Monitoring Key Performance Indicators of Geothermal Fields Using Automatic Reservoir Simulations

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The Developing Requirements of Geothermal Field Operators

- Models applicable at ever smaller time scales.
- A comprehensive overview of the state of the reservoir.
- More accessible and up-to-date model results.
- Increased interaction from field operators with the models.

What are the “Key Performance Indicators”?

- Easily understandable parameters to estimate the response of the reservoir to utilization.
- For example:
  - Renewability of mass and energy in the reservoir in context with production.
  - Expected time of when to drill new make-up wells.
  - Expected time until new make-up wells are no longer profitable.
  - The limit of sustainable utilization of the reservoir.
  - Development of production, enthalpy and wellhead pressure.
  - Distribution of thermodynamic properties in the reservoir.
  - Total primary energy in the reservoir.
- The KPIs that are selected can be tailored to each client.

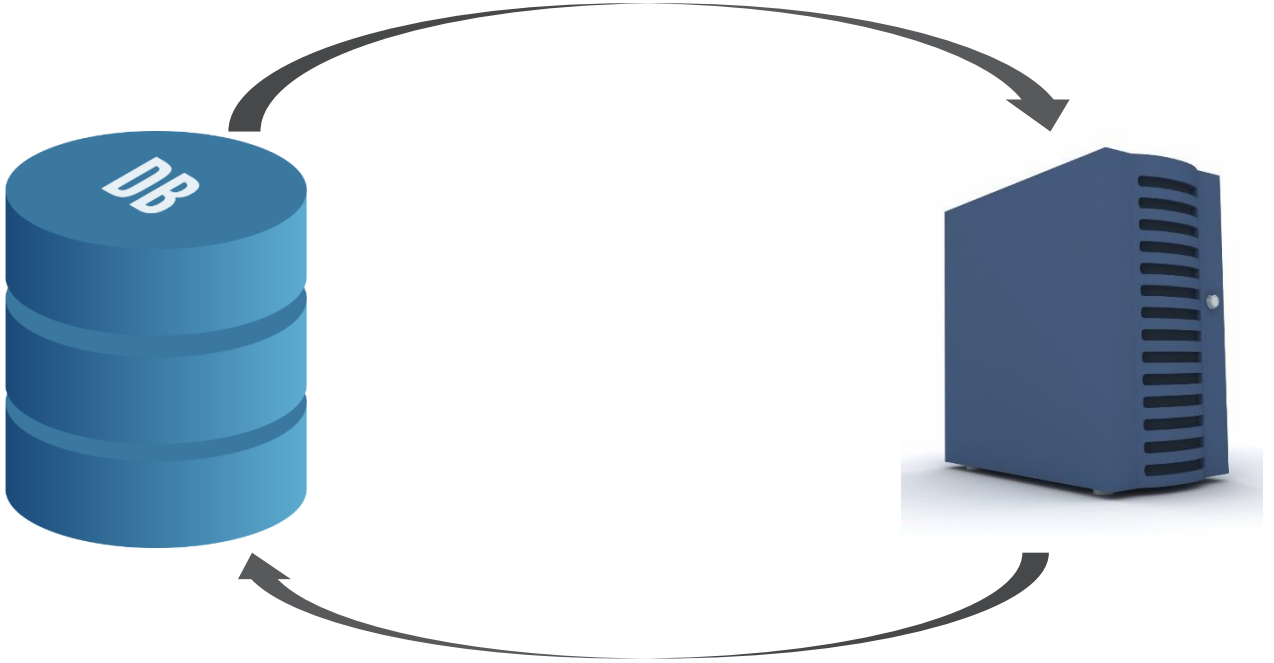
The Traditional Approach in Modelling

- Data is gathered from multiple sources with varying quality and different formats.
- The data is manually converted into a form that the modelling software can understand.
- The simulation is performed and a written report handed in to the field operator.

The Modelling Approach in this Project

- The field operator collects data into standardized form, reviews the data quality and releases appropriate data to the modeler via an SQL database.
- The modeler collects data from the database at regular intervals.
- The reservoir model is automatically calibrated with the new data.
- The reservoir simulation is performed.
- Several easily understandable KPIs are calculated from the model results.
- The KPIs and other modelling results are uploaded to the operators SQL database.

Measurements and other data about the field



Field operator
(Landsvirkjun)

Modeller
(Vatnaskil)

Model results and key performance indicators

Benefits of the Methodology - I

- Data are accessible in a standardized format which is easily converted to a format that the modelling software can understand.
- Data are available with quality labels which helps the calibration process.
- Reservoir models are updated and run with the newest available data at regular intervals.
- The results are presented on the form of easily understandable KPIs.

Benefits of the Methodology - II

- Easier monitoring of reservoir response to changes in production and injection.
- The geothermal field operator gets a better overview of the sustainability of the utilization.
- Earlier insight into whether the utilization strategy of the field needs to be changed
- The field operator can access both the KPIs and other simulation results for further analysis.

Future Work

- Addition of more calibration parameters to the process: subsidence, tracers, gravity, etc.
- Ability of the field operator to run scenarios by manipulating parameters in the model through a web interface.
- Automatic generation of interactive visual results.