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Integration of Renewables: RES and FIT

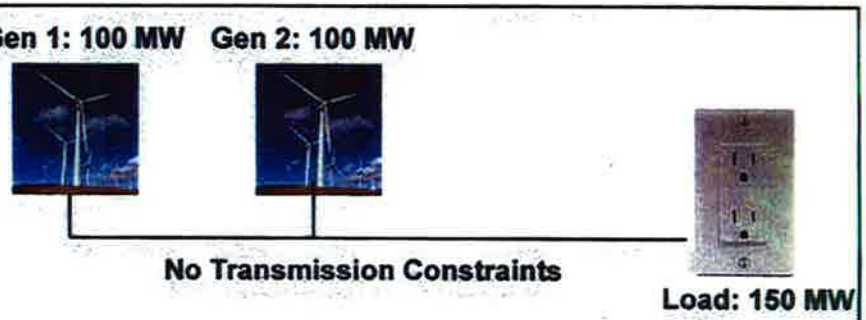
Ministry of Energy Update

October 29, 2010

Understanding Oversupply and Congestion

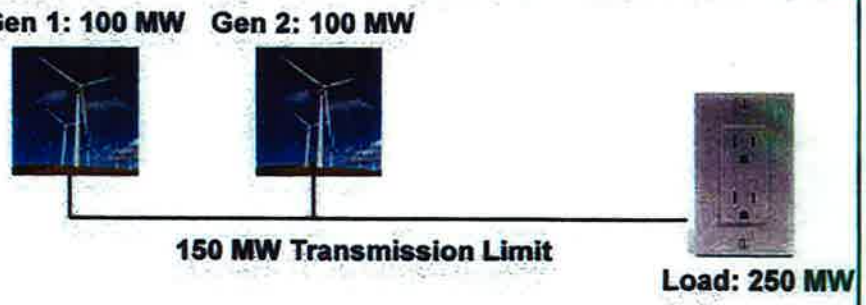
Global oversupply is generally driven by general lack of demand affecting substantially all of the system

In this example, there is 50 MW of *oversupply* result from having more supply than demand



Local curtailment can also be driven by general lack of demand and/or by transmission limits

In this example, there is 50 MW of *congestion* due to transmission limits



Oversupply is affected by the lack of balance between supply and demand, which are driven by many factors

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Oversupply: A temporal issue here to stay?

- Oversupply is looming in the near term as more resources come on line
  - Ontario's nuclear capacity alone is often sufficient to meet demand overnight
- Relief is possible in the "bathtub years" but…
  - Surplus Baseload Generation (SBG) likely to remain as a problem
  - Currently during surplus baseload (oversupply) situations, generators are dispatched off according to the price they bid into the IESO market
    - To continue running in oversupply situations generators may bid prices down to -2,000 $/MWh price floor
      - OPA Contracts need to provide the right incentives to motivate efficient market behaviour through either (a) exposure to negative prices or (b) offer restrictions
    - The IESO's planned introduction of dispatch protocols for intermittent generation could improve this situation
      - IESO is exploring changes to dispatching protocols during oversupply situations – modification of 5-minute economic merit order dispatch to incorporating longer-term issues (akin to an administrative dispatch)

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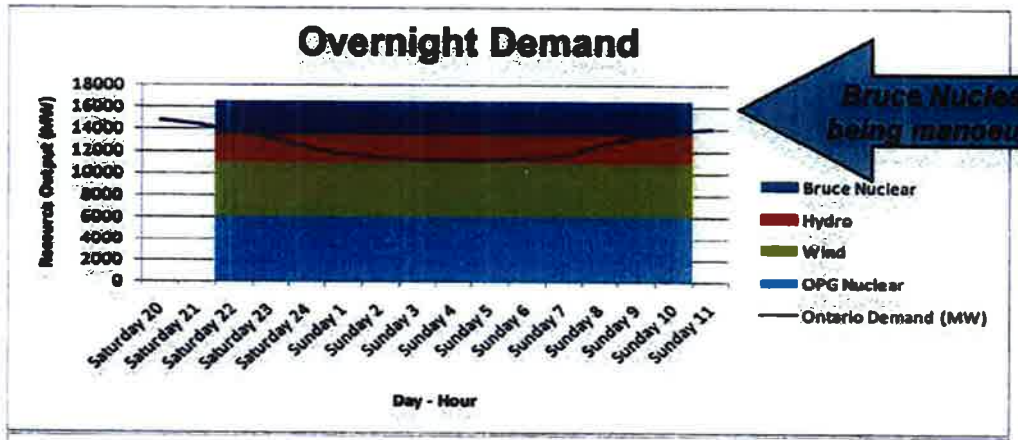
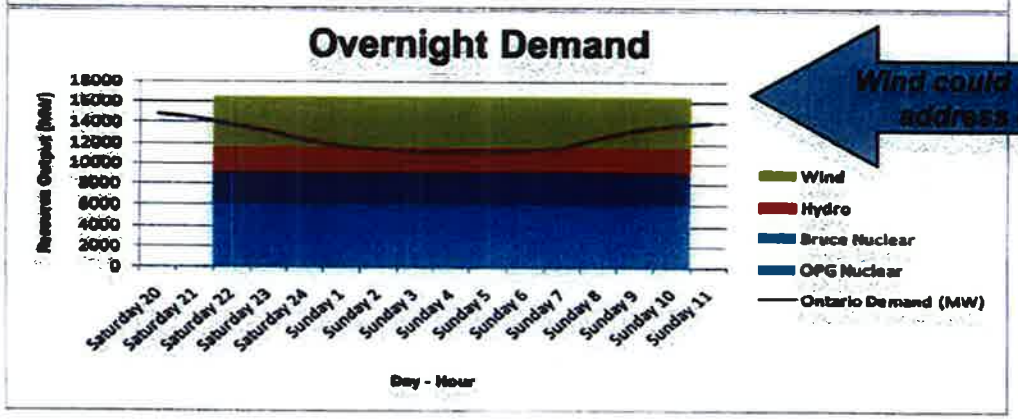
Curtailment Order Matters

- Ideally wind would be dispatched off before baseload hydro and nuclear given that it can be curtailed on short notice, with few regulatory issues (unlike hydro) and for short periods of time (unlike nuclear)





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Examining Trade-offs

Nuclear

- Long shutdown/return times (2-3 days)
- Highly complex operations to manoeuvre
- Greater likelihood of breakdown or error
- Limited dispatch granularity (i.e. entire unit has to be shut down – high minimum load)
- Impacts on operations and maintenance and longevity of units

Water

- Less complex than nuclear but regulatory restrictions are growing
- Safety concerns related to spill and hydro operation
- Some dispatch granularity

Wind

- Operationally less complex with fewer limitations
- Unknown/Little safety or regulatory concerns
- Greatest potential for dispatch granularity

All resources will rightfully claim that dispatch has a wear and tear impact

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The Economics of Curtailment

Wind Curtailment Cost		Other Resources Curtailment Costs
Payment to OPG and small Hydro for Production	=	Payment to OPG and small Hydro for Production
+ Payment to OPG Nuclear for Production	=	+ Payment to OPG Nuke for Production or Curtailment (through increased rates)
+ Payment to Bruce Nuclear for Production	=	+ Equivalent Payments to Bruce Nuclear for Lost Production
+ Curtailment Payment to Wind Suppliers for a Few Consecutive Hours of Curtailment	=	+ Payment to Wind Suppliers for Production
	<	+ Cost of Natural Gas Production (or imports) to Offset Lost Nuclear Production
	<	+ Environmental Impacts of Using Natural Gas (or Imports) to Offset Lost Nuclear Production
Total Costs of Paying for Wind Curtailment	<	Total Costs of Not Paying for Wind Curtailment

Bruce Nuclear gets paid whether it operates or not, and due to the longer down-times for nuclear, replacement gas production is needed, resulting in higher costs.

It is therefore more cost-effective to pay for wind to curtail than paying for nuclear or hydro curtailment.

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Oversupply - Minimizing its Occurrence

- Suppliers are arguing that the OPA should take on the risk with respect to oversupply, because the OPA is:
  - Responsible for the addition of generation in the province through procurement
  - Determines the supply mix and is responsible to plan future generation and transmission to meet needs

- Existing contracts' risk profiles need to be taken into account as Contracts evolve

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Oversupply – Managing when it Occurs

- Current situation is not efficient for the system as a whole
  - For example, curtailing Bruce Power for an overnight problem is not efficient as shut-down nuclear capacity has to be replaced for the next 2 days, resulting in higher costs for replacement power
    - However, curtailing a nuclear facility ahead of a wind facility may be appropriate for longer oversupply events
- With oversupply being a reality, the IESO recognizes that changes are needed to address dispatch order during SBG events:
  - Potentially moving towards incorporating longer-term decision-making into dispatch model
  - Working on Policy White Paper
    - OPA has been involved and will be asked to review paper, along with Ministry
- As IESO's policy gets developed, OPA has to ensure that the Contract structures and incentives align for optimal results
  - OPA currently examining RES and FIT to pay for curtailment
  - Need to also assess incentives/clauses in hydro-electric and nuclear contracts

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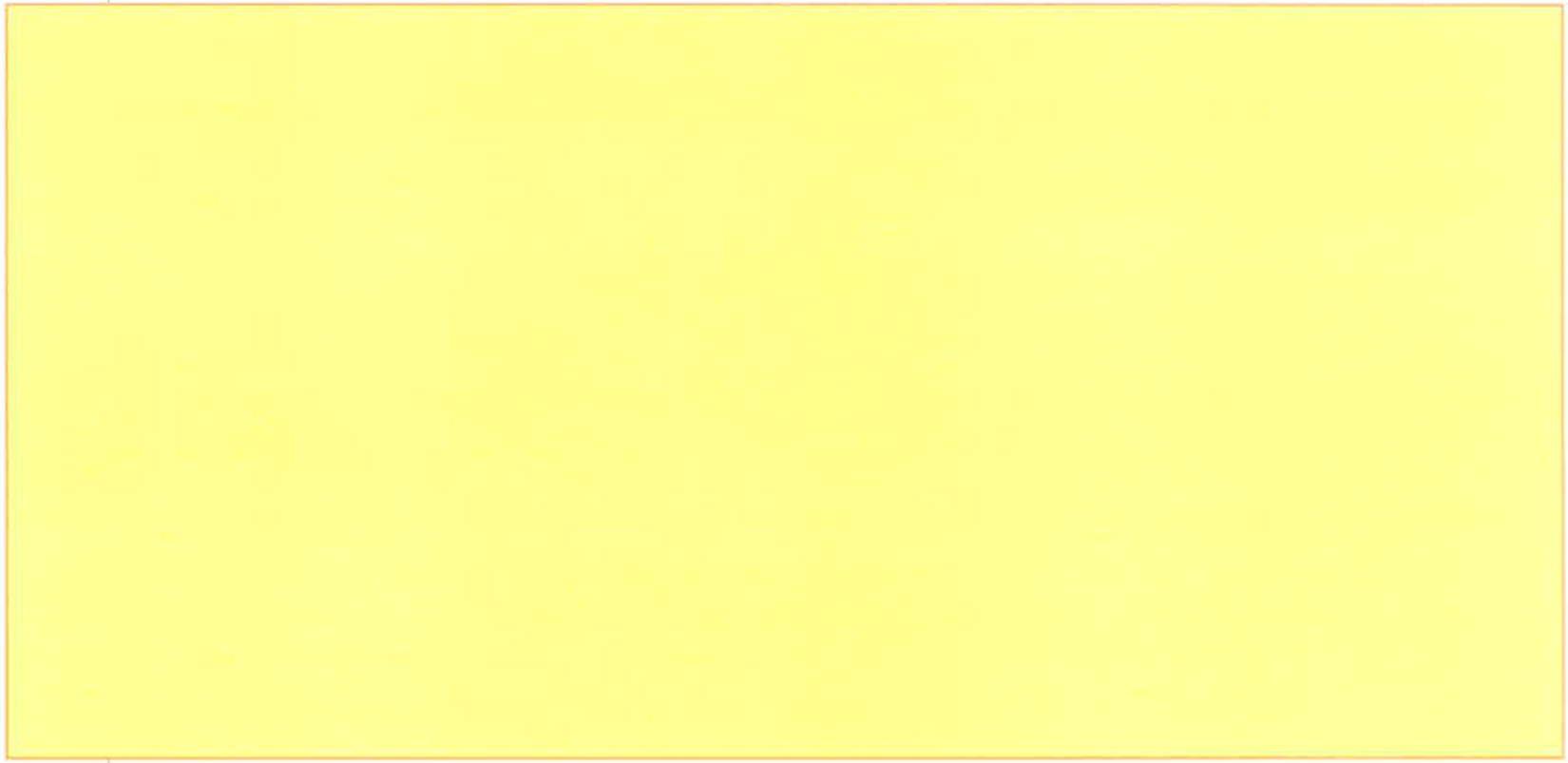
OPA Contracts: Efficient Risk Sharing

- Intent of contracts is to alleviate the risk associated with capital cost recovery due to volatility of an 'energy only' market



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FIT

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FIT Curtailment Mechanism

- **FIT has a mechanism for incenting curtailment during global oversupply**
  - If 1hr pre-dispatch price falls below $5/MWh **or** the IESO has published an "over generation advisory" **and** a generator receives a dispatch order
  - If Suppliers choose to avail themselves under the right conditions, they will receive their full contract price for the lost production
  - Generators can also decide not to curtail and be exposed to negative prices (which will be deducted from their contract price)
- **However, FIT resources have no incentive to be curtailed during local oversupply as there is no payment for lost production**
  - They are not exposed to any negative local price or other penalties/incentives vis-à-vis local oversupply/congestion
  - The expectation is that most generators would "run away" from local oversupply by offering minimum market price of -2,000 $/MWh
  - This results in inefficiencies as other resources (nuclear, hydro) will be dispatched off instead

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RES

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RES Issue: Background

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RES Group Proposal

- OPA, IESO and RES Group have been working together on this issue
  - In the summer, OPA received latest proposal from RES Group

- OPA committed to continue to work on the issue and get back to Suppliers on results of joint IESO & OPA activities aimed at improving the integration of renewable resources

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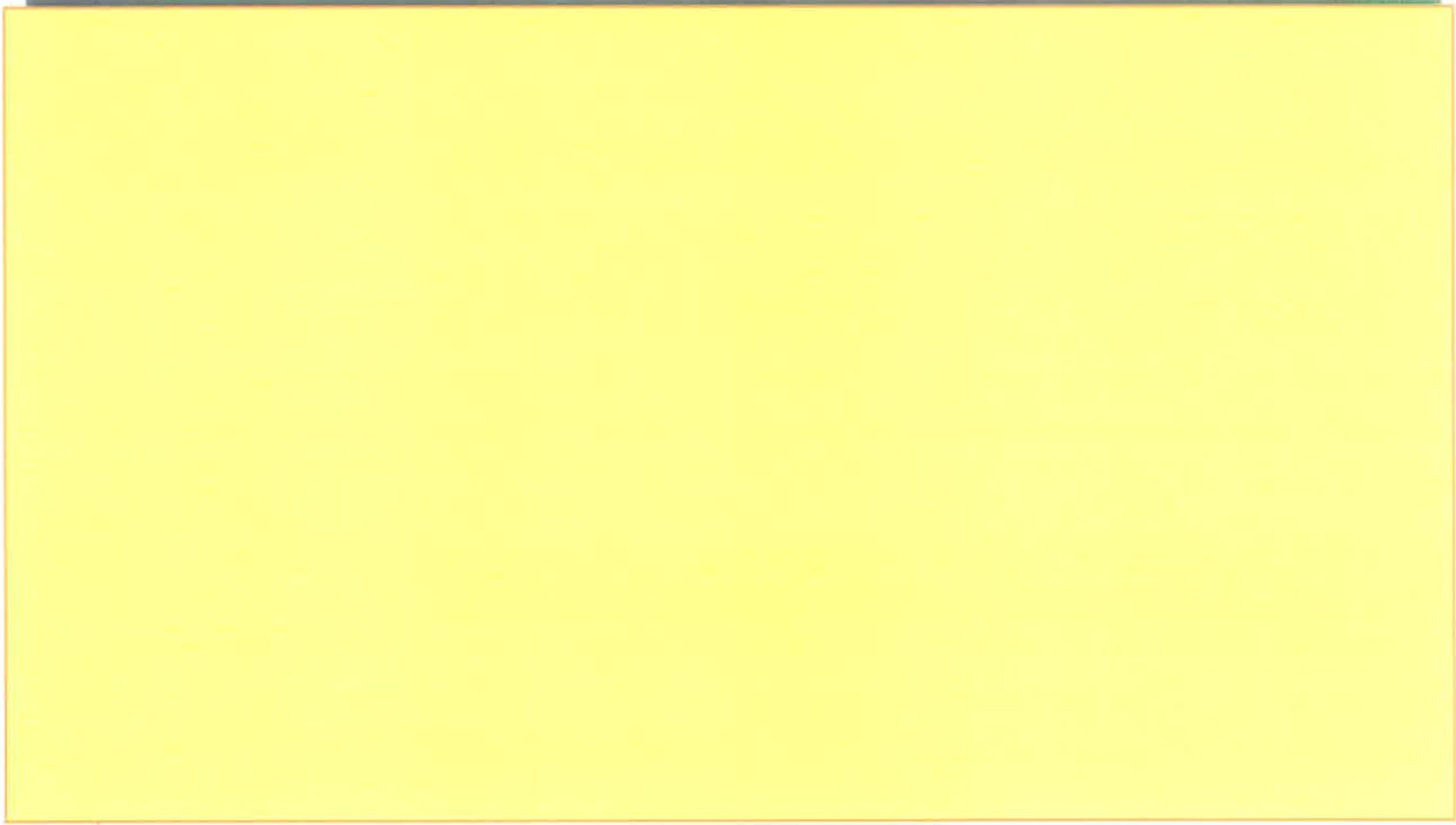
Financial Impact of Curtailing RES Suppliers



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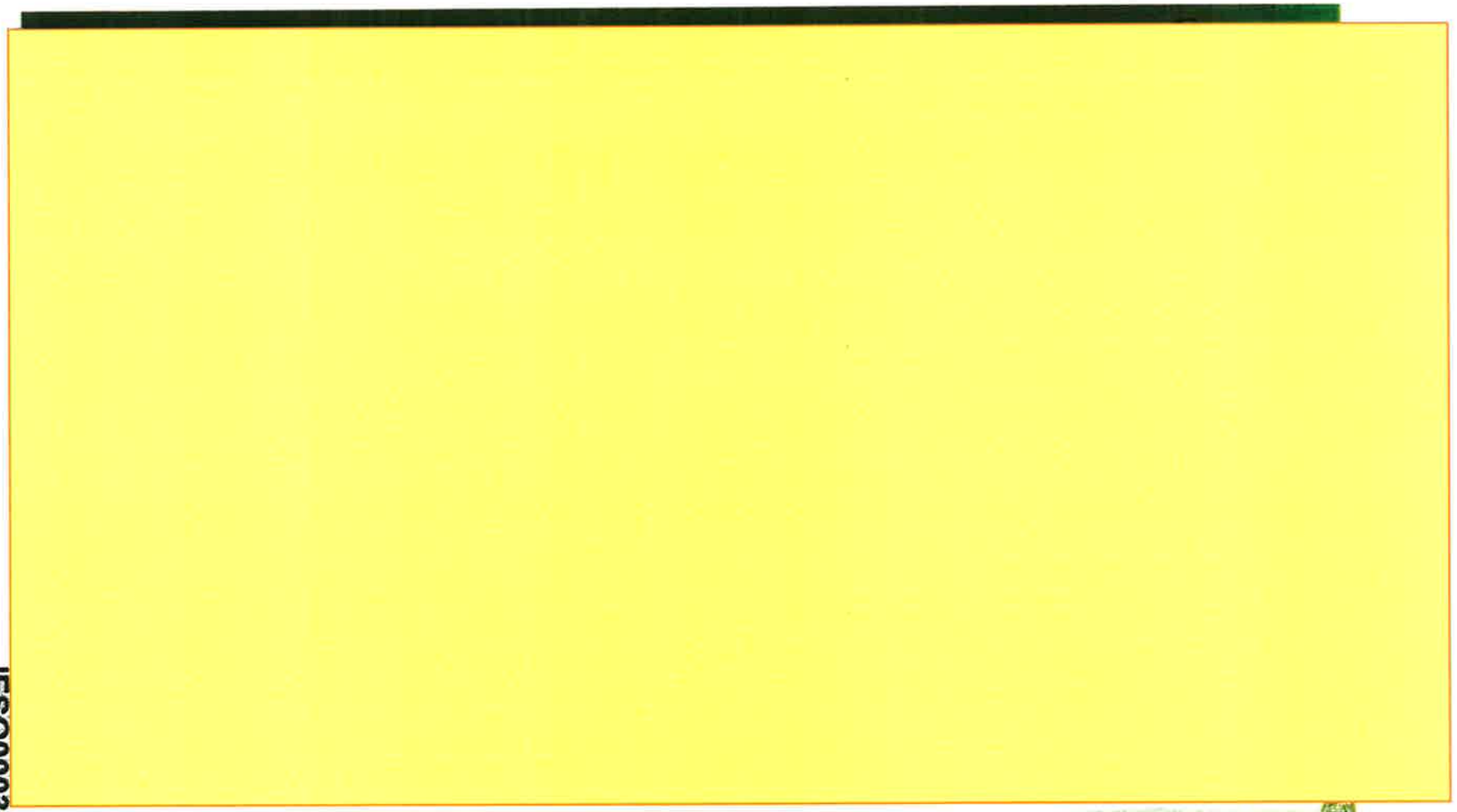
Example Costs for RES (2009)



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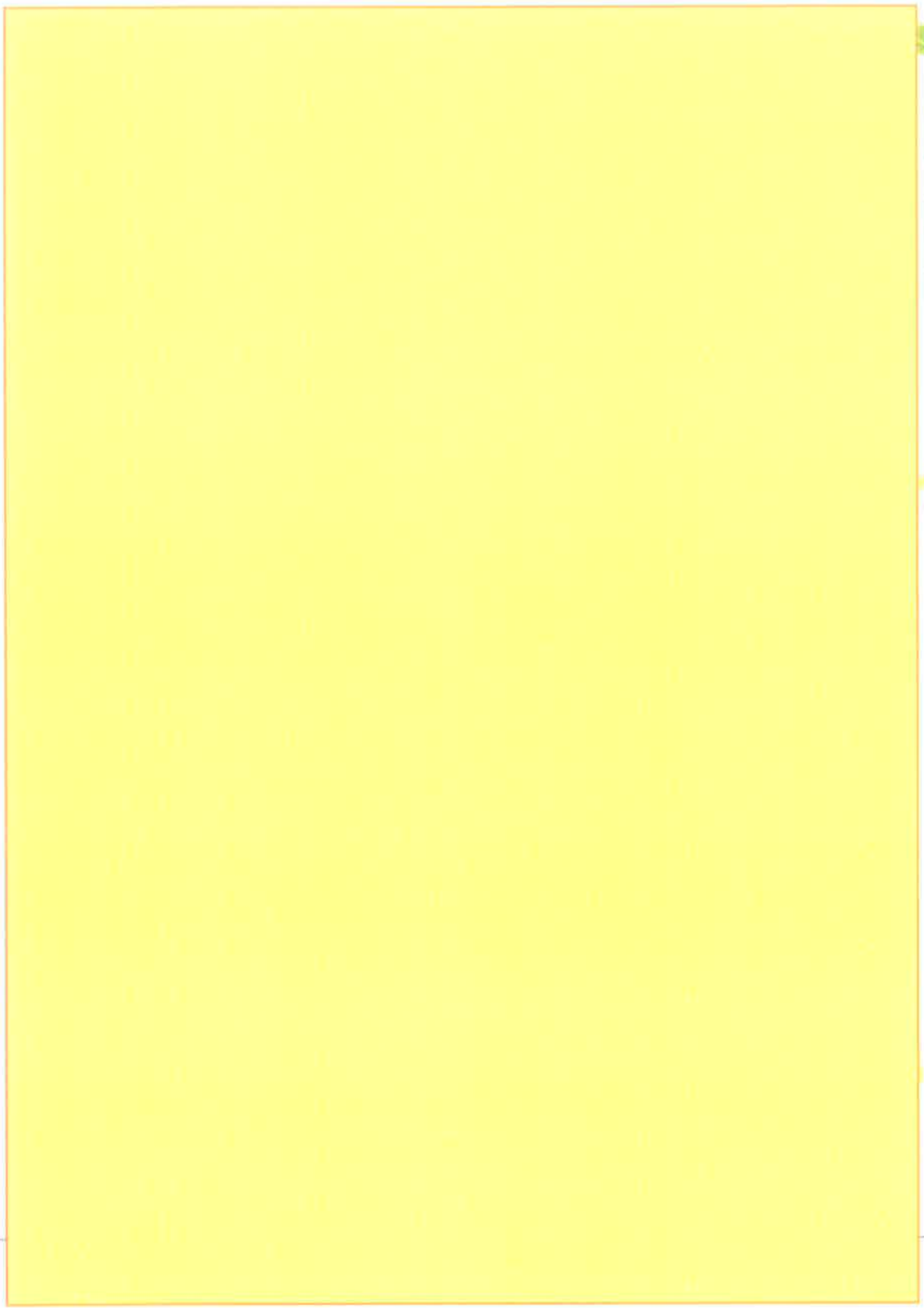

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CONCLUSIONS

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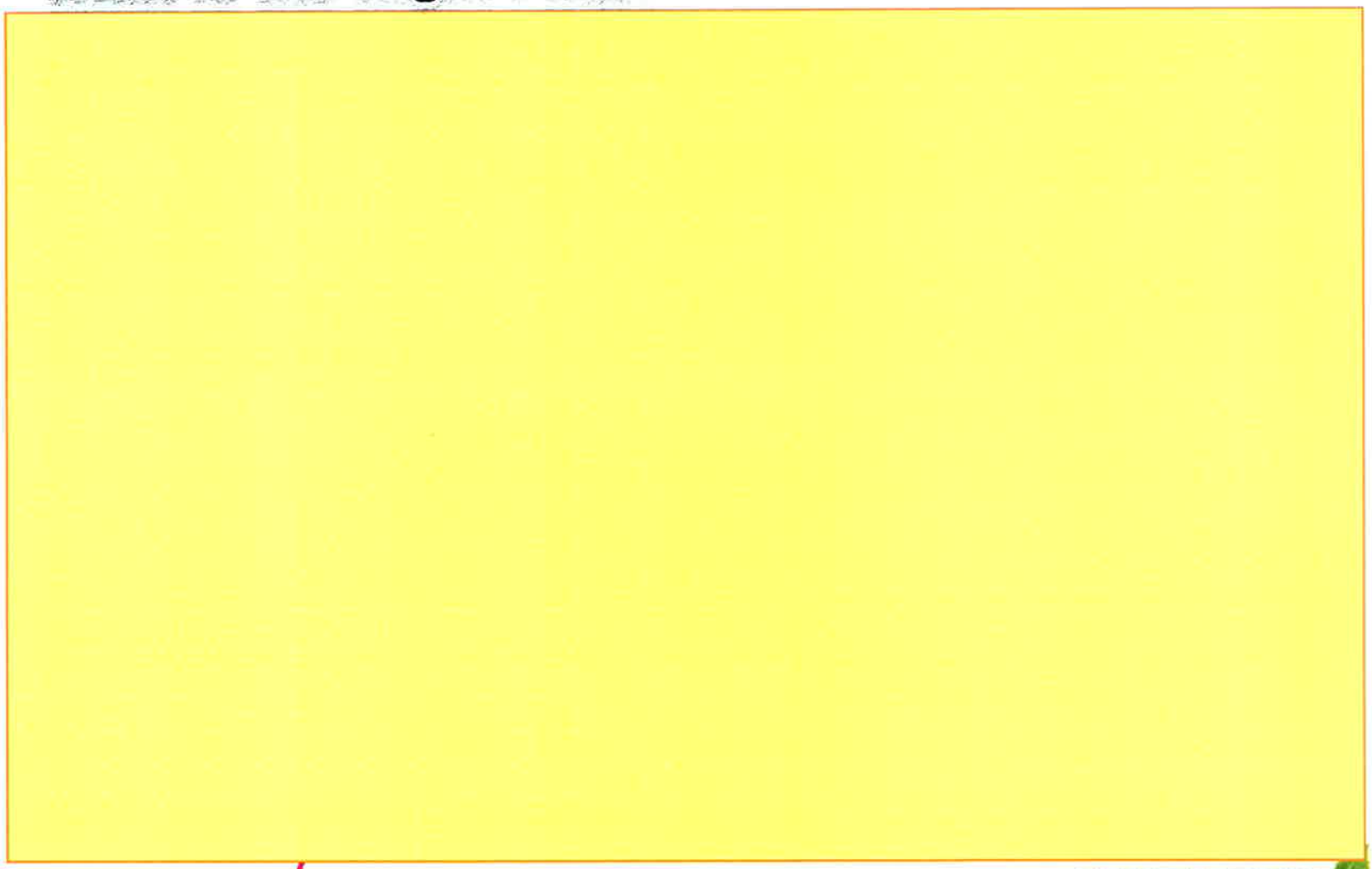
What is the Right Path?



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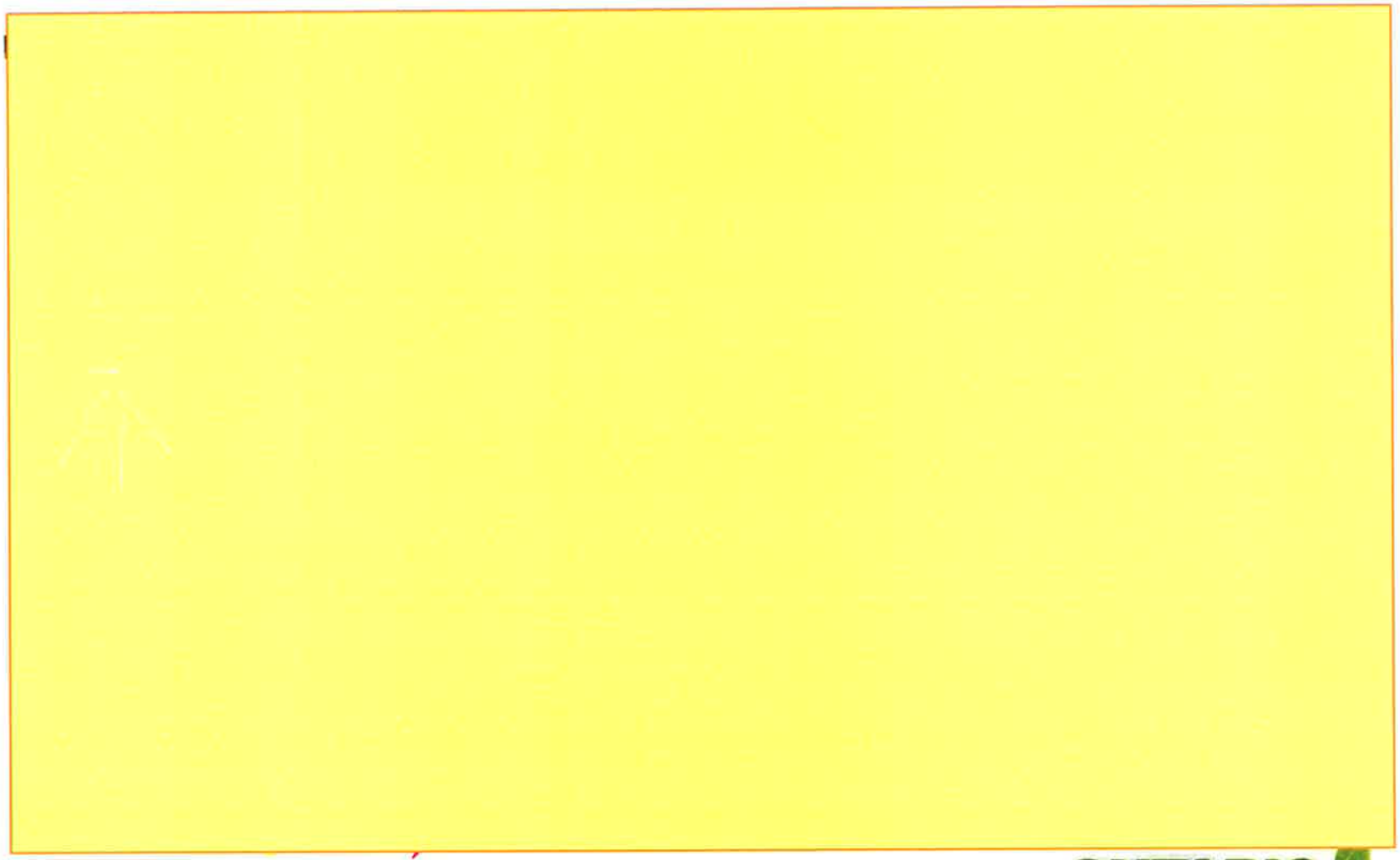
Integrating Renewables into the IESO Market

- In order to integrate the extensive growth of renewables (FIT) on the system, the IESO is exploring on a number of market changes
  - Intermittent facility dispatch on a 5 minute basis
  - Centralized forecasting
  - Paying congestions management settlement credits (CMSC)
  - Evolving dispatch rules akin to administrative dispatch

Changes to FIT and GEIA



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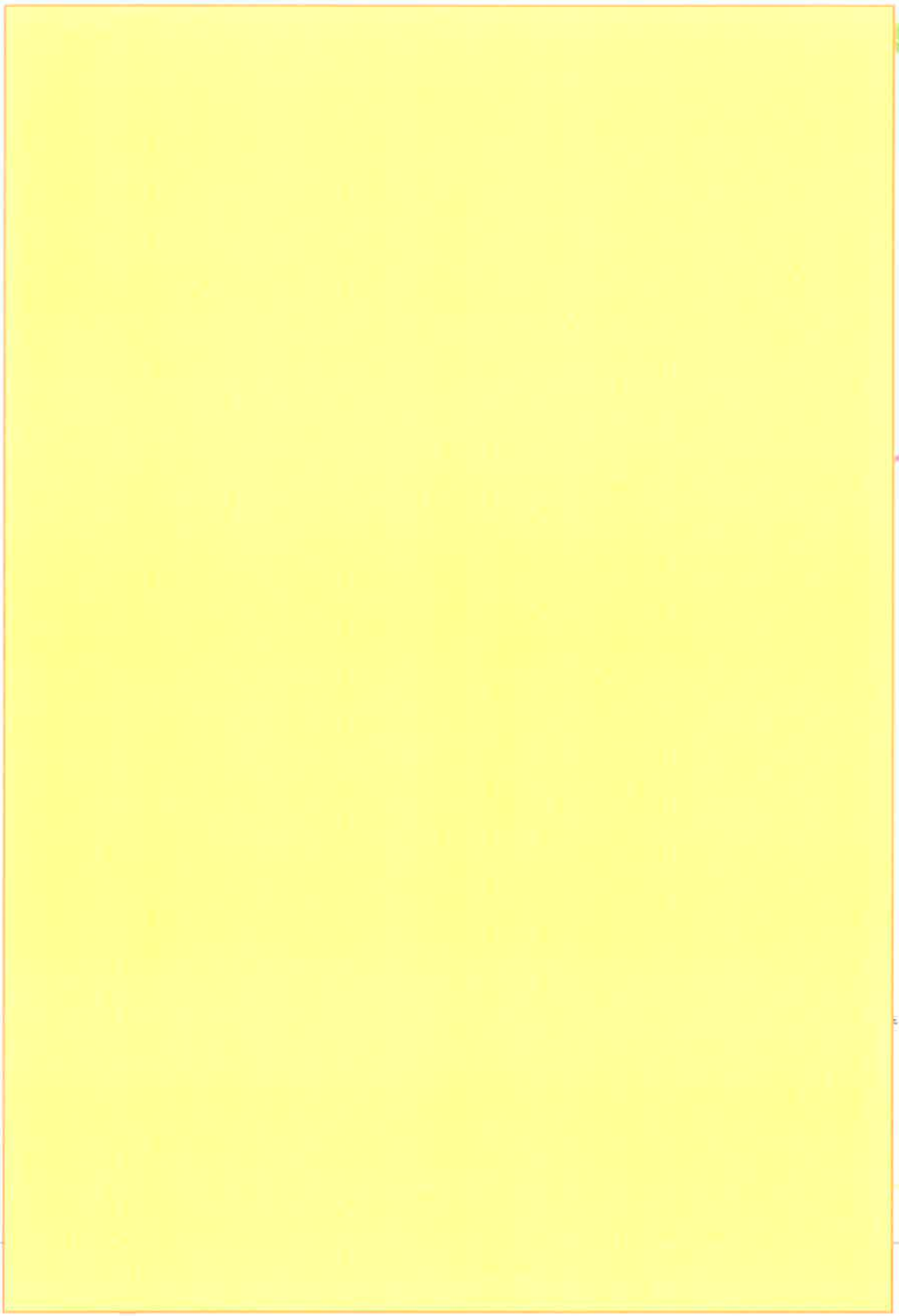

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Appendix A:
How the Curtailment Mechanisms Work

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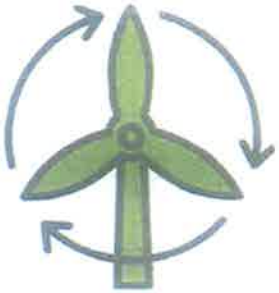
FIT Scenario #1 - No Oversupply

- FIT Contract Price is 135 $/MWh
- Supplier Bids -40 $/MWh into IESO market
- Local Price and HOEP are >0
- No curtailment under these conditions



Supplier Offer	-40
Local Price	10
HOEP	10
Curtailment	No
Net Revenue	135
Facility operates and receives Contract Price	

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FIT Scenario #2 - Global and Local Oversupply

- FIT Contract Price is 135 $/MWh
- Local Price = -50 $/MWh
- HOEP = -50 $/MWh

Supplier Offer	-40
Local Price	-50
HOEP	-50
Curtailment	Yes
Net Revenues	135
Facility dispatched off by the IESO. Receives full contract price for lost production.	

OR

Supplier Offer	-60
Local Price	-50
HOEP	-50
Curtailment	No
Net Revenues	85
Facility continues to produce but negative HOEP is deducted from contract price	

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FIT Scenario #3 - Local Oversupply Only

- FIT Contract Price is 135 $/MWh
- Mixed curtailment under these conditions
- Local Price = -50 $/MWh and HOEP are > 0 $/MWh

Current FIT Contract

Supplier Offer	-40
Local Price	-50
HOEP	10
Curtailment	Yes
Net Revenues	0
Facility is dispatched off by IESO and receives nothing	

Supplier can revise bid to "run away" from dispatch instruction

Supplier Offer	-60
Local Price	-50
HOEP	10
Curtailment	No
Net Revenues	135
Facility operates and receives Contract Price	

FIT Scenario #4 - Global Oversupply Only; Local Need

- FIT Contract Price is 135 $/MWh
- No curtailment under these conditions
- Local Price > 0 $/MWh and HOEP =-50 $/MWh

Current FIT Contract

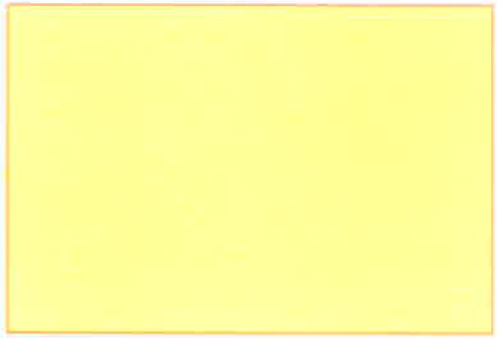
Supplier Offer	-40
Nodal Price	10
HOEP	-50
Curtailment	No
Net Revenues	85

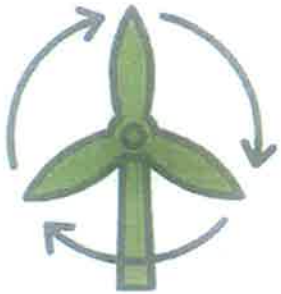
Facility will likely not be curtailed but will have negative HOEP deducted from Contract Price

Imperfect incentive that Contract Price is reduced despite there being a local need

RES Scenario #1 - No Oversupply

- RES Contract Price is 96 $/MWh
- Supplier Bids -1 $/MWh
- No curtailment under these conditions
- Local Price and HOEP are >0 $/MWh





Supplier Offer	-1
Local Price	10
HOEP	10
Curtailment	No
Net Revenues	96
Facility operates and receives Contract Price	

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RES Scenario #2 - Local Oversupply Only

- Contract Price is 96 $/MWh
- Curtailment under these conditions
- Local Price = -50 $/MWh and HOEP are > 0 $/MWh

Current RES Contract

Supplier Offer	-1
Local Price	-50
HOEP	10
Curtailment	Yes
Net Revenues	0

Facility dispatched off by the IESO. Receives nothing.

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RES Scenario #3 - Global and Local Oversupply

- Contract Price is 96 $/MWh
- Local Price = -50 $/MWh and HOEP =-50 $/MWh

Supplier Offer	-1
Local Price	-50
HOEP	-50
Curtailment	Yes
Net Revenues	0

Facility dispatched off by the IESO. If specific conditions are met reflecting global oversupply there is no Contract Payment for lost production.

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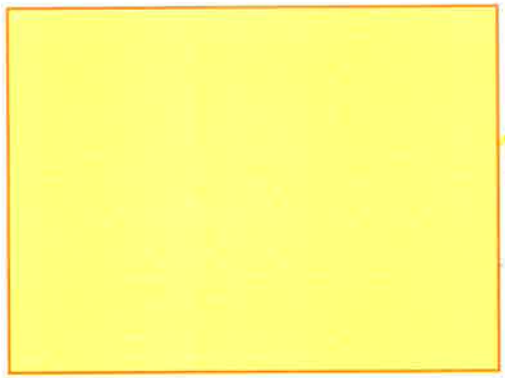
RES Scenario #4 - Global Oversupply Only, Local Need

- Contract Price is 96 $/MWh
- No curtailment under these conditions
- Local Price > 0 $/MWh and HOEP = - 50 $/MWh



Supplier Offer	-1
Local Price	10
HOEP	-50
Curtailment	No
Net Revenues	96
Facility operates and receives Contract Price	

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