HIGH FREQUENCY DATA IN THE EMPS MODEL

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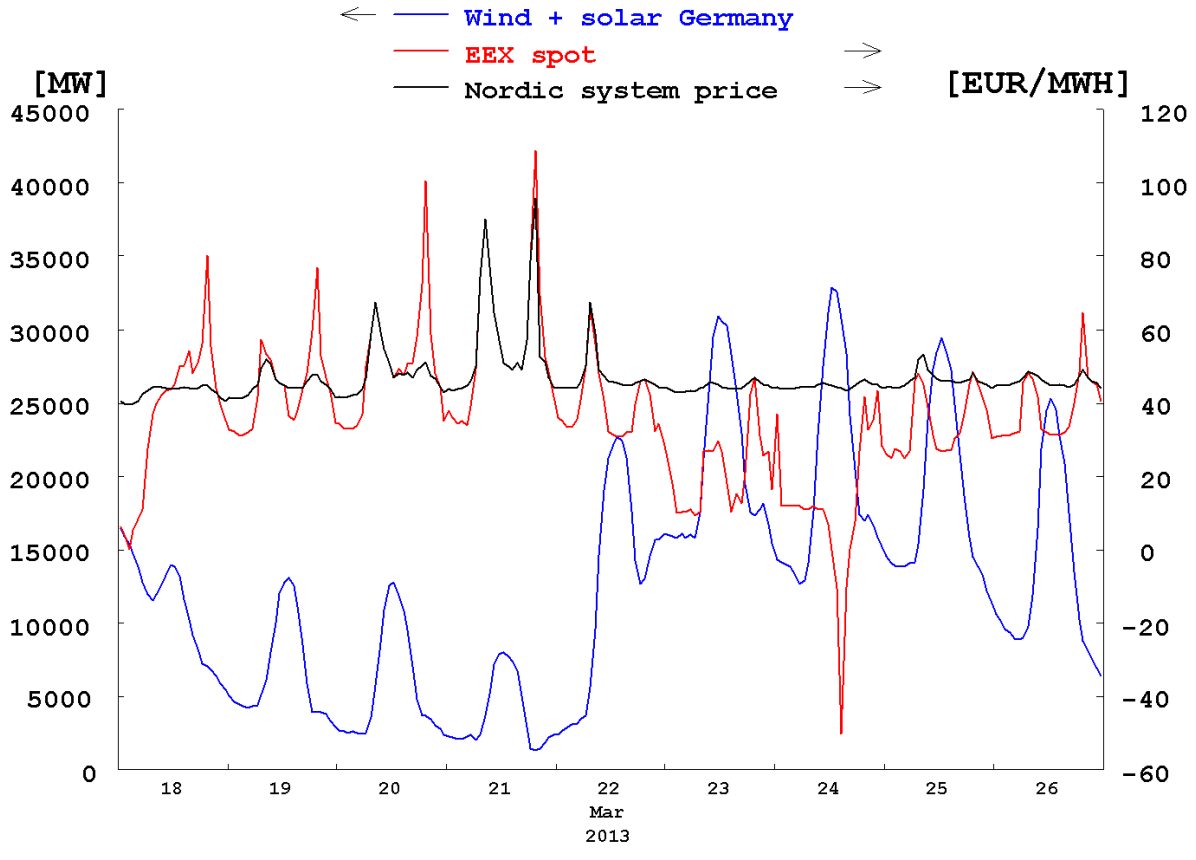
Agenda

- Motivation
- Implementation status
- Results and value
- EMPS model development
- Implementation challenges

Motivation



- More renewable intermittent production Nordic and Continent
- Currently about 34 GW solar installed in Germany, 32 GW wind power
- More transmission capacity to Continental system

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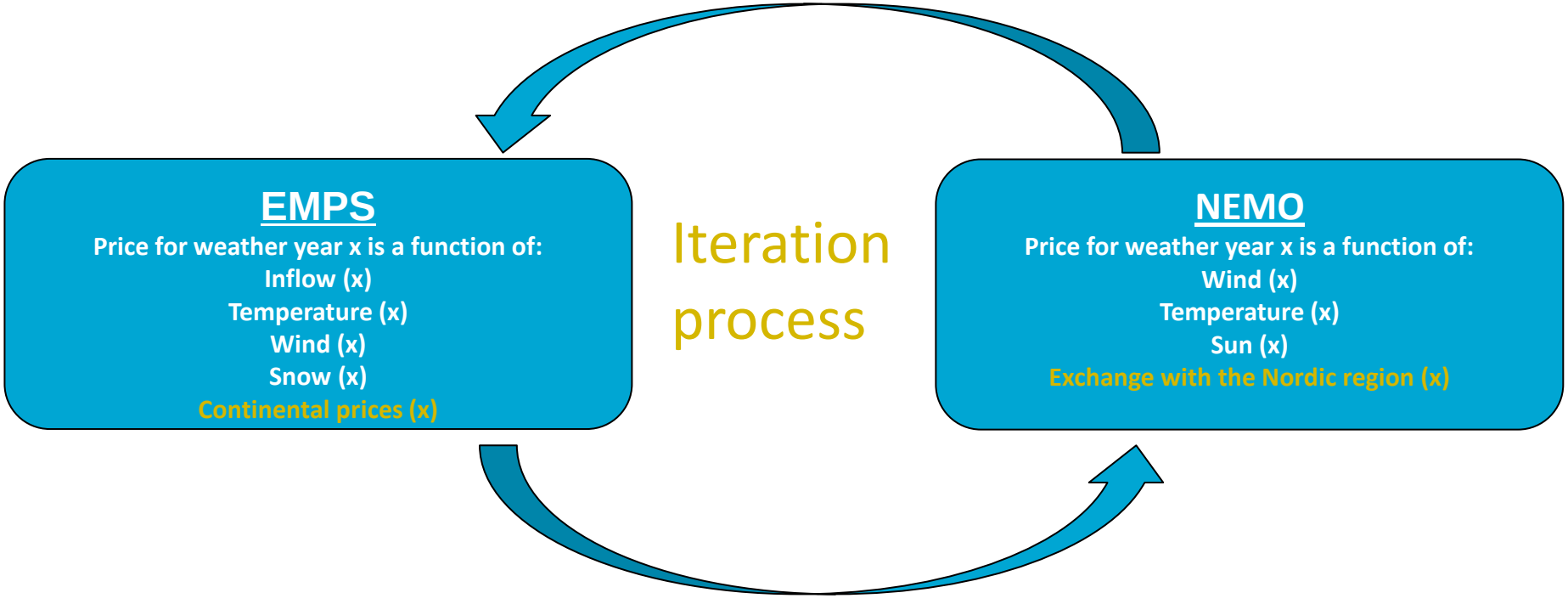
Implementation status

- DONE:
- 3 hourly resolution (56 load segments) in long term price forecast 2012
- Continental and Nordic (EMPS) model integrated with consistent weather scenarios

- IN PROGRESS:
- Weekly 5 year forecasts with high data frequency (3h or h) to be implemented this year
- Larger implementation job in operative forecasts
  - Includes seasonal model
  - More surrounding tools and systems, more time critical processes

Weather scenarios in EMPS (Nordic model) and NEMO (Continental model)

Continental prices for each weather year (3 hourly resolution)



Exchange between the Nordic and the continental market for each weather year (3 hourly resolution)

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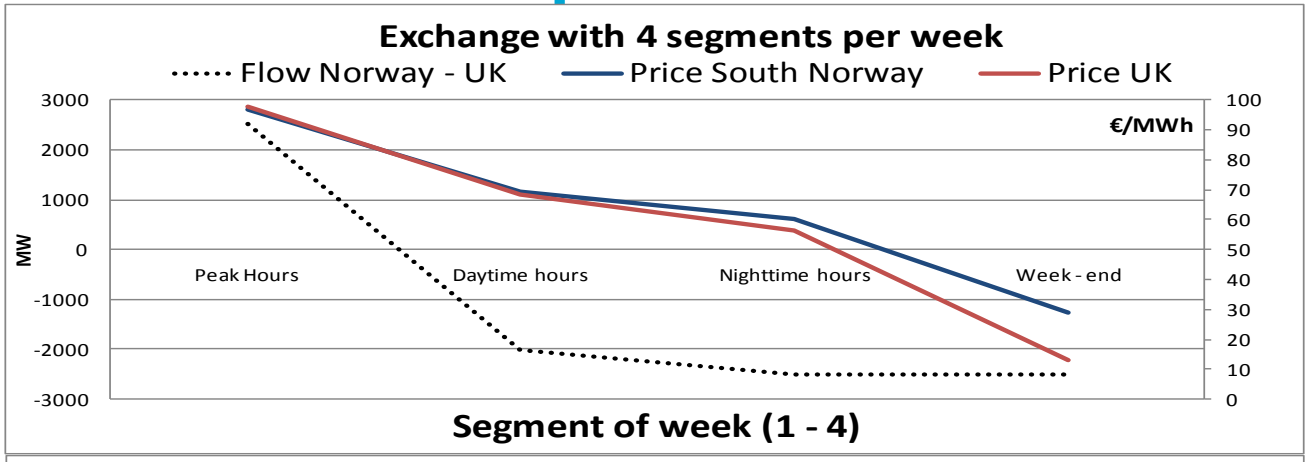
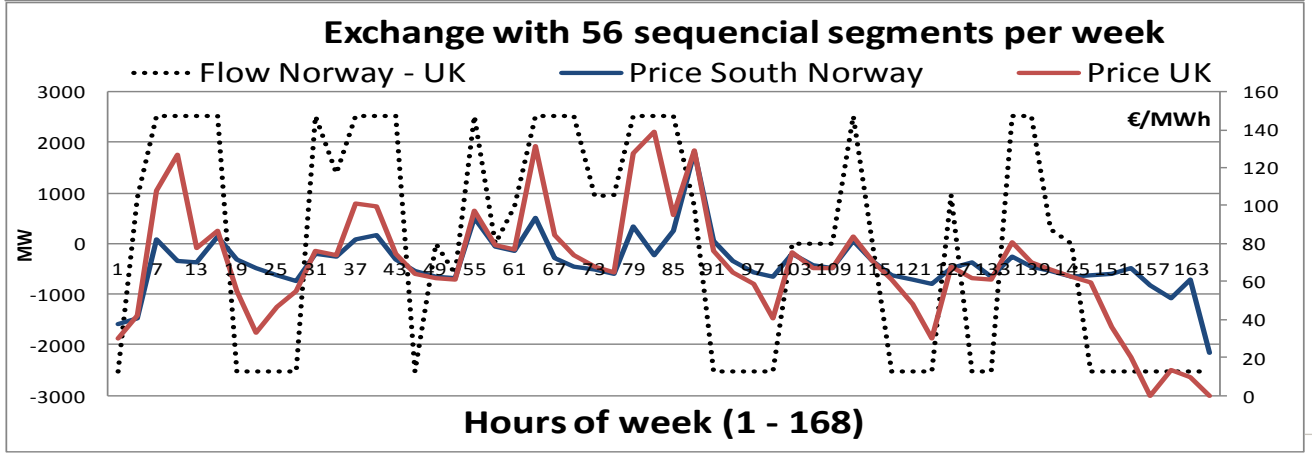
Results example: Interconnectors





- Both examples from same week and scenario
- Able to show an irregular price pattern and corresponding flow
- Very different results – aggregation to 4 load segments causes problems

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Value of 3 – hourly data

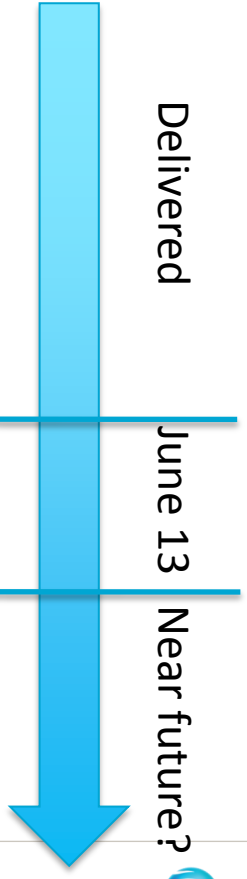
- Detailed weather scenarios
  - Describes short term variations on production and prices caused by weather
  - Correlations between weather variables (temperature, solar, wind, snow and inflow)
  - Consistent scenarios – correlations in time and space described
- Better price forecasts
  - Describe short term variation
  - Explains historical short term variations reasonably well
- Calculate value of flexibility
  - Investments
  - Water values

Challenges

- Model development
  - Basic functionality all ready developed
  - Stressing parts of the original logic – need for further development
- Calculation
  - Problem size increases with more data – time is a limited factor
  - Both model improvements and better hardware needed
- Detailed input
  - Matching of time series data
  - Even if model is ready, detail and quality of input is an issue
- IT systems development
  - Surrounding models and tools are not necessarily ready for handling 3 - hourly data
  - A lot of data to handle (56*260*80 = 1.164.800 data for each variable)

Model development

- Extension to hourly data (From max 12 to 168 load segments)
- Samtap calculation time improvements
- Wind and exogenous prices with hourly data
- Daily consumption temperature correction
- Maskenett.DATA as time series
- Parallel seasonal model
- Daily inflow in seasonal model
- Calendar model (Remove 52 week year and EFI – week)
- Time series API
- ReOpt (samtap extension/alternative)



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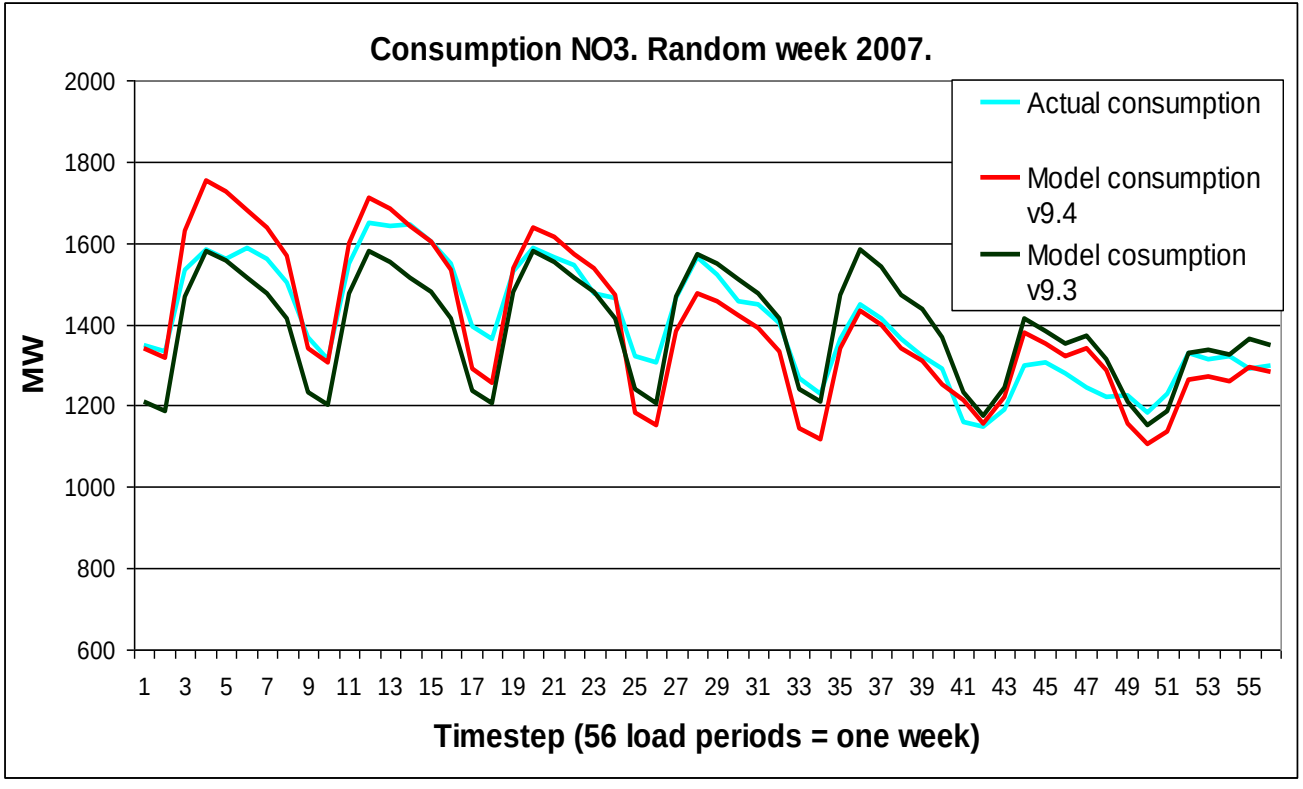
Calculation times (5y parallel Nordic model)

Model	4 load segments	3 hourly data
Strategy	15 min	90 min
Detailed dispatch	7 min	25 min
Seasonal model	5 min	10 hours

- Strategy scales only to 14 cores (number of aggregated areas)
- Seasonal model is built to scale for hundreds (thousands?) of cores
- Reporting (kurvetegn etc.) also consumes a considerable amount of time
- Working on parallel seasonal model
- Will acquire new hardware

Detailed input



- Daily temperature correction helps explain actual consumption better
- Still no exact match
- What details are most important, and where to improve model and input?
- The level of precision required is demanding

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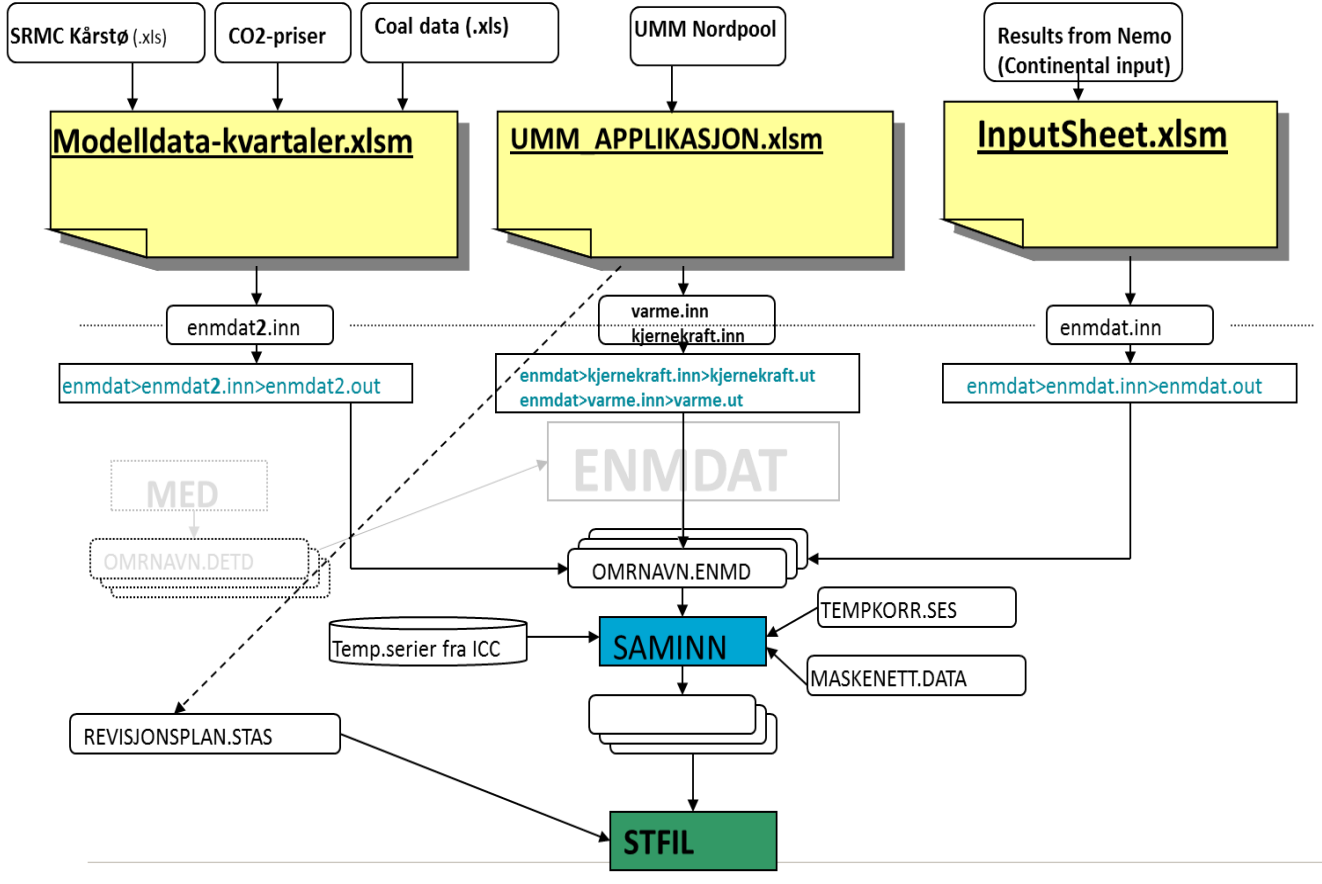
IT - tools need adaption



- Surrounding tools and systems not ready for higher frequency data
- The increased amount of data calls for more sophisticated data handling

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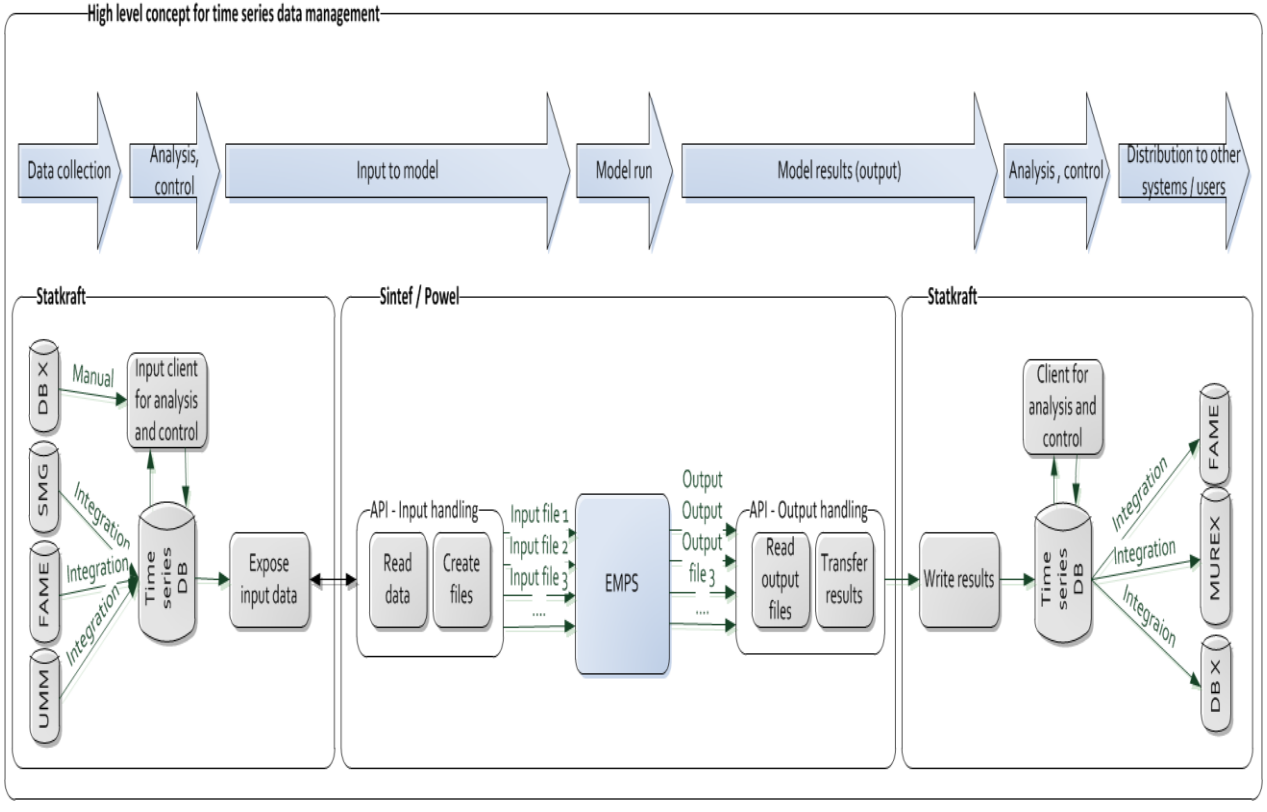
Concept for input and results



- Store all time series in a database
- Calendar time series (not EFI week)
- Work with APIs - abstract away from inefficient file formats and result applications
- Build new tools for handling input / results

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