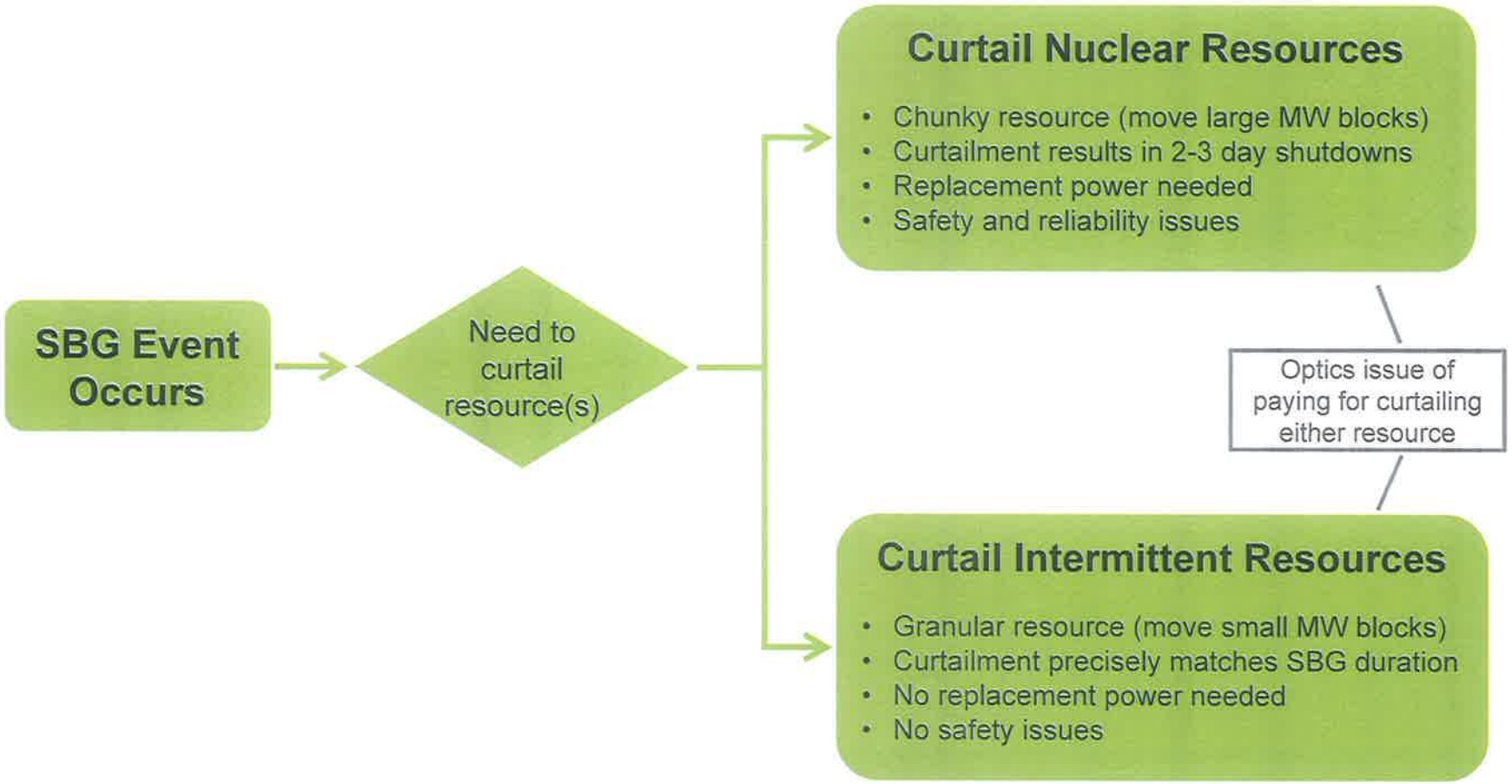
Overview of Curtailment and OPA Contracts

March 29, 2011

Agenda

1. FIT Curtailment provisions
2. RES Curtailment provisions
3. Cost of Curtailment

Efficient Curtailment



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FIT and Curtailment

FIT Facilities Operation During Positive Prices

- FIT Suppliers get paid for every MWh of generation
  - Their goal is to maximize generation (focus on good wind regimes) while also maximizing their operation in the IESO administered market (focus on optimal offer strategy)

FIT and the IESO Market

FIT Resources are price takers in the market

That means regardless of offer price, FIT gets paid 135 $/MWh

Therefore, they offer -2,000 $/MWh (Minimum Market Price)

Low offer price means they are among last resources operating and hence they can maximize production

This approach works well when system conditions are good on both a global and local basis

However, this approach creates issues when facing oversupply or congestion

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FIT Contract Provides Incentives to Curtail During Global Oversupply or Negative Prices

FIT Contract exposes Suppliers to negative market price (HOEP)

When FIT operates during a negative price hour, contract price is reduced by negative market price

Example:
HOEP -10 $/MWh
If FIT operates, Supplier receives
135 – 10 = 125 $/MWh
*Exposure limited to 0 $/MWh

Suppliers have 2 options

Continue to operate during negative price event

Will result in reduced revenue

Change offer price to signal willingness to curtail
For example, from -2,000 to 0 $/MWh

Pre-dispatch price
< 5 $/MWh
or
IESO issues Oversupply Advisory

If curtailed, will receive full contract price

Ratepayers pay when resource is not needed
However
It results in reduced system efficiency by having to curtail nuclear and/or hydro ahead of intermittents

Requires close monitoring and forecasting of market prices
BUT it allows Suppliers to receive full contract price while ensuring system efficiency

Either approach reflected in economics and financing of each FIT project

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FIT Operation: Local Perspective

FIT Suppliers' Perspectives

Suppliers can put themselves at the "bottom of the offer stack" (by offering -2,000 $/MWh) to operate during a local (congestion/oversupply) problem

System Perspective

During a local problem, other generators (those with higher offer prices, such as hydro and nuclear) will be curtailed before FIT

Analysis shows that it is more efficient to curtail intermittents ahead of nuclear and hydro

In order to achieve improved market efficiency IESO Market Rule changes are required:
- Implement dispatchability
- Limit offer prices for intermittent facilities

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FIT Residual Risks

- Current FIT Contract minimizes negative price risks for Suppliers as long as they are proactive in participating in the IESO market

- They can reduce their exposure to negative HOEP by adjusting their offer price and ensuring they curtail

- However, there are two circumstances where FIT Suppliers have risk exposure:
  1. There could be instances when they may not have proactively adjusted their offer price, but HOEP turns negative, reducing their revenues
  2. In situations when they change their offer price to avoid forecasted negative price events, they may be curtailed, and not receive their contract payment if the forecasted event does not occur

Improving System Efficiency

- Current market rules and FIT contract provisions do not ensure system efficiency

- Increasing system efficiency, requires:
  - IESO Market Rule Changes to:
    - Enhance visibility and forecasting
    - Ensuring 5 minute dispatchability
    - Limit offer price for all intermittent generators
      - Pushes them above hydro and nuclear in the offer stack
  - FIT Contract Changes:
    - Reflect market rule changes and ensure incentives are aligned
    - Section 1.7 requires OPA to indemnify Suppliers from material economic impacts of IESO Market Rule changes
      - OPA has issued letter to FIT contract holders acknowledging this obligation

FIT Economics: Current vs. Future

Current

1. **Regular conditions**: FIT can produce whenever the wind blows and receive full contract price
2. **Global Oversupply**: Offer price can be adjusted to curtail and still receive full contract price
3. **Local Issues:** Avoidance of local issues through a low offer price, resulting in continued operation and receipt of full contract price
4. **Residual Risk**: Some minor residual risk

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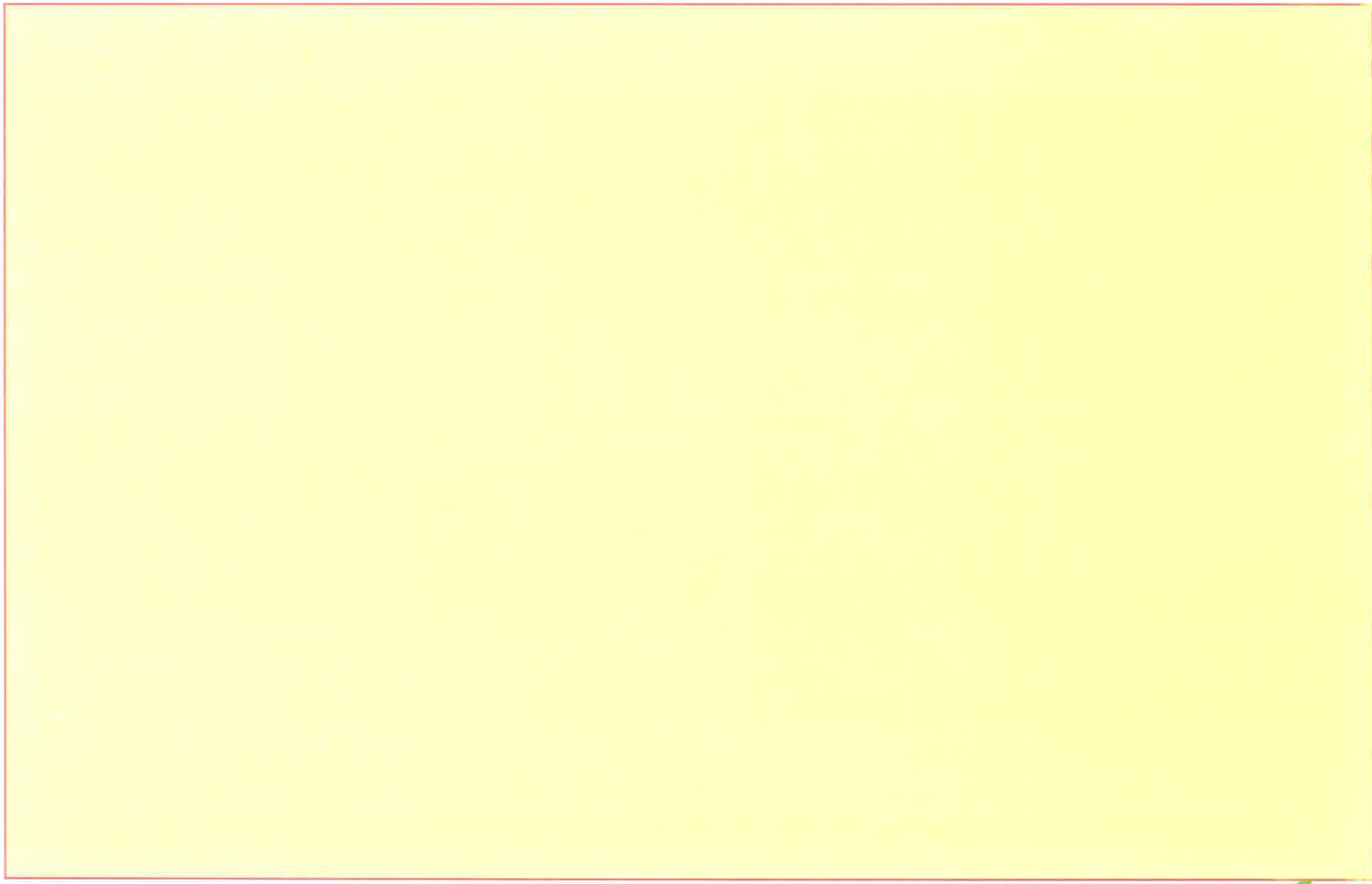

* Does not include existing RES Wind capacity on system

FIT: Summary

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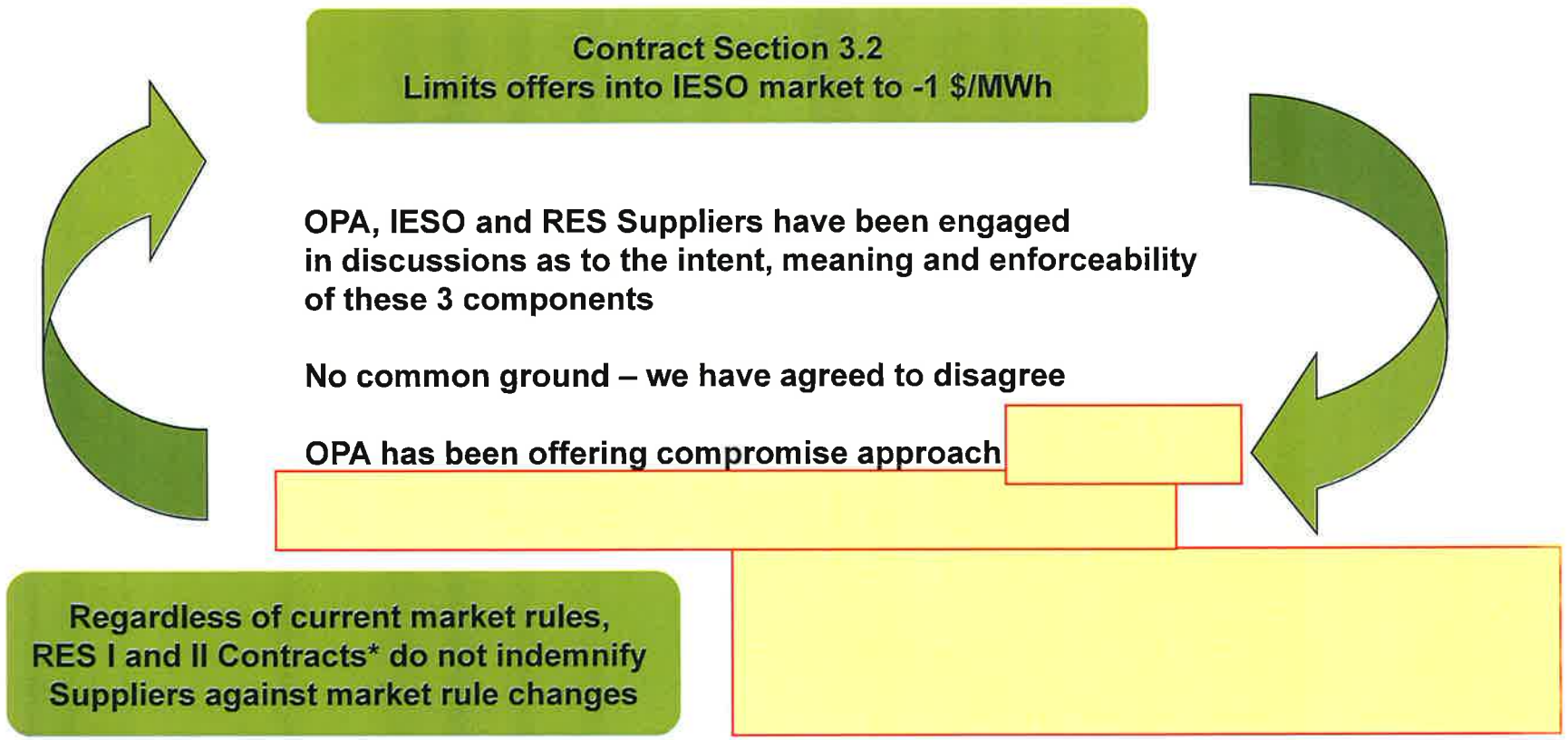
RES Contracts and Curtailment

How are RES Contracts different?



* *RES III contracts provide market rule protection*

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Negotiations with RES Group

OPA Offer - December 2010
OPA pays for local curtailment
RES Suppliers bear costs of global curtailment

RES Proposal - February 2011
OPA pays for all curtailment costs
Upgrade, operation and administrative costs shared between RES and OPA

OPA Offer - March 2011
OPA pays for local curtailment
RES Suppliers bear costs of global curtailment
But OPA will pay for all foregone generation when, on an annual basis, global curtailment exceeds a certain annual production cap

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Costs of Compromise Approach

- OPA has proposed to cap RES Suppliers global exposure to an annual amount of generation equal to:

- The following table outlines the curtailment costs under the compromise approach based on various SBG scenarios
  - Assumes a 30% capacity factor and 60/40 split of local vs. global curtailments

- Assuming negotiations with RES Group are successful, the total cost of the compromise approach will depend on:

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RES Negotiations: Next Steps

- OPA letter to be issued March [30]
  - IESO letter will also be issued stating that market rule changes will be introduced in the near future which will facilitate dispatch of RES facilities

Comparison of Curtailment Costs

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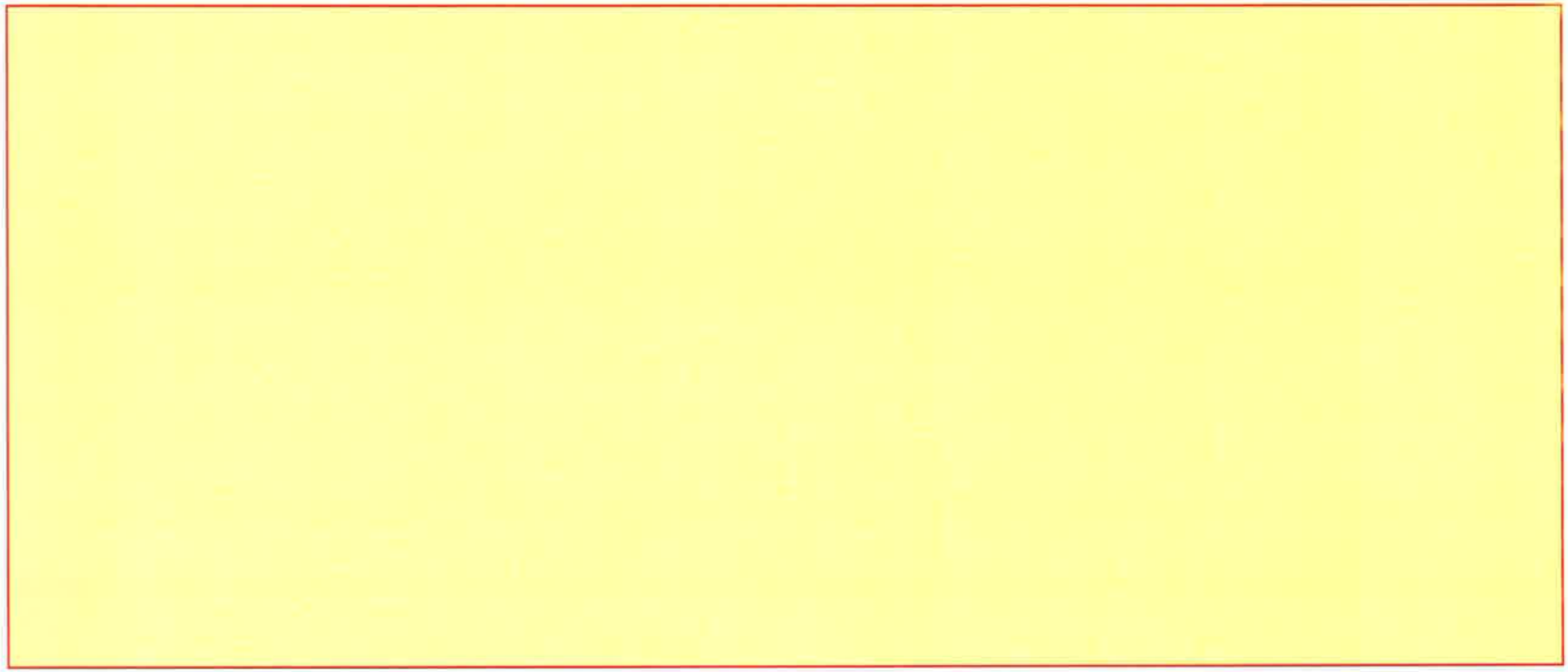
Costs of Replacement Power

- Replacement power is generally needed when curtailing nuclear units for short-term oversupply events (SBG – surplus baseload generation)
- Avoiding the need for replacement power leads to the lowest cost option of addressing SBG events for the ratepayer

- Note that annual incremental curtailment costs will vary based on extent of SBG and the resources curtailed and those used for replacement power

Why are Contract costs unavoidable?

- Power Purchase Agreements (PPAs) only pays generators when they produce
  - This incents facilities to maximize production, which is important during times when the electricity is needed
  - OPA has PPA-style contracts with:
    - Renewable resources: RES, RESOP, FIT, HCI, Renewable CHP
    - Nuclear resources: Bruce Power



* Depending on outcome of negotiation around curtailment compensation

Curtailment – Total Annual Costs

- Table below outlines total annual costs based on the SBG scenarios

- Using wind to curtail can result in ratepayer savings by avoiding replacement power

** Assume a 50/50 RES/FIT split with OPA paying for all curtailment*

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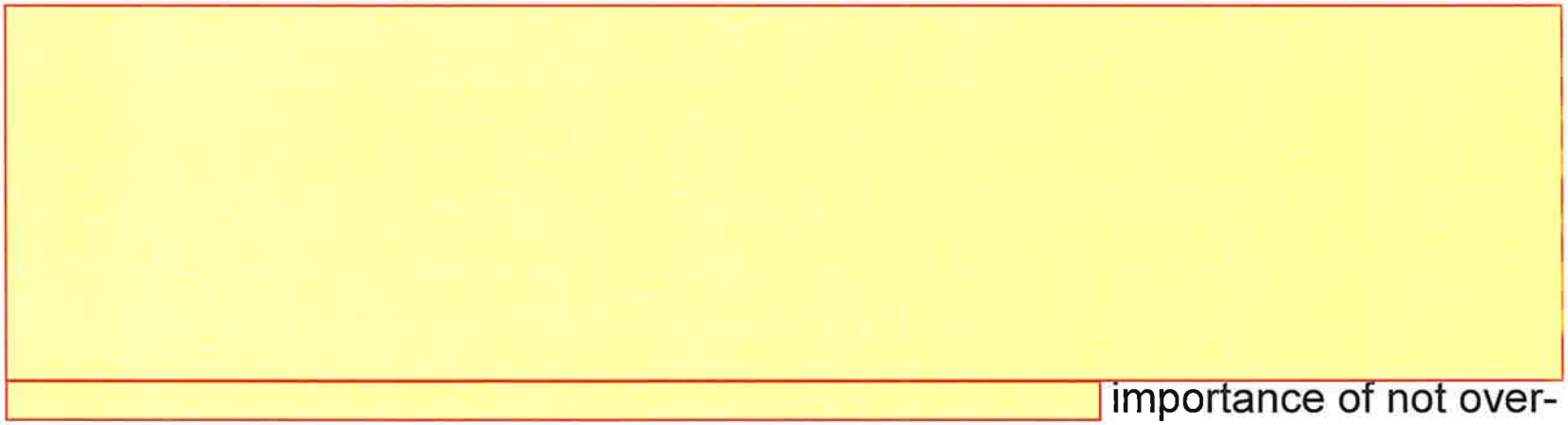
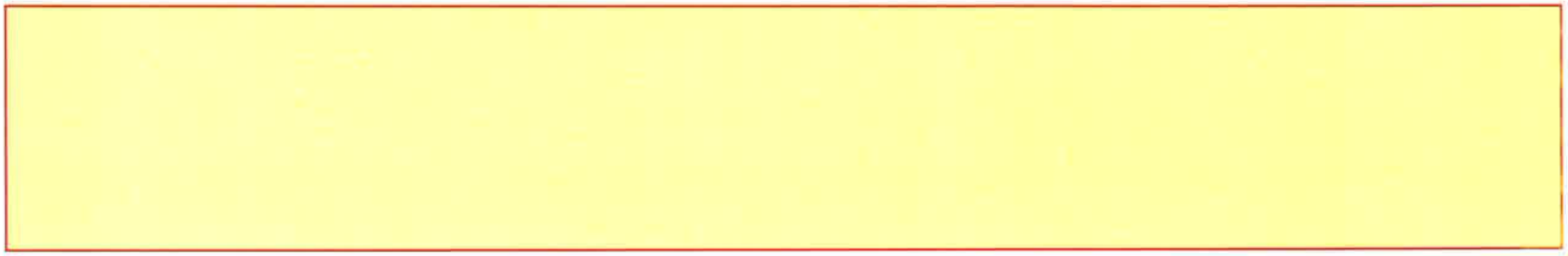
Summary

- Impossible to accurately forecast curtailment costs
  - Numerous variables that change from year to year impact the calculation (e.g. weather, demand, resource mix, and resulting SBG hours & depth)



importance of not over-procuring resources and ensuring new resources are placed in the correct locations

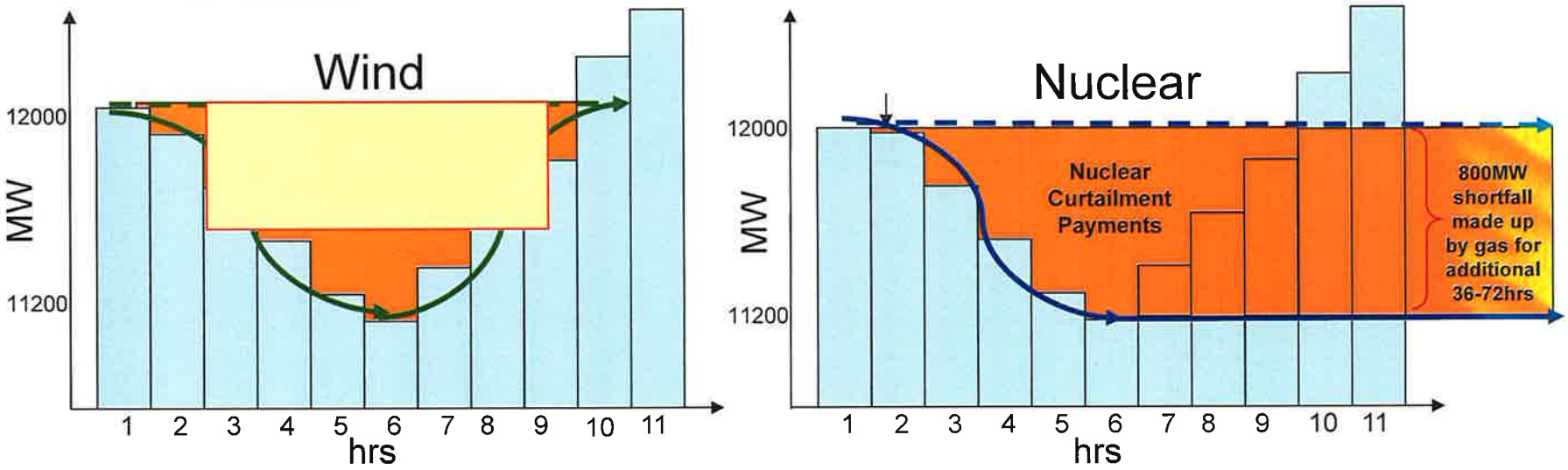


Appendix

Curtailment and Granularity

- Example: Addressing a single 800MW maximum, 8hr SBG event

  - However for nuclear resources, ratepayers pay for **incremental natural gas** generation beyond the end of the SBG event



- **Resource "Chunkiness"** - additional costs arise when curtailing nuclear because:
  - When depth of SBG event differs from size of nuclear unit, system will be turning off excess baseload capacity (e.g. meeting a 500MW surplus by turning off 800MW unit results in a 300MW delta being made up with higher cost resources)
  - Nuclear unit ramp rates (up and down), and high minimum loads, do not allow for the following of load as closely as could be accomplished with wind

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