

Upscaling Geothermal Heat: Synthetic Models Advising Field Development (PPT)

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Publication date 2019 **Document Version** Final published version

Citation (APA) Daniilidis, A., Nick, H. M., & Bruhn, D. (2019). *Upscaling Geothermal Heat: Synthetic Models Advising Field Development (PPT)*. DAP symposium 2019, Delft, Netherlands.

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Upscaling Geothermal Heat: Synthetic Models Advising Field Development

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DAP symposium 2019, March 12th

Research Funded by:



Ministerie van Economische Zaken



Steering committee Platform

ebn

Motivation

Primary energy consumption by source, World

Primary energy consumption by source across the world's regions, measured in terawatt-hours (TWh). Note that this data does not include energy sourced from traditional biomass, which may form a significant component of primary energy consumption in low to middle-income countries. 'Other renewables' includes renewable sources including wind, geothermal, solar, biomass and waste.





Other renewables Solar PV Nuclear Hydropower

Coal

<2°C.

Motivation EU-28 (2015) 60 30 50 25 40 Percentage (%) 15 30 10 20 5 10 0 Services Other Industry Agriculture and forestry Households Transport 0 Space heating

Households, EU-28				
Water heating	Lighting and appliances	Cooking	Other end uses	Space cooling

Geothermal systems





Background Three types of reservoir models



TUDelft

Background Well spacing



Background Interference – two doublets



Willems et.al. 2017





Underlying idea

"Simple" synthetic model X1000s realization

Analyze results



Capture uncertainty Consider scenarios

Obtain generalizable conclusions



Devise strategy

"Upscale" findings to field scale

Synthetic model 2 doublets separated by one fault



3

Example simulation Top view





TUDelft





√ 0

System lifetime Temperature drop



System lifetime Percentage drop T≤95%T_{t=0}



NPV At system lifetime



TUDelft

System lifetime Well configuration







Example simulation Top view





System lifetime Well configurations T \leq 95% T_{t0}









Field scale





"Sinple" synthetic model X1000s realization

Analyze results



Capture uncertainty Consider scenarios

Obtain generalizable conclusions



Devise strategy

"Upscale" findings to field scale

Relevance



Source: Heat Roadmap Europe 2013

TUDelft

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