Using Business Architecture blueprints to mitigate the organizational impact of policy change in Alberta's deregulated electric industry

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Electricity and Electricity Markets

- Electricity is a unique product
  - Indistinguishable no matter who produces it
  - Consumed as soon as its produced
  - Can be stored but has short “shelf-life”
- Despite (or because of it) this we have deregulated it….
  - 1900s electricity deemed a “natural monopoly”
  - Improvement in transmission technology allowed for separation of the generation from the wires
  - 1990 the first deregulated markets started to appear
  - Competition should result in cost minimization and force prices toward their minimum

Alberta Electric System Operator

- Alberta deregulated electricity in 1996
- Alberta Electric System Operator mandate:
  - Ensure the safe reliable economic operation of the system in a fair, efficient and openly competitive manner
  - Develop a competitive wholesale market for electricity
  - Plan for the future needs the electric transmission system
  - Provide customer access to the transmission system and market
- Unique “energy only” power pool
- Plan for no congestion on the wires
- Part of the larger North American interconnected system
- Not under federal (US), but rather provincial regulation

Electricity deregulation issues in Alberta

- Price spikes – price caps
- Congestion
  - unable to build wires fast enough
- No of suppliers
- Lack of demand response
- New Technologies
  - Solar
  - Combined cycle
  - Wind
  - Storage
- Seams issues
- Capacity concerns

Short-run problems tend to be more dramatic than the benefits

Alberta Electricity statutes and regulations

- In the last 16 years there have been
  - 10 amendments to the Electric Utilities Act
  - 8 amendments to the Transmission Regulation
  - Creation of the Alberta Utilities Commission Act in 2004
  - 22 other related acts and regulations created for the purposes of defining the electricity market in Alberta
- And as a result market rules have been impacted
  - Roughly 3 to 5 significant market rule changes per year
- All having an impact on the market implementation

❖ A regulation is a law, supported by an enabling statute or Act, issued by the executive branch of government.

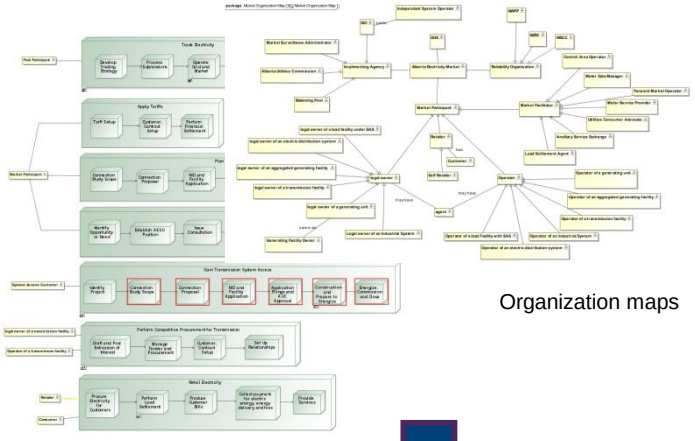
Market Evolution

- *We know our market design is constantly evolving*
- *Cant always see exactly what particular change coming next*
- *When we do, must adapt quickly*
- *And that adaption must be done right*
  - *Market clears $6B to $8B / year*
  - *No clearinghouse*
  - *Real-time market, prices set every minute*
  - *Market must operate on reliable grid*

AESO strategic planning

Environmental Scanning

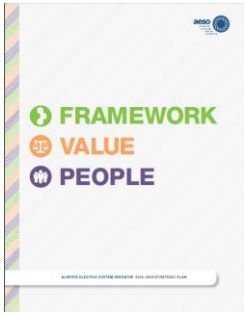
Audit Current Strategy



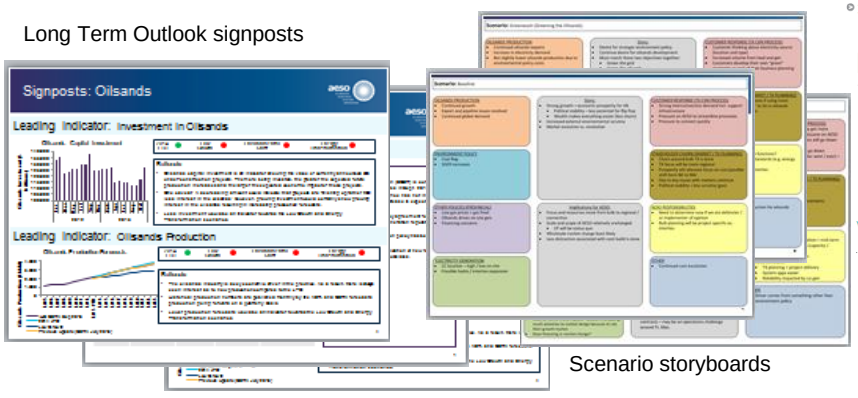
Organization maps

Value streams

Development of New Plan



Long Term Outlook signposts



Scenario storyboards

Strategy to Tactics

- Our strategic plan describes what we must do from a framework, value and people perspective.
- It introduces possible scenarios, the likelihood of them occurring, and the implications to the electricity market

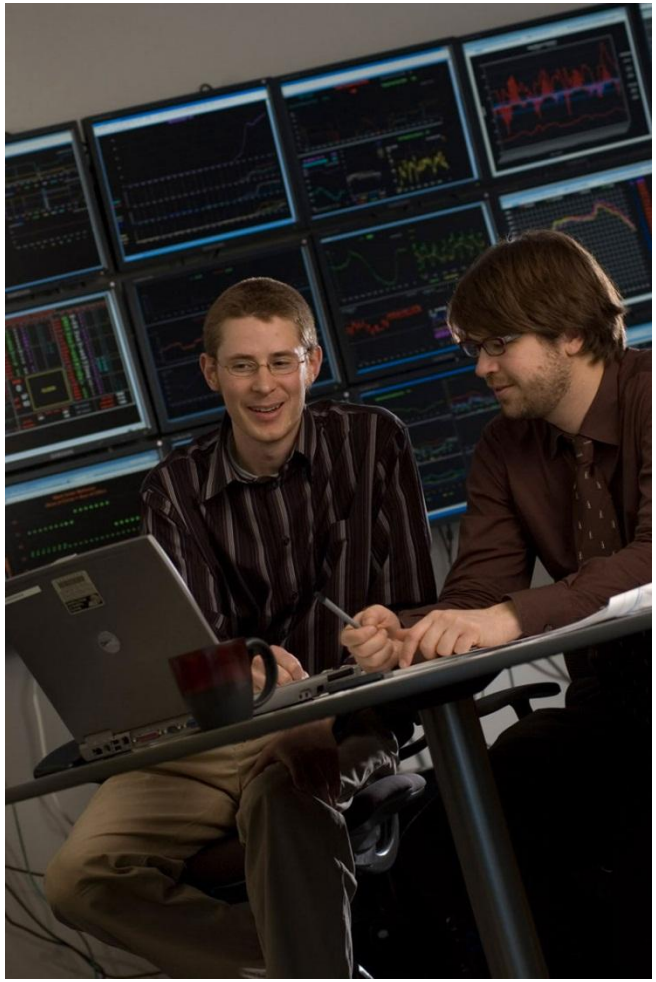
- Each strategic implication has tactical requirements
  - What must change from current state
  - How can the changes best be made

Dealing with the Tactical Demands

- Market *Economic Models*
  - *produce electric market price forecasts, value and uncertainty analyses*
- *Scenario Implementation Analysis*
  - *Assess unforeseen impacts*
  - *Perform Capability Assessments for new products*
  - *Simplify the market design – fit into what we have, reuse*
    - *Simpler the rule change the more likely it wont be contested*
  - *Understand competing initiatives*
  - *Refactoring opportunities*

Market Economic Models

Market Simulation



Hourly dispatch:

- By Generator
- Total load

Transmission Constraints

Transmission System

Scenario Implementation Analysis

"Marchitecture" – Market Architecture

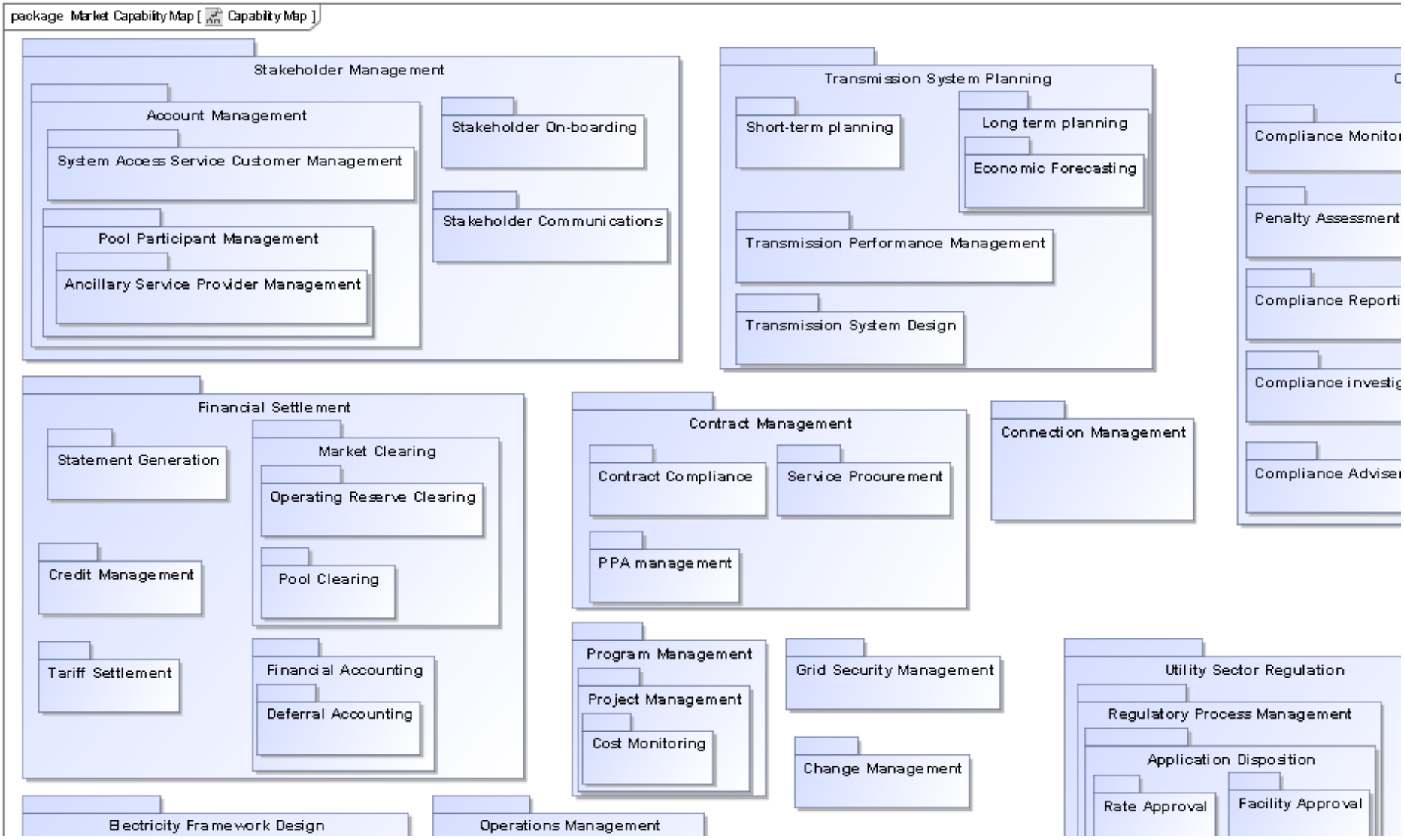
- A blueprint of the Electricity Market that provides a common understanding of its structure and is used to align long-term objectives and tactical demands.
- In other words, a tool to assess impact of market evolution
  - Implement a market design that addresses the current issues, while respecting our mandate, and guiding policy
- Should "revolution" occur we will be well positioned to deal with that too
  - i.e. Major revision to the Electric Utilities Act

Our “Blueprint”

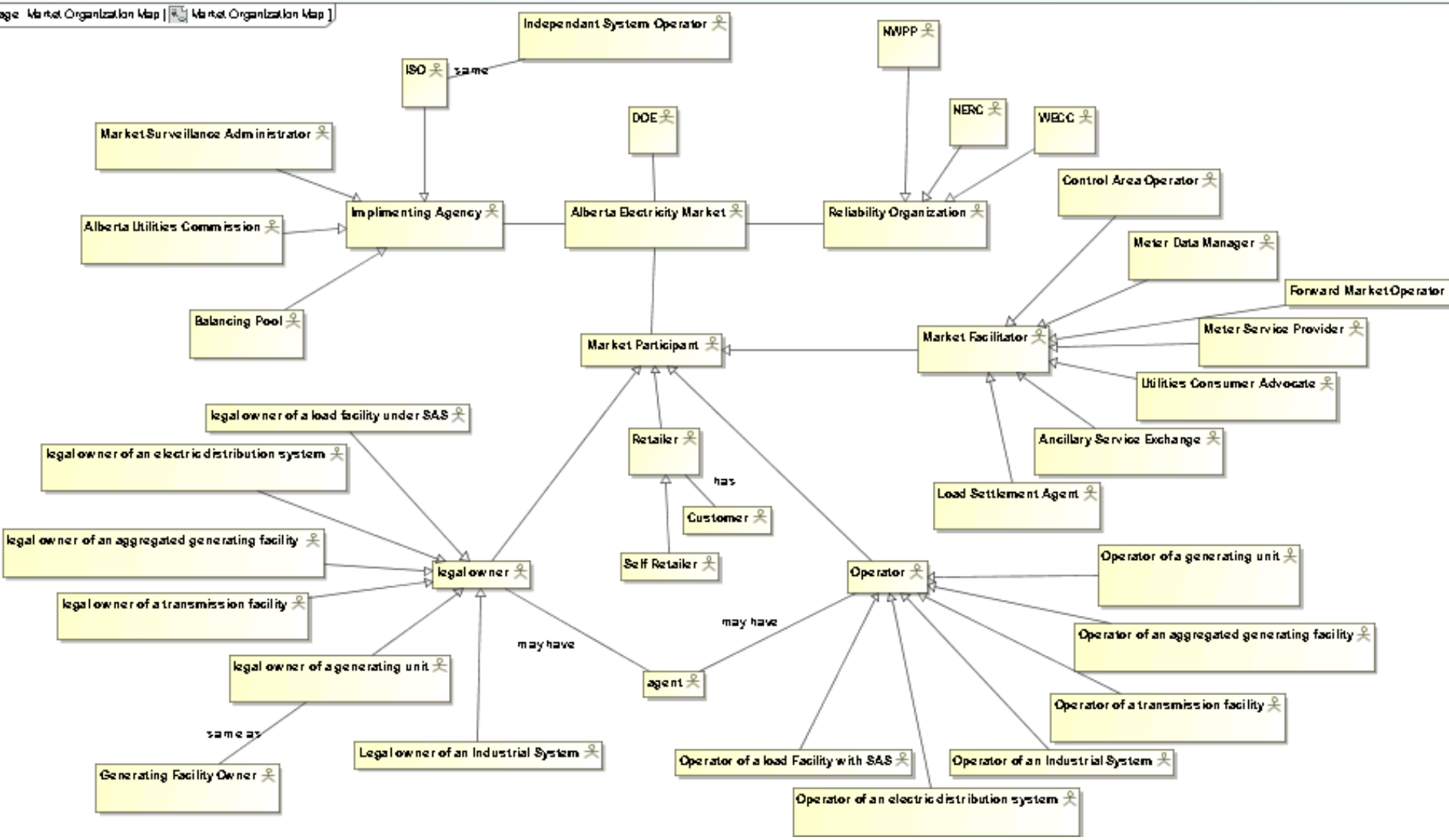
- Is a combination of
  - Capability maps
  - Information maps
  - Product maps
  - Organization and stakeholder maps
  - Model impacts of Initiatives identified via stereotyping
  - Industry Reference models representing key stakeholders
  - Value stream mapping

  - All done using UML constructs
    - and liberties with the UML standard

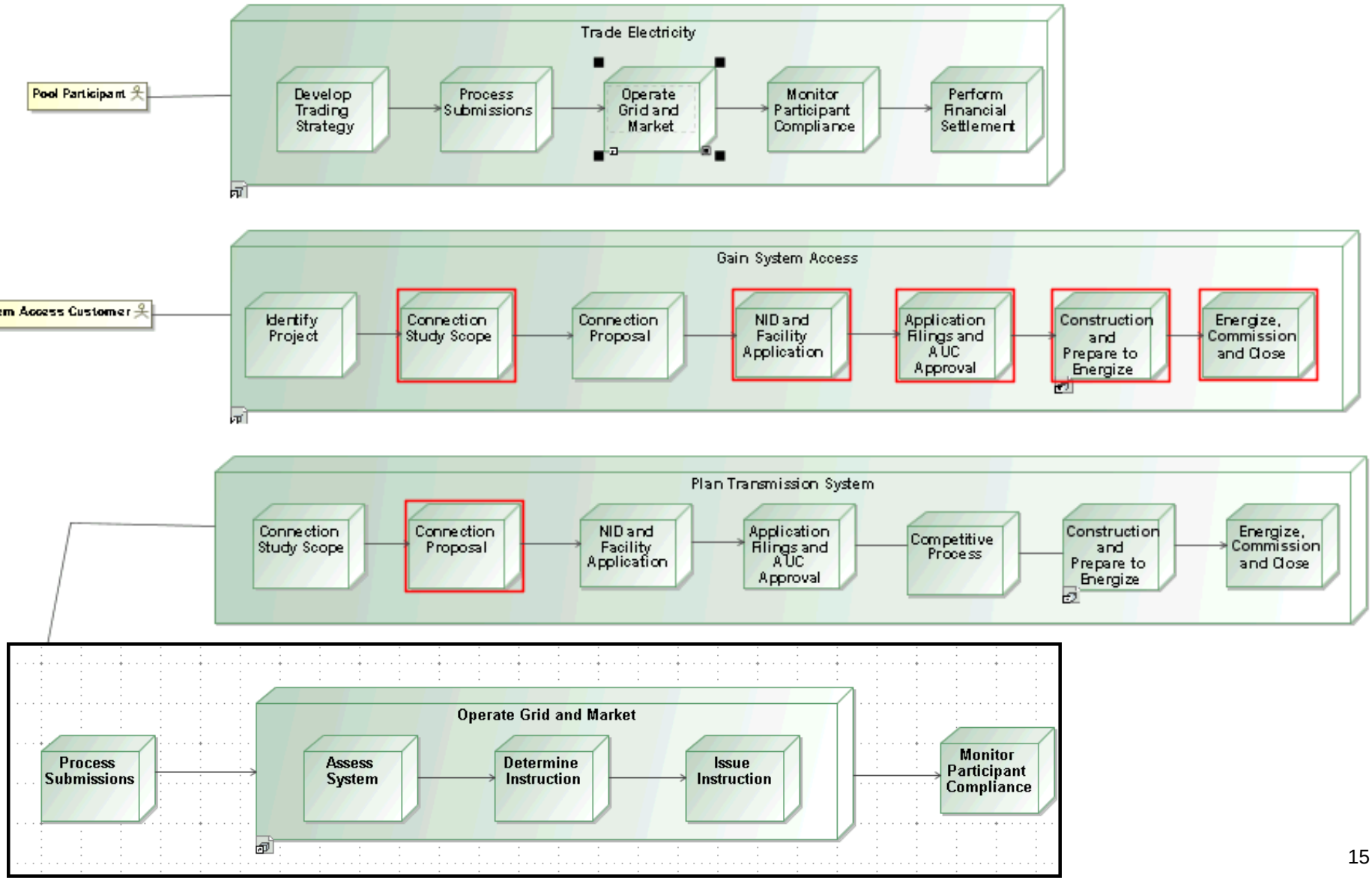
Capability Map (as UML packages)



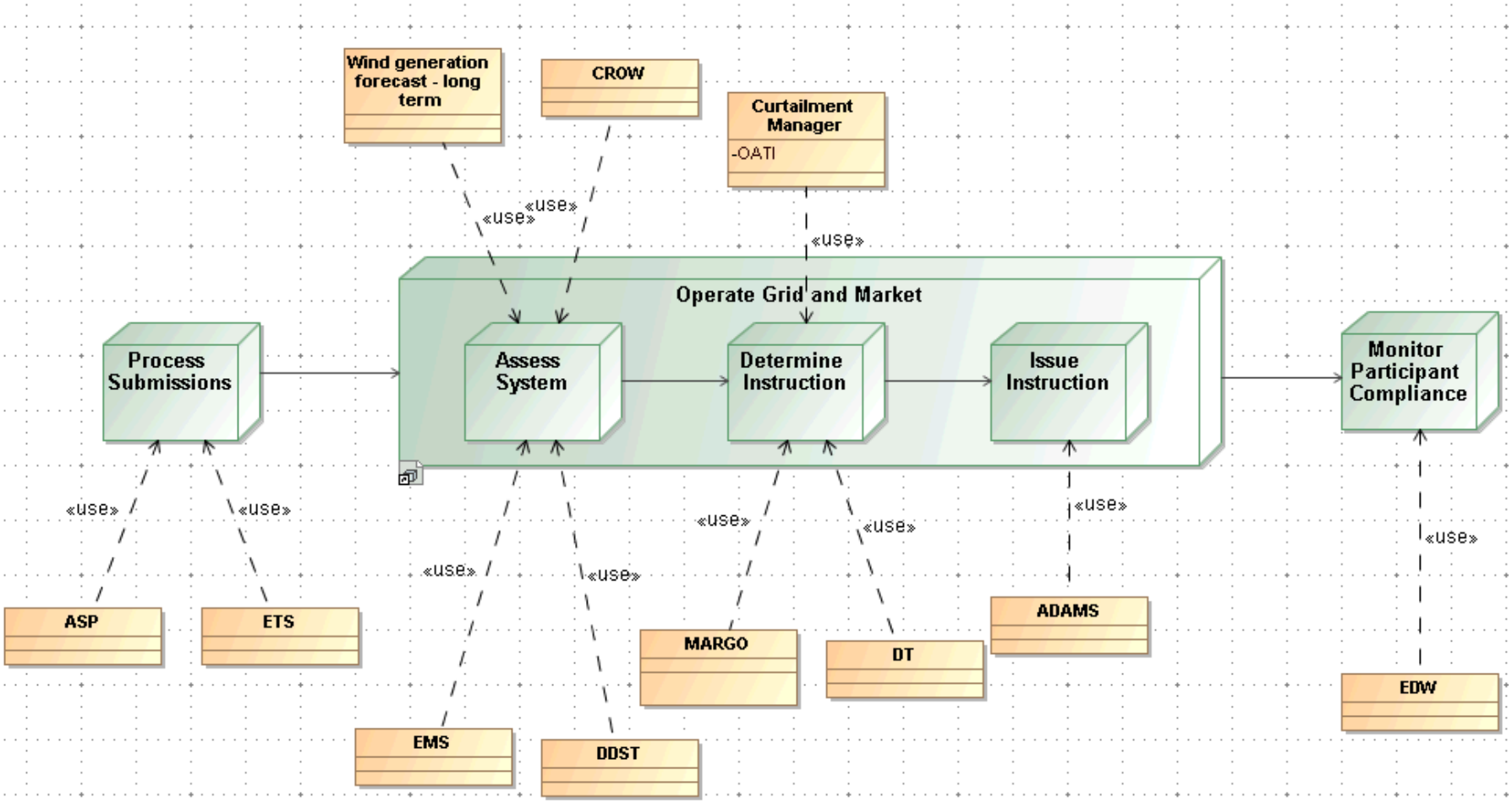
Organization Map (as UML Actors)



Value Streams (as UML nodes)



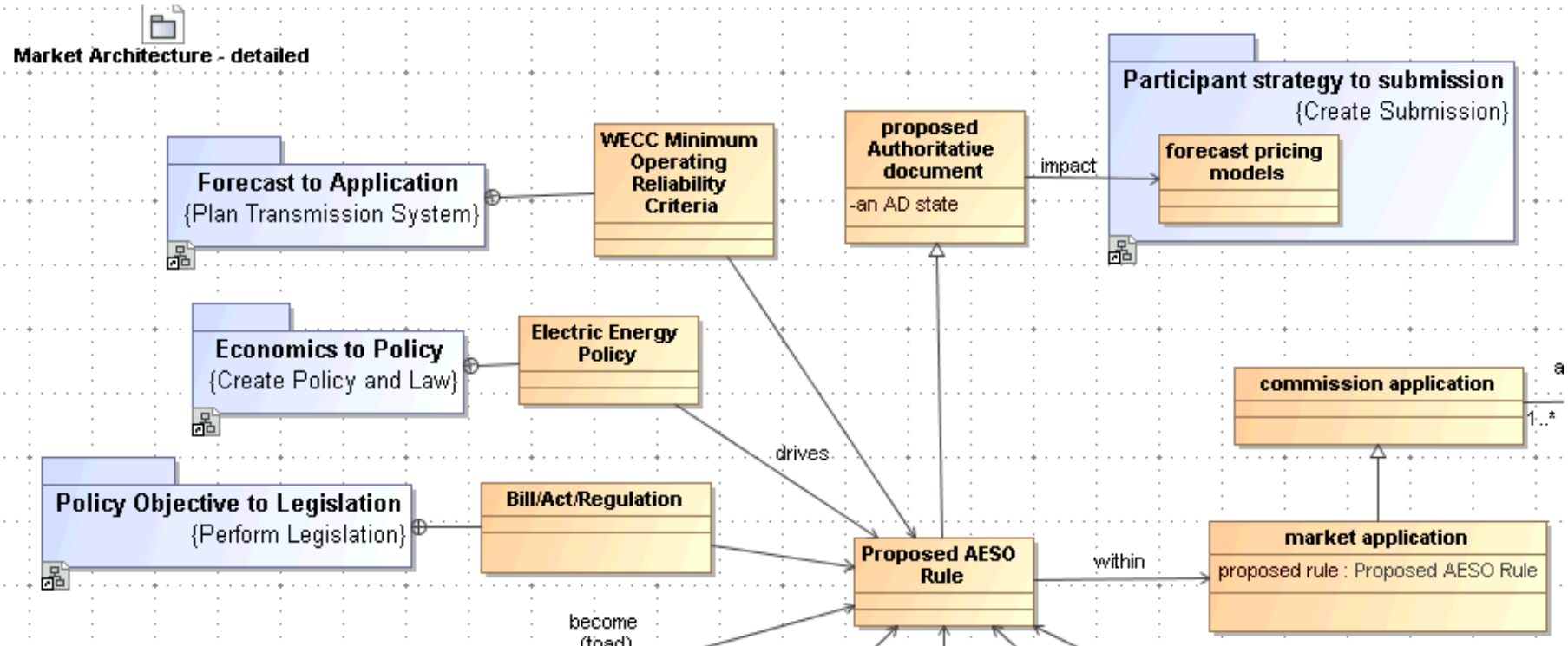
Cross Mappings example
IT Systems to Value stages



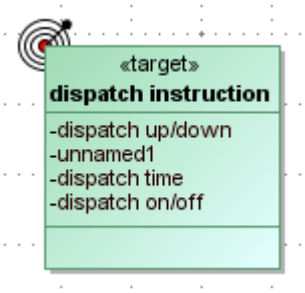
Information Maps (as UML classes)

Market Model is information map grouped by capability:

- UML Classes are classes
- UML Packages are capabilities
- UML Actors are individuals
- UML Associations and generalizations are role links



How it began

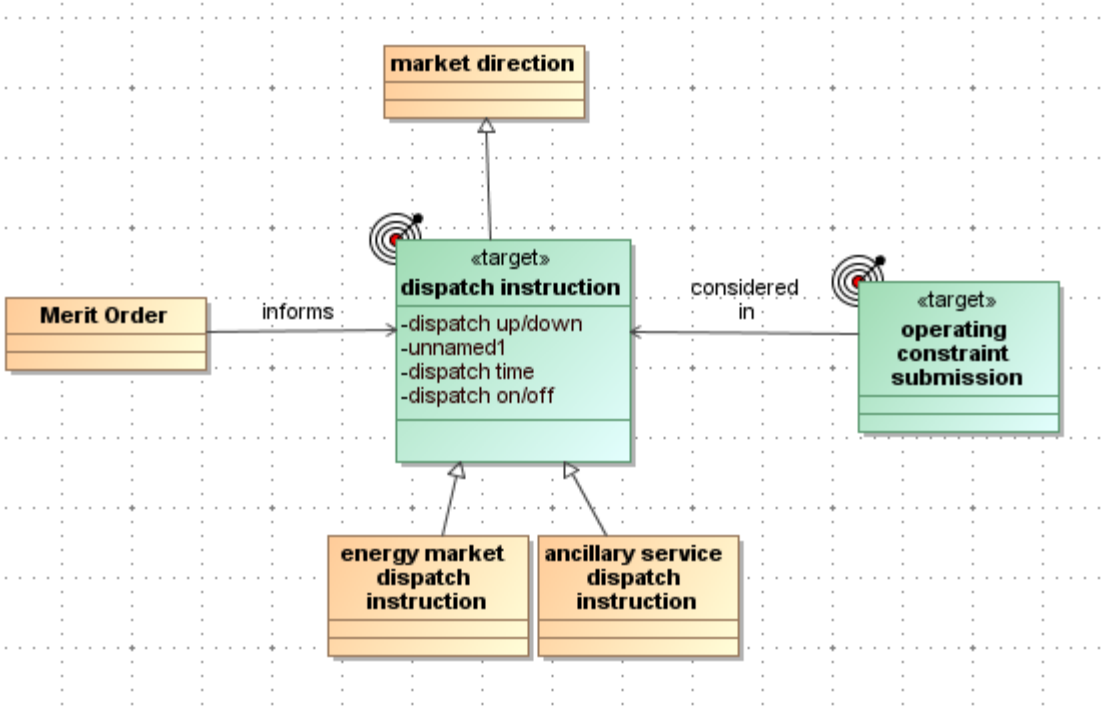


With each element asked:

- What went into an elements creation?
- What is it used for?

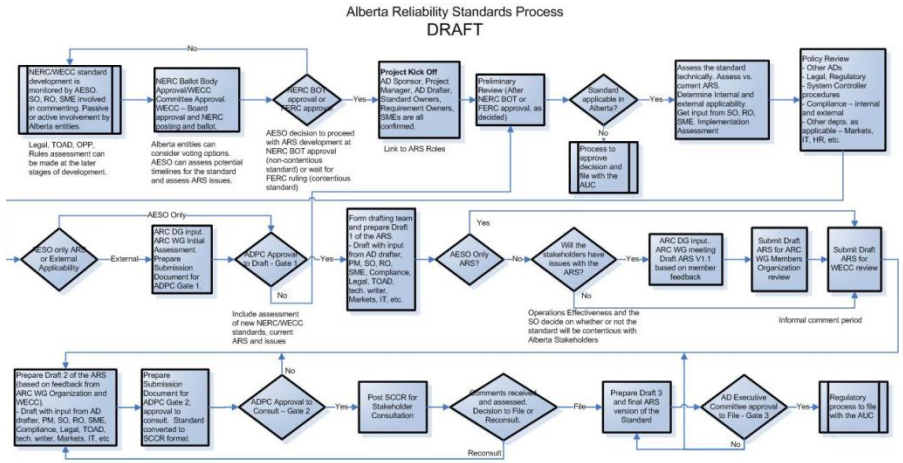
Role Links

- One market object feeds the creation of another market object
- One market object may be a parent or child of another market object

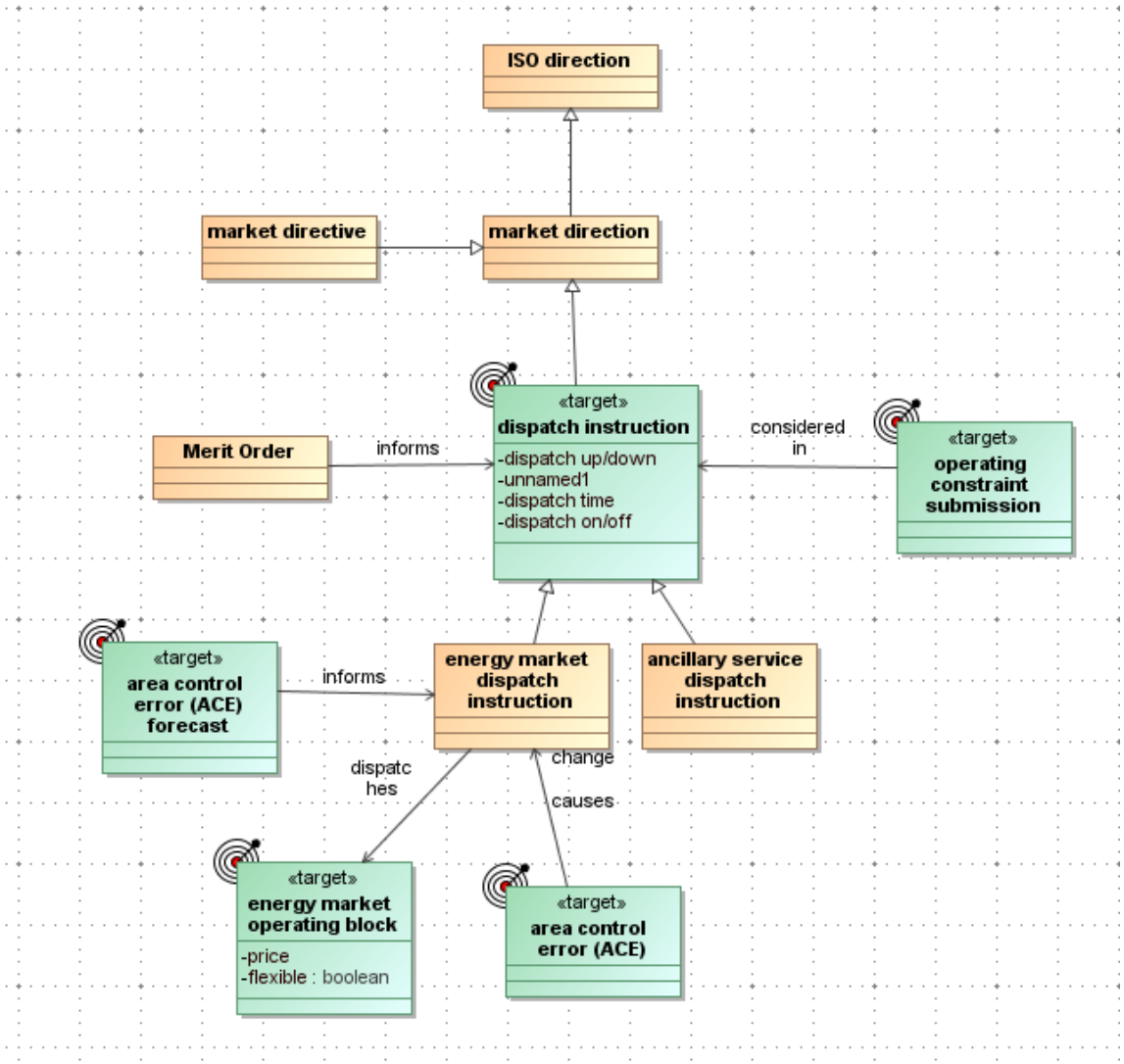


Associations may represent business processes

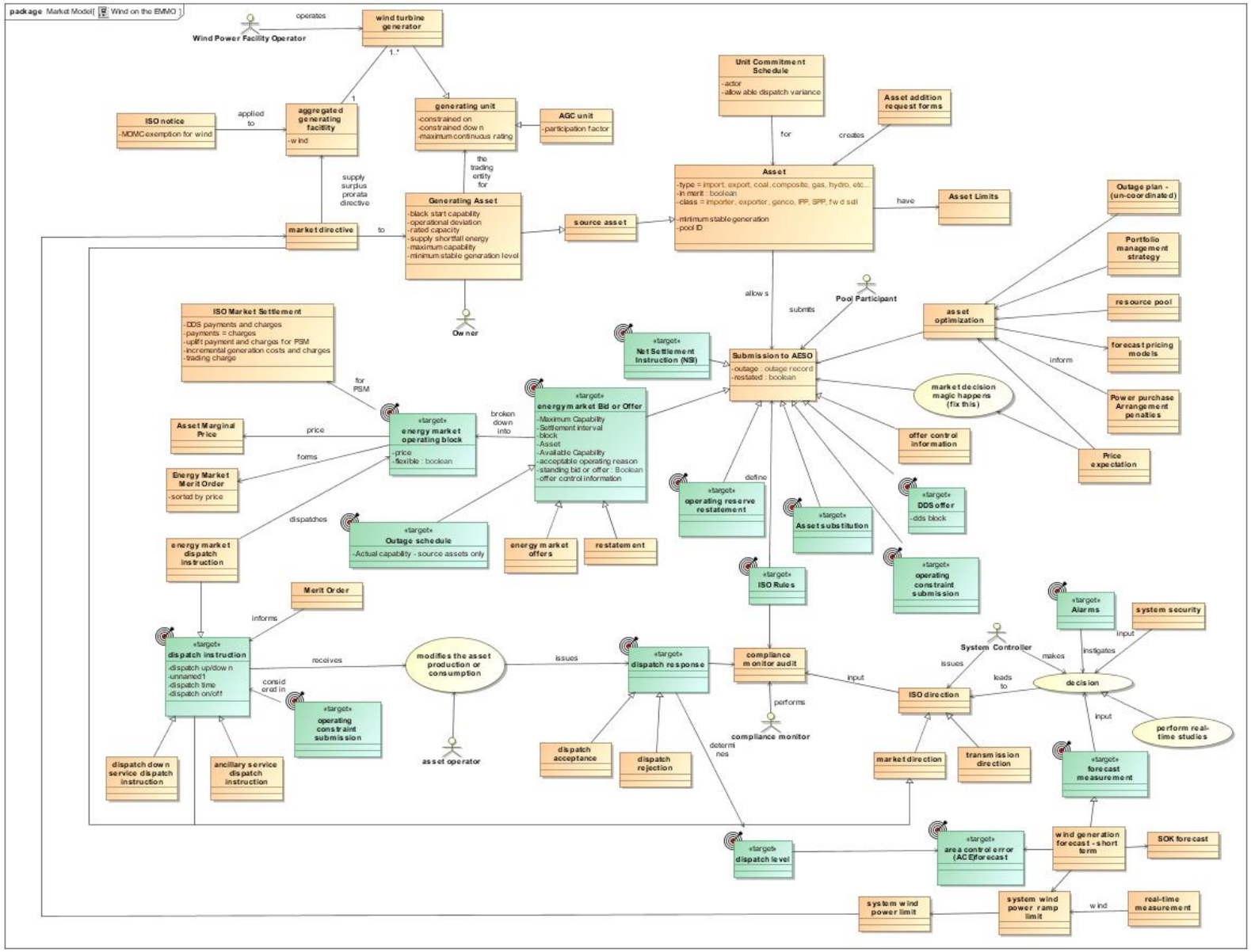
- input/output model
- physical market elements and actors identified

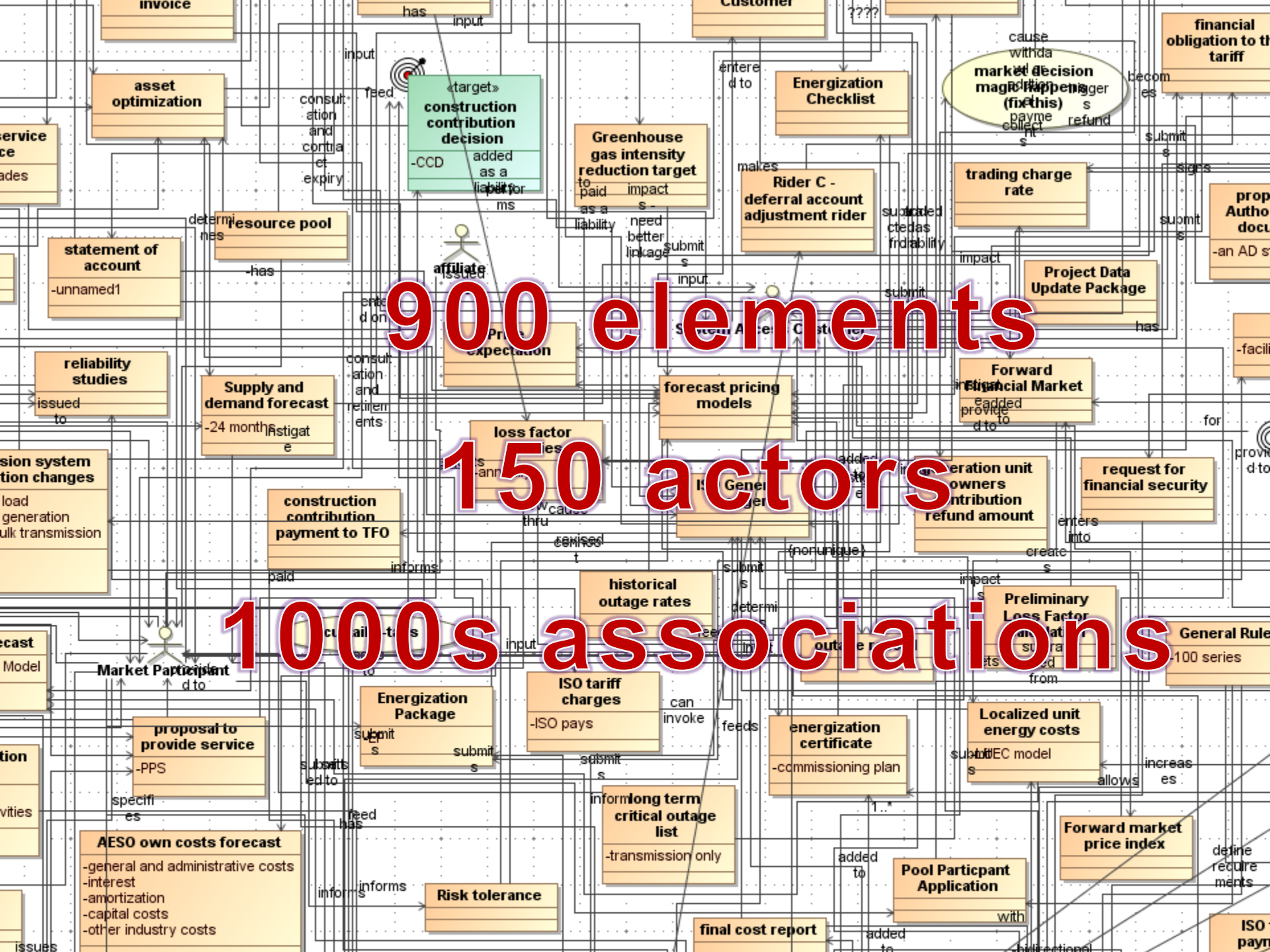


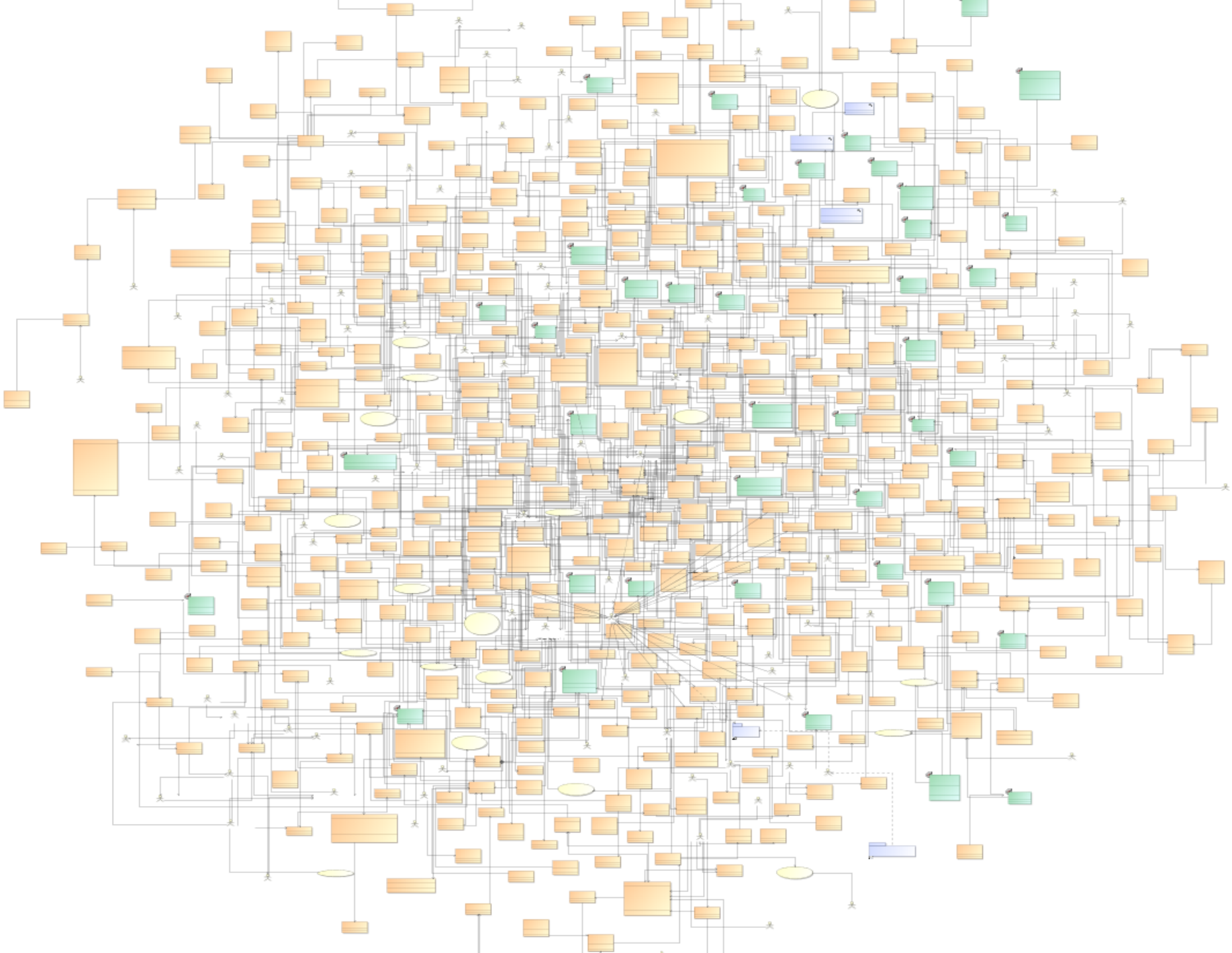
Growing the model



More elements, more associations



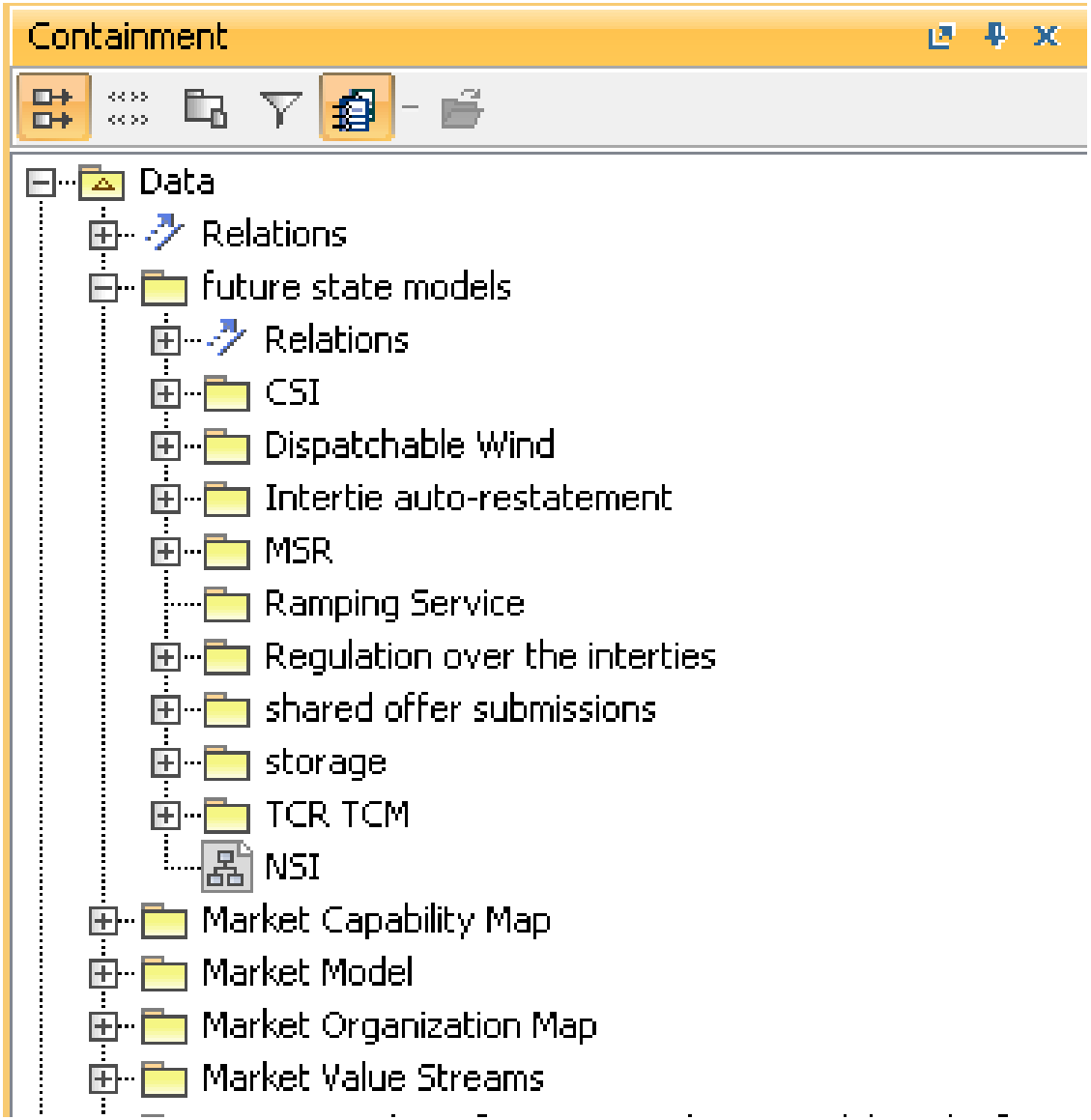

900 elements
150 actors
1000s associations
asset optimization
«target»
construction contribution decision
-CCD
Greenhouse gas intensity reduction target
Energization Checklist
Rider C - deferral account adjustment rider
trading charge rate
Project Data Update Package
resource pool
statement of account
-unnamed1
affiliate
reliability studies
Supply and demand forecast
-24 months
forecast pricing models
loss factor
Forward Financial Market
request for financial security
construction contribution payment to TFO
historical outage rates
Preliminary Loss Factor
General Rule
-100 series
Market Participant
ISO tariff charges
-ISO pays
Energization Package
energization certificate
-commissioning plan
Localized unit energy costs
proposal to provide service
-PPS
AESO own costs forecast
-general and administrative costs
-interest
-amortization
-capital costs
-other industry costs
long term critical outage list
-transmission only
Risk tolerance
Forward market price index
Pool Particpant Application
final cost report



Scenario Thread Pulling

1. Choose the scenario
2. Identify market element central to the theme of the scenario
3. Pull on the threads – query the model
4. With each iteration assess the scenario against the element
5. If no risk to the element stop pulling the thread
6. Document the implications of the to each element (impact assessment)
7. Remove the clutter
8. Look for implementation options to mitigate the risk
   - The simpler, the better
   - Pros and cons of each design scenario

Initiative mapping - Future state models



Case Study: Dispatchable Wind

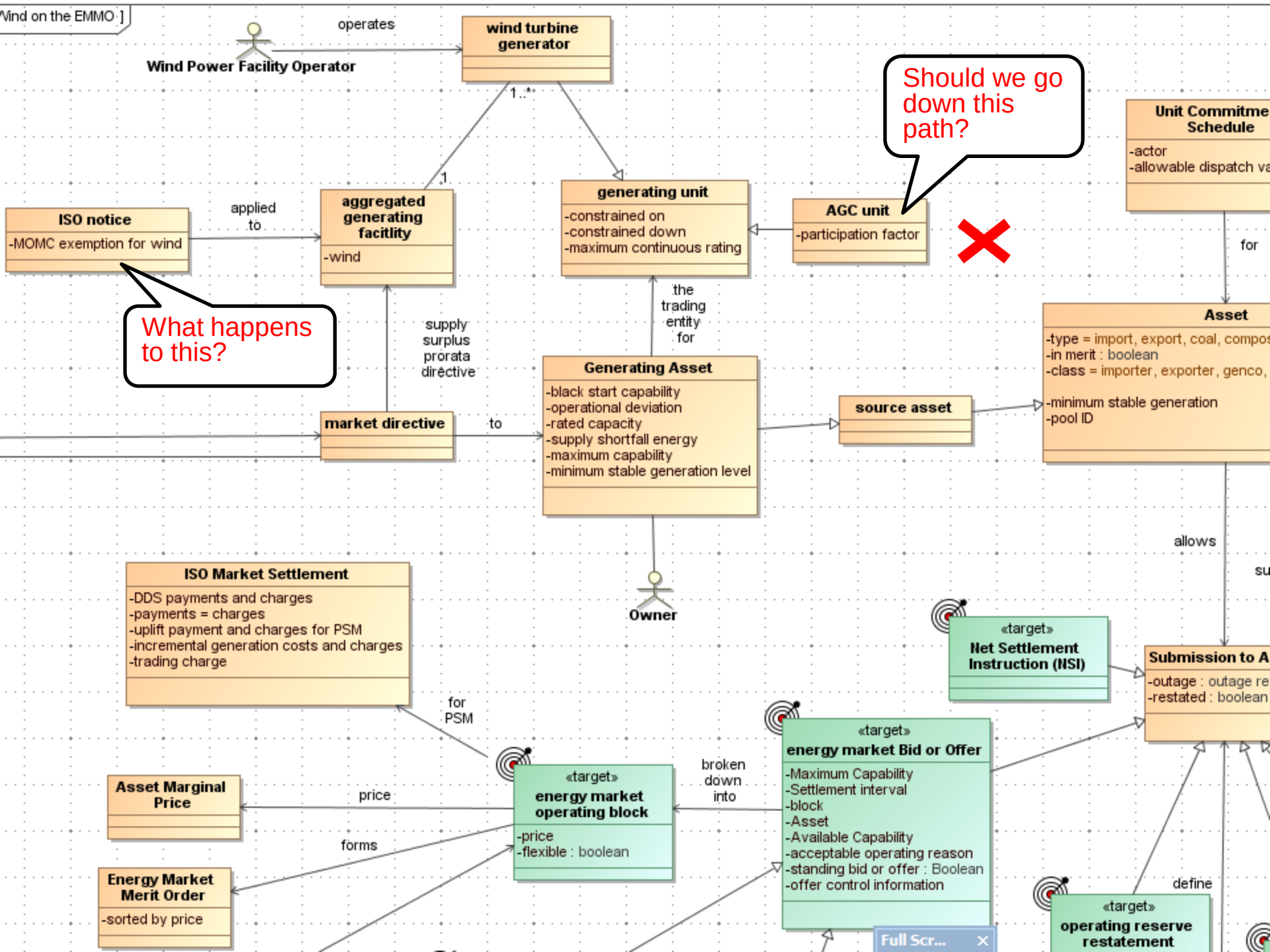
- Wind generation generates when the wind blows, not when we dispatch it
- Wind generation declared non-dispatchable and exceptions were made to deal with the poor fit compared to current fleet
- Market impact - when the wind blows the market price drops due to an inability to offer prices

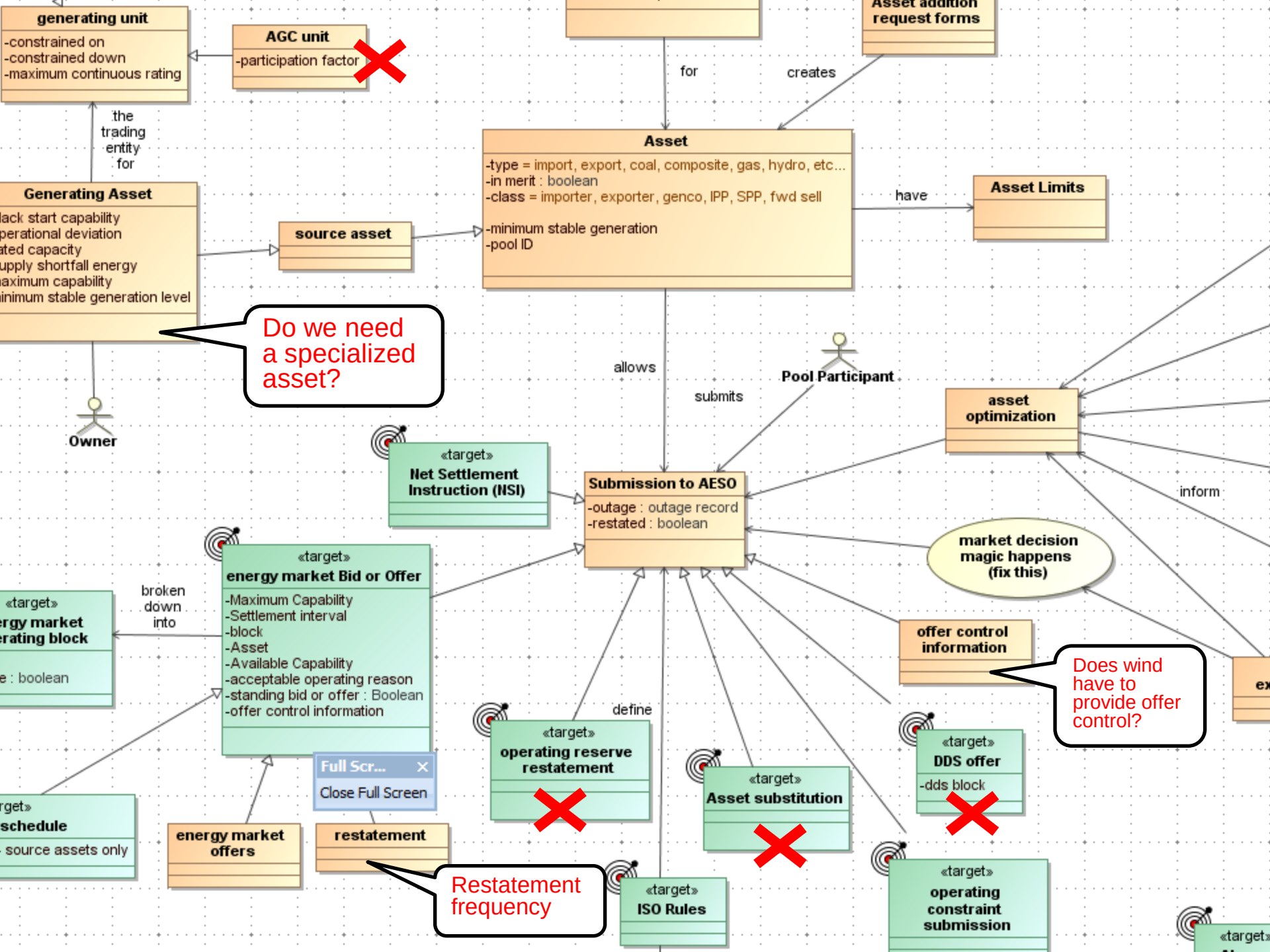
- How can we allow the wind to participate?
  - Fair
  - Efficient
  - Openly competitive

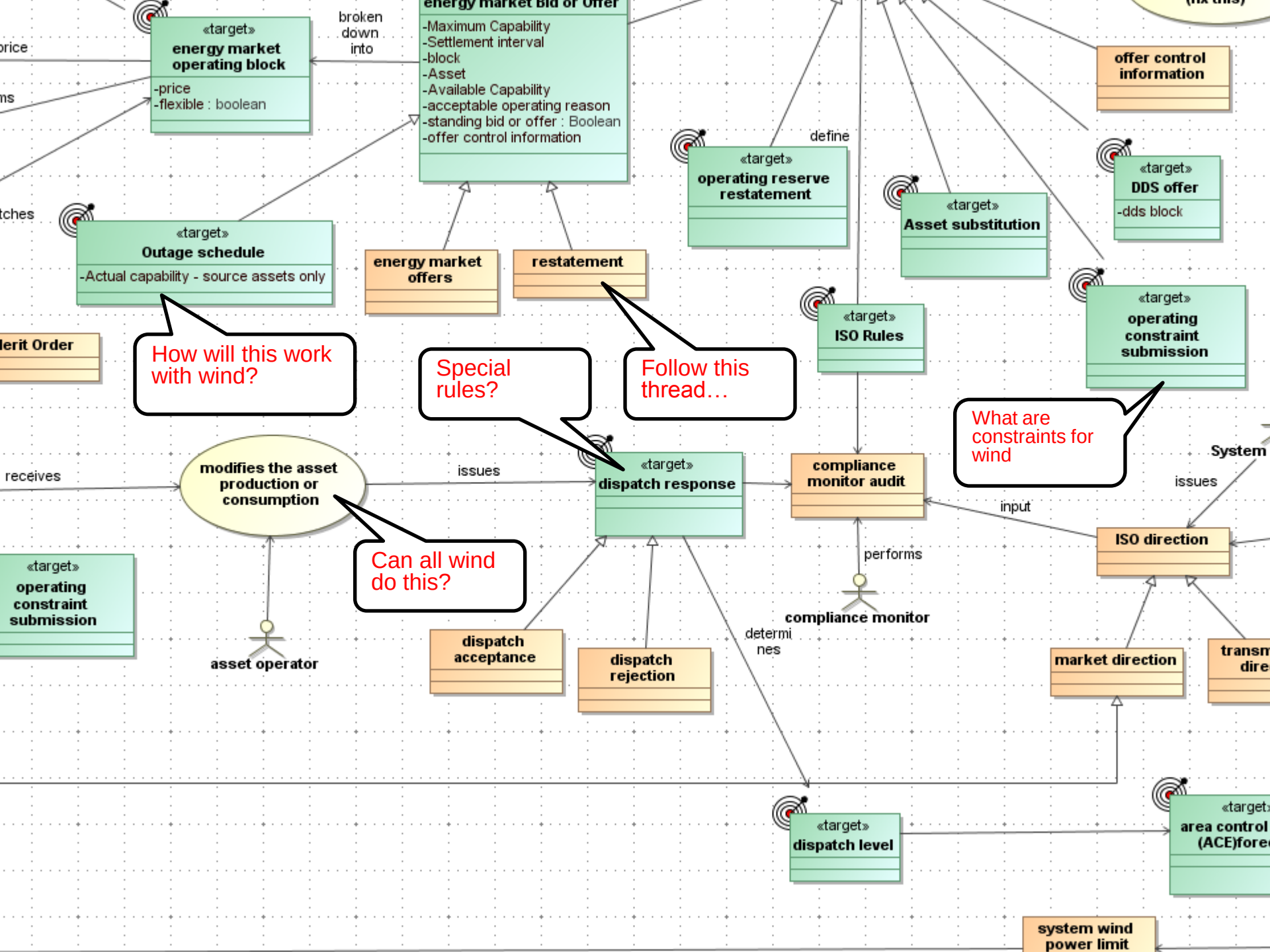
Impact analysis using the market model

Making Wind Dispatchable

- Pick an element of the current market – for example “dispatch instruction”
- Look at the inputs and outputs of “dispatch instruction”
- Follow the threads and see where they lead
- Assess impacts to each element
  - Where are your decision points?
  - What haven't you considered?
  - What needs to change?

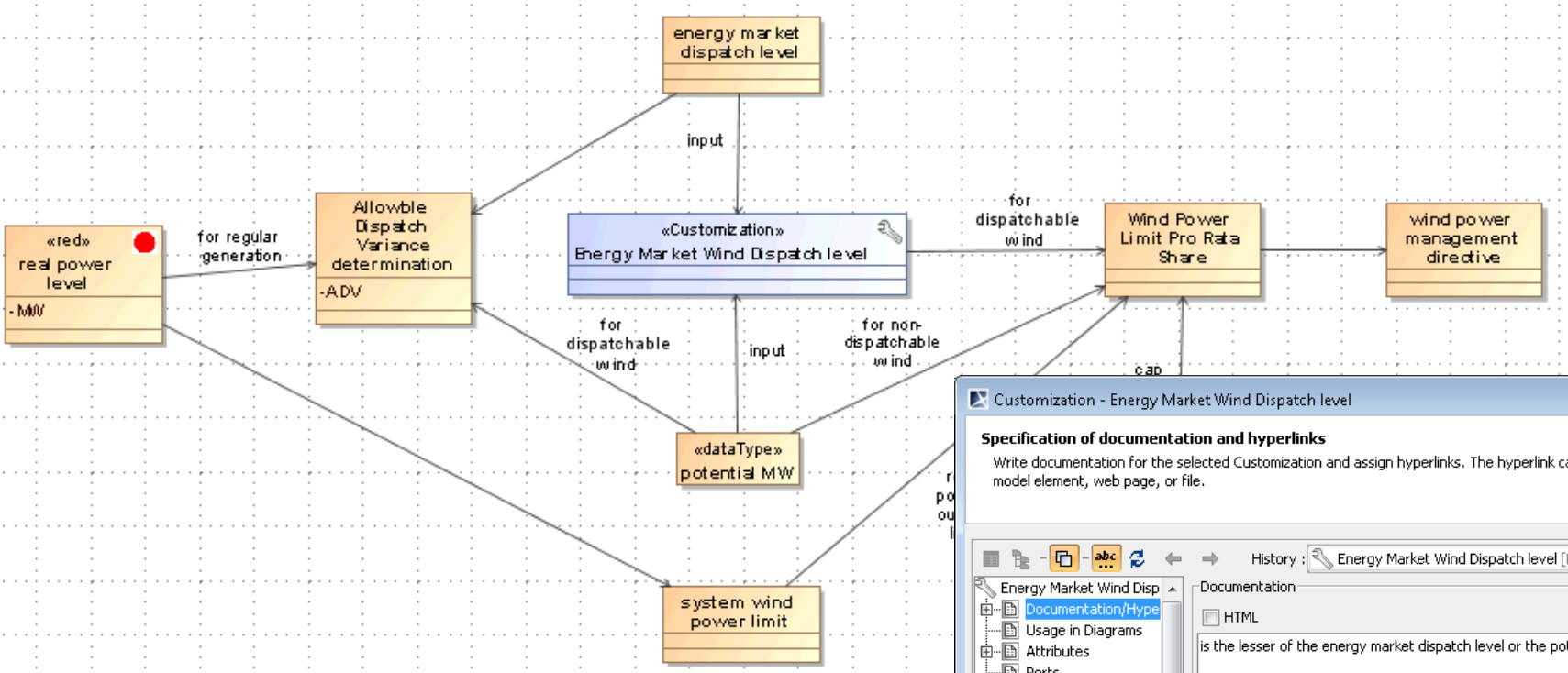

Wind on the EMMO]
operates
Wind Power Facility Operator
wind turbine generator
1..*
1
Should we go down this path?
Unit Commitme
Schedule
-actor
-allowable dispatch va
ISO notice
-MOMC exemption for wind
applied to
aggregated generating facitlity
-wind
generating unit
-constrained on
-constrained down
-maximum continuous rating
AGC unit
-participation factor
for
What happens to this?
supply surplus prorata directive
the trading entity for
Asset
-type = import, export, coal, compos
-in merit : boolean
-class = importer, exporter, genco,
-minimum stable generation
-pool ID
Generating Asset
-black start capability
-operational deviation
-rated capacity
-supply shortfall energy
-maximum capability
-minimum stable generation level
market directive
to
source asset
allows
ISO Market Settlement
-DDS payments and charges
-payments = charges
-uplift payment and charges for PSM
-incremental generation costs and charges
-trading charge
Owner
«target»
Net Settlement Instruction (NSI)
Submission to A
-outage : outage re
-restated : boolean
for PSM
«target»
energy market Bid or Offer
-Maximum Capability
-Settlement interval
-block
-Asset
-Available Capability
-acceptable operating reason
-standing bid or offer : Boolean
-offer control information
broken down into
Asset Marginal Price
price
«target»
energy market operating block
-price
-flexible : boolean
forms
Energy Market Merit Order
-sorted by price
define
«target»
operating reserve restatement
Full Scr...

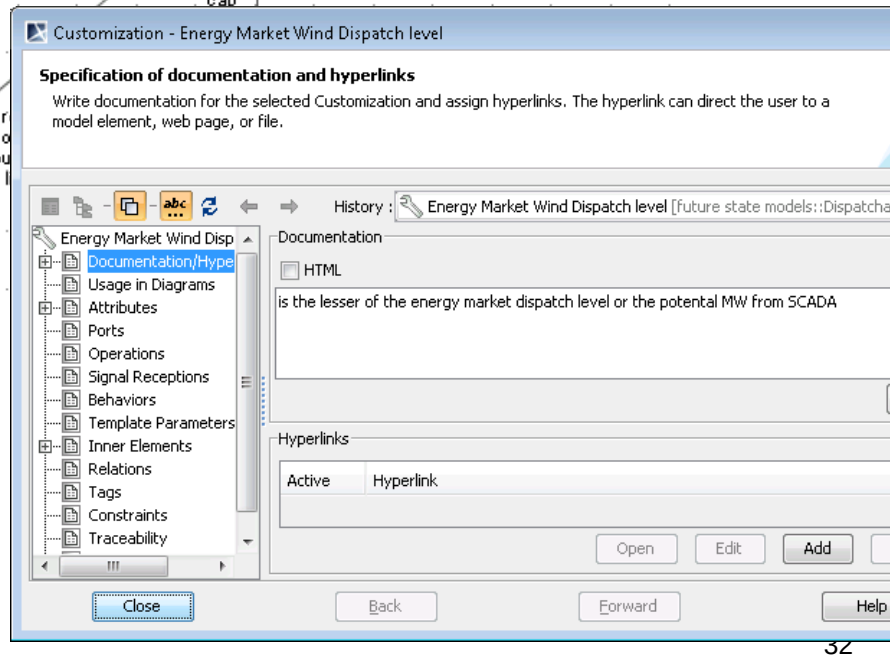

generating unit
-constrained on
-constrained down
-maximum continuous rating
AGC unit
-participation factor
Asset addition request forms
for
creates
the trading entity for
Asset
-type = import, export, coal, composite, gas, hydro, etc...
-in merit : boolean
-class = importer, exporter, genco, IPP, SPP, fwd sell
-minimum stable generation
-pool ID
have
Asset Limits
Generating Asset
lack start capability
perational deviation
ated capacity
upply shortfall energy
aximum capability
inimum stable generation level
source asset
Do we need a specialized asset?
allows
submits
Pool Participant
Owner
asset optimization
«target»
Net Settlement Instruction (NSI)
Submission to AESO
-outage : outage record
-restated : boolean
inform
market decision magic happens (fix this)
«target»
energy market Bid or Offer
-Maximum Capability
-Settlement interval
-block
-Asset
-Available Capability
-acceptable operating reason
-standing bid or offer : Boolean
-offer control information
broken down into
offer control information
Does wind have to provide offer control?
define
«target»
operating reserve restatement
«target»
Asset substitution
«target»
DDS offer
-dds block
Full Scr...
Close Full Screen
energy market offers
restatement
Restatement frequency
«target»
ISO Rules
«target»
operating constraint submission


«target»
energy market operating block
-price
-flexible : boolean
broken down into
energy market Bid or Offer
-Maximum Capability
-Settlement interval
-block
-Asset
-Available Capability
-acceptable operating reason
-standing bid or offer : Boolean
-offer control information
offer control information
define
«target»
operating reserve restatement
«target»
Asset substitution
«target»
DDS offer
-dds block
«target»
Outage schedule
-Actual capability - source assets only
energy market offers
restatement
«target»
ISO Rules
«target»
operating constraint submission
How will this work with wind?
Special rules?
Follow this thread…
What are constraints for wind
modifies the asset production or consumption
receives
issues
«target»
dispatch response
compliance monitor audit
input
ISO direction
System
issues
performs
compliance monitor
asset operator
Can all wind do this?
«target»
operating constraint submission
dispatch acceptance
dispatch rejection
determi nes
market direction
«target»
dispatch level
«target»
area control (ACE)fore
system wind power limit

Model impacts of Initiatives identified via stereotyping

Solution to making wind dispatchable





- Stereotyping allows us to see unimplemented design elements in context to current state

Market design change impact assessment

1. Purpose

2. Introduction / Background

3. Impact Analysis

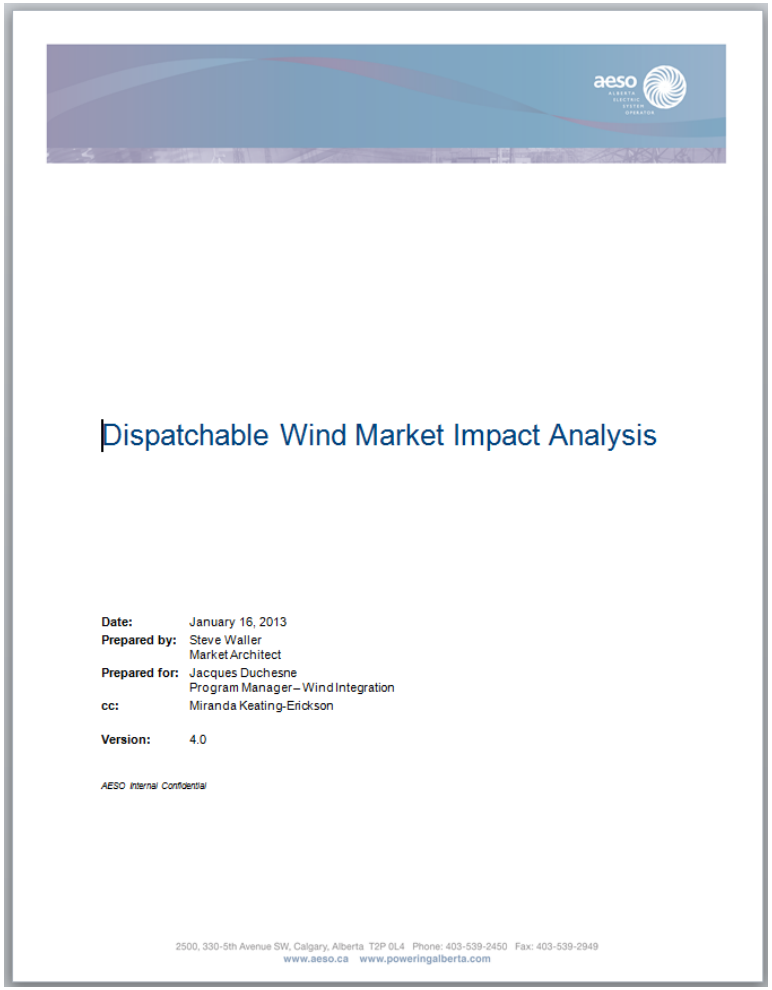
- 3.1. Applicability of MOMC for wind generation letter
- 3.2. Trading Assets for wind
- 3.3. Ancillary Services from wind generation
- 3.4. DDS Participation
- 3.5. Offer control submissions for Wind
- 3.6. Allowable Dispatch Variance (ADV)
- 3.7. Wind restatement frequency and Acceptable Operating Reasons
- 3.8. Alignment of real potential MW and Available Capability
- 3.9. Forecasting wind power – dispatch decision support
- 3.10. Forecasting wind power – Outage recording
- 3.11. Forecasting wind power – Short-term Adequacy Assessments
- 3.12. Forecasting wind power – Wind Power Management

4. Conclusions

5. Recommendations

6. Appendix

- 6.1. Market Model diagram
- 6.2. November 22, 2007 letter



Dispatchable Wind Market Impact Analysis

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cc: Miranda Keating-Erickson

Version: 4.0

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Conclusion

- Can’t say what we have done makes sense for your organization.
- Tailor your BA practice to meet the needs of your organization.
- Be clear of the objective and value.
  - advising on the corporate strategy, while sexy, is only one aspect of the value that Business Architecture brings
- Don’t forget the tactical benefits.

Thank you