Optimal SpotBid

A stochastic bidding model in practical use

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Helping utilities work smarter

Optimal SpotBid = Hotshot Bidding
Short summary

- Stochastic model
- Powel and Vattenfall
- Coordination
- Powel Optimal Hydro + Powel Optimal SpotBid

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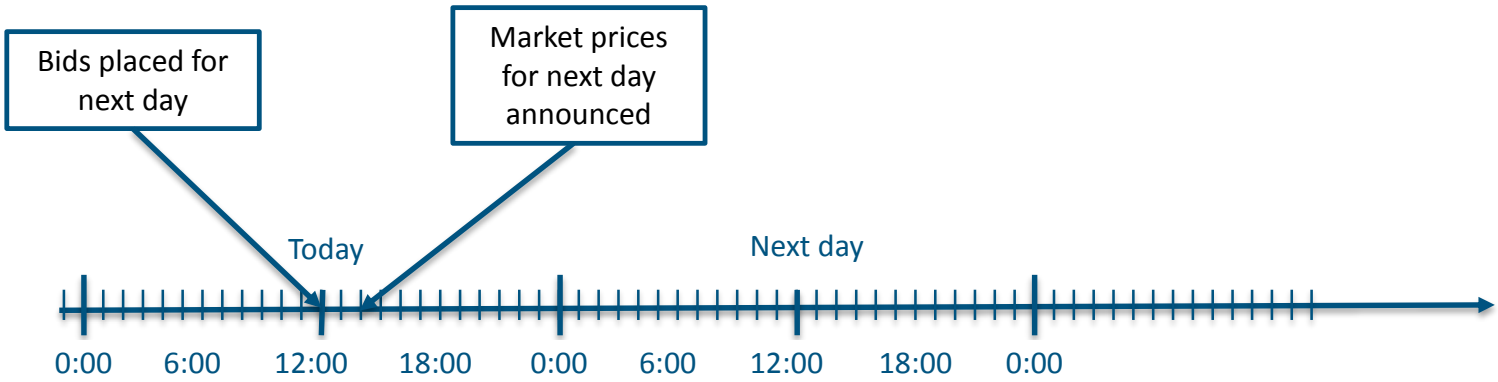
Optimal SpotBid
Uniqueness

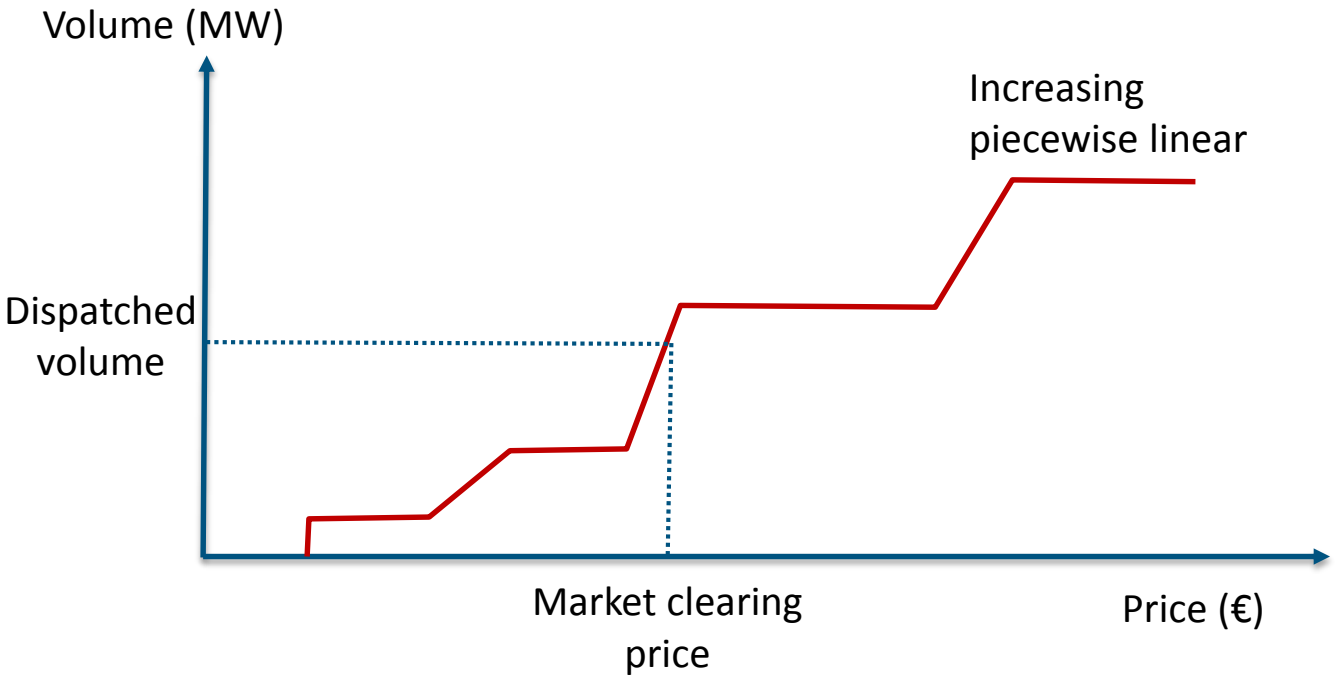
- Price uncertainty explicitly
- Calculates optimal bids (price and time dependent)
- In concert with production planning model
- Why use this model?
  - Get the right price for the power
  - Lower the risk

Nord Pool
Spot market

One bid for every hour in next day

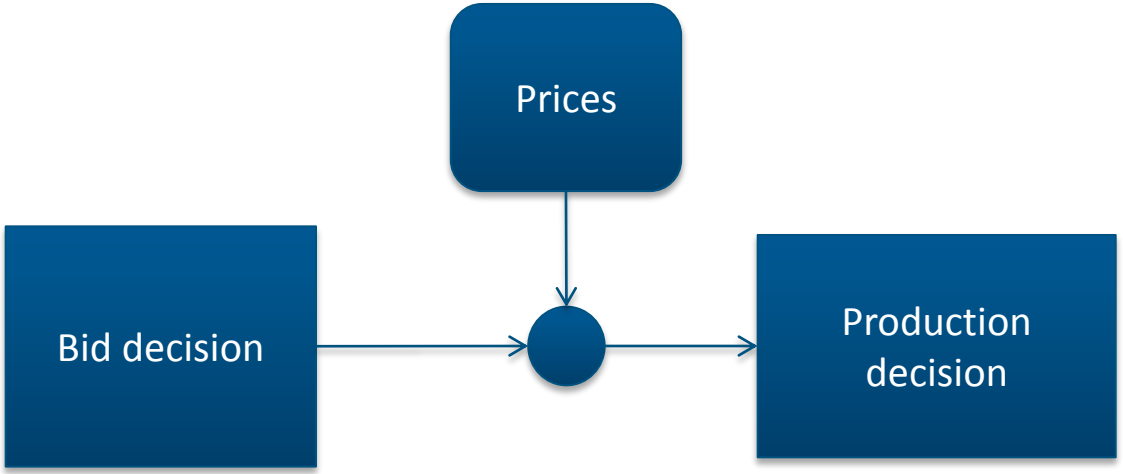


Bid stack
An example

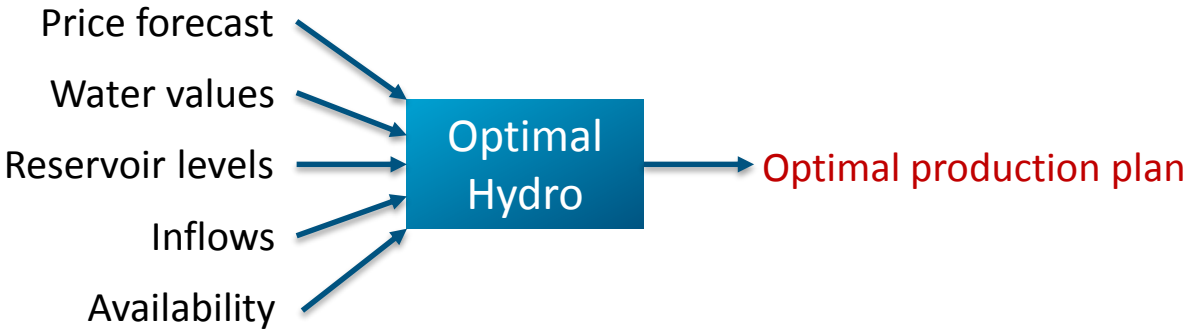


Traditional Day Ahead Planning

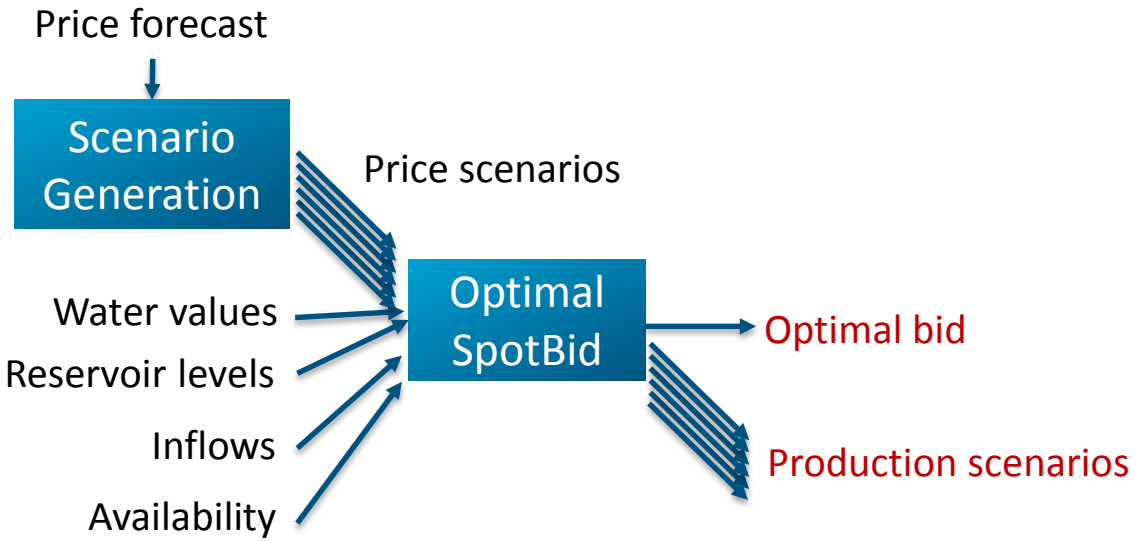
The real order of decisions



Optimal Hydro
Input and output

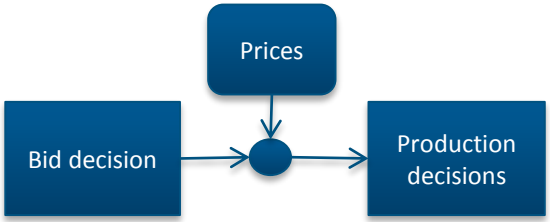


Optimal SpotBid
Input and output



Bid model

- Linear programming model
- Stochastic programming (2 stages)



- First stage variables: The bids
- Second stage variables: Production plans

Maximize expected revenue minus cost!

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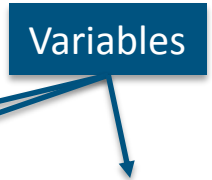
Optimal Hydro and Optimal SpotBid
Simplified ”mathematical” models

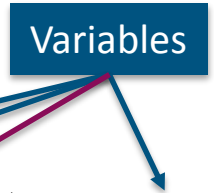
Hydro objective:

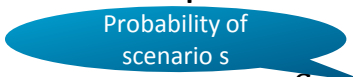


$$\text{Max} \sum_{t=1}^{T}(p_t x_t - d_t(x_t - x_t^{plan})) - c(w_T)$$

Max Revenue – Cost for deviation from plan – Cost of water

SpotBid objective:





$$\text{Max} \sum_{s=1}^{S} q^s \left(\sum_{t=1}^{T} p_t^s x_t^s - d_t\left(x_t^s - b_t(p_t^s)\right) - c(w_T^s)\right)$$

Max Expected Revenue – Cost for deviation from bid – Cost of water

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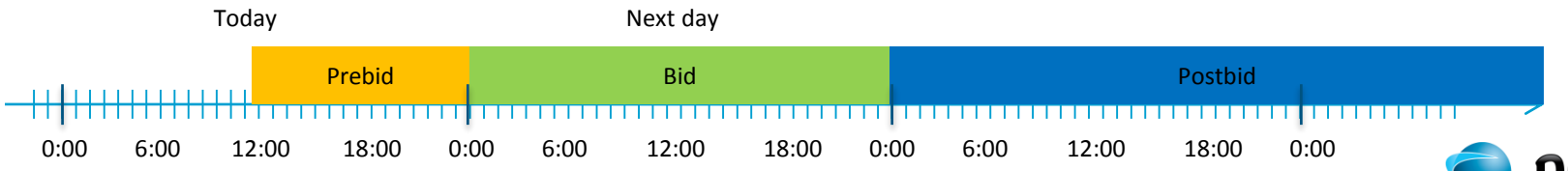
Modes of production

Prebid period: Produce the volumes from yesterday's bid

Bid period: Produce according to today's bid

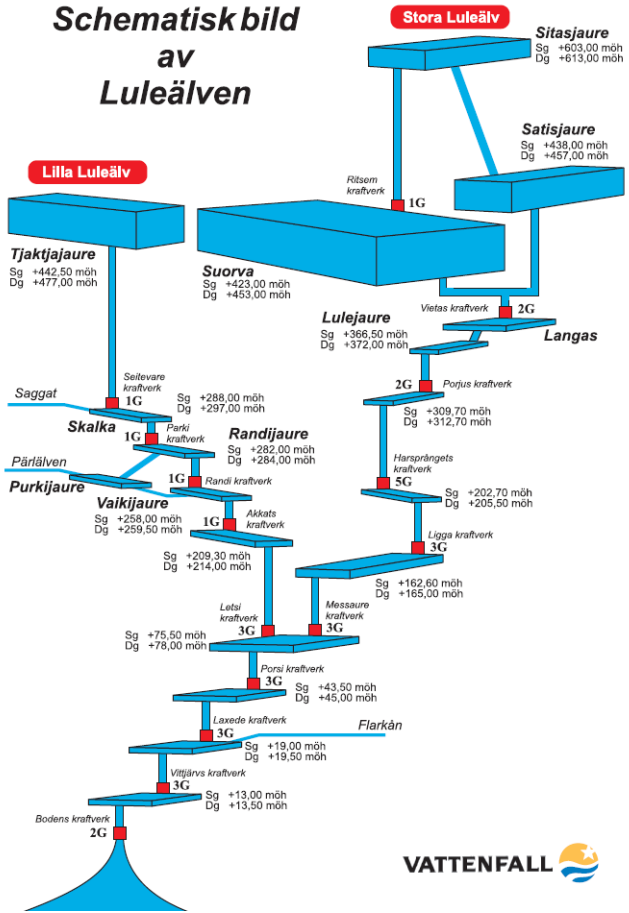
Postbid period: Produce according to best price



Advantages

- Realistic model of the bid situation
- Handles uncertainty in price
- Lower (eliminates) the risk of not being able to produce the spot volumes
- Possibility to catch price spikes
- Handles the topology of the water course
- Detailed model of the river
- Coordinated bidding with production planning
- (Rather) short solution times

The Challenge



Key Facts

- Day ahead (Elspot)

- 5 – 10 minutes

- No commitment (on/off) decisions

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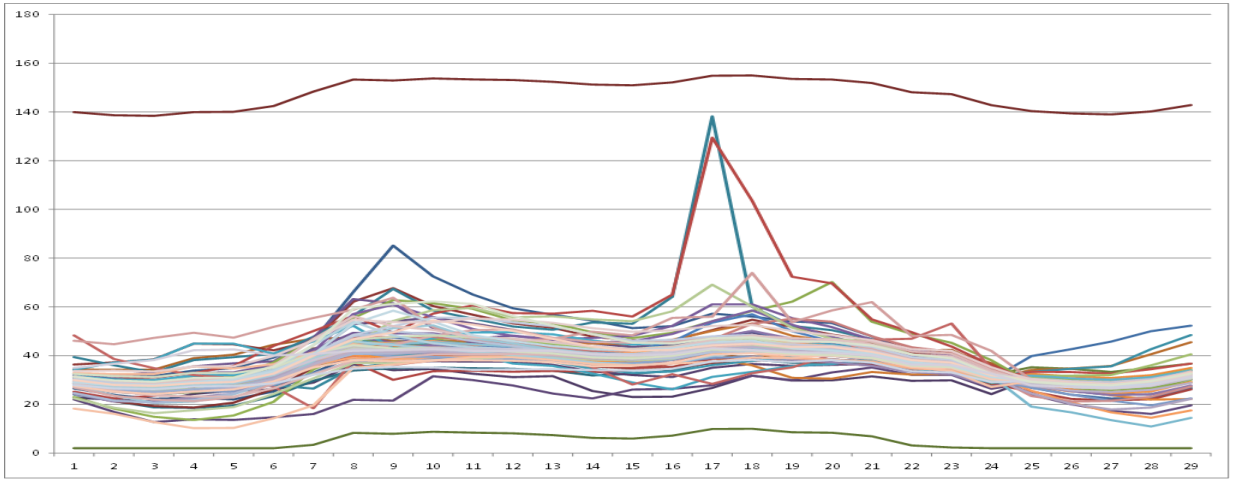
100 Price Scenarios

- too few scenarios => inconsistent results
- too many scenarios => bad performance
- some extreme scenarios also necessary



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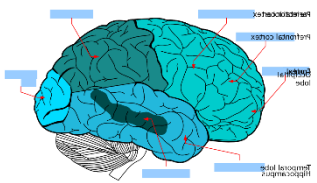
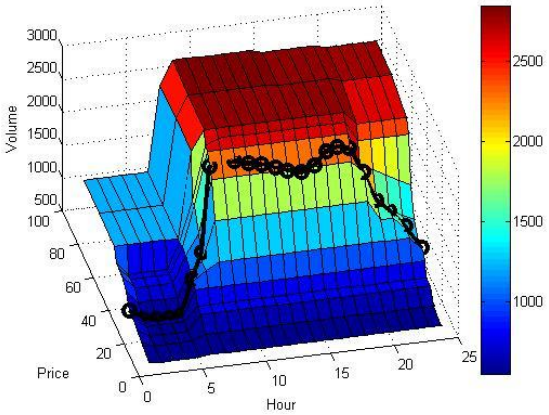
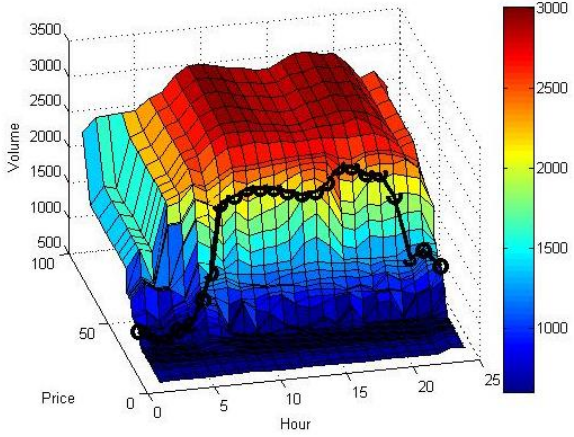
Way of working







Often quite similar bid curves