

# CHALLENGES IN SMART ENERGY TRANSPORT BY USING TRENCHLESS TECHNOLOGY

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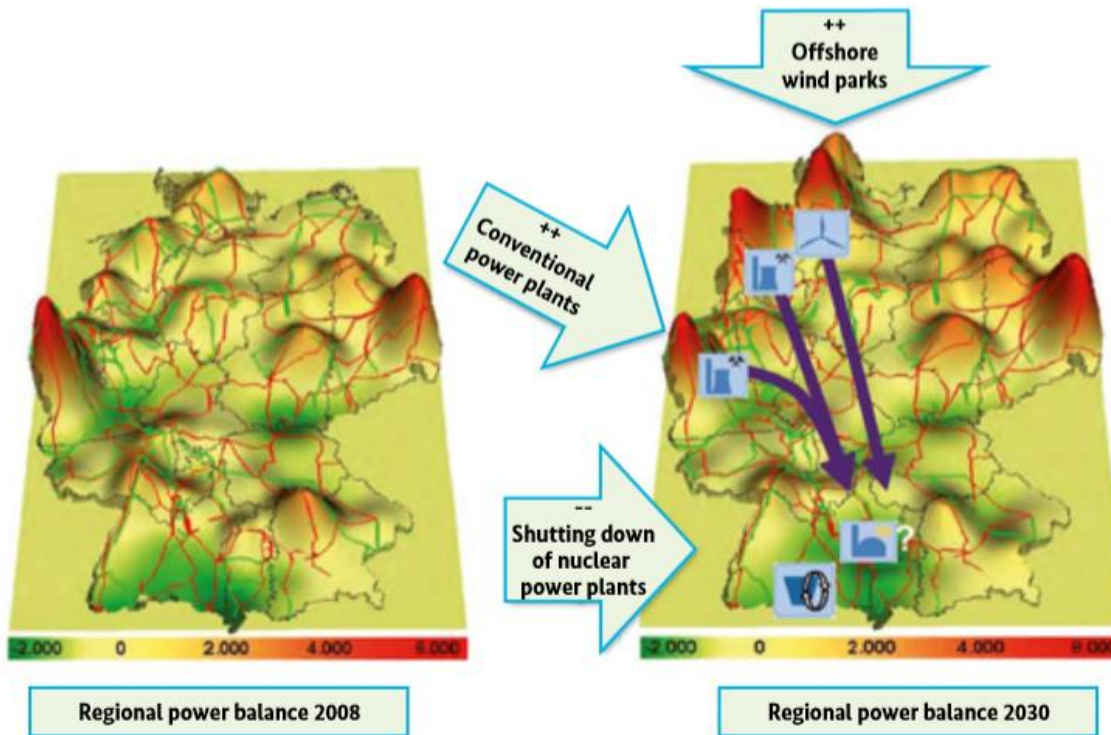
## Energy conception of the German federal government 2010:

	Today	2020	2030	2040	2050
<b>Cut in greenhouse gas emissions (against 1990)</b>	- 27 %	- 40 %	- 55 %	- 70 %	- 80 %
<b>Proportion of renewable energy in gross final energy consumption</b>	10 %	18 %	30 %	45 %	60 %
<b>Share of renewables in electricity consumption</b>	16 %	35 %	50 %	65 %	80 %
<b>Cut in primary energy consumption (against 2008)</b>	- 6 %	- 20 %			- 50 %
<b>Cut in electricity consumption (against 2008)</b>	- 7 %	- 10 %			- 25 %
<b>Cut in energy consumption in transport sector (against 2008)</b>		- 10 %			- 40 %

# Background – Power concept

Today:  
Small Pilot routes for 380 kV

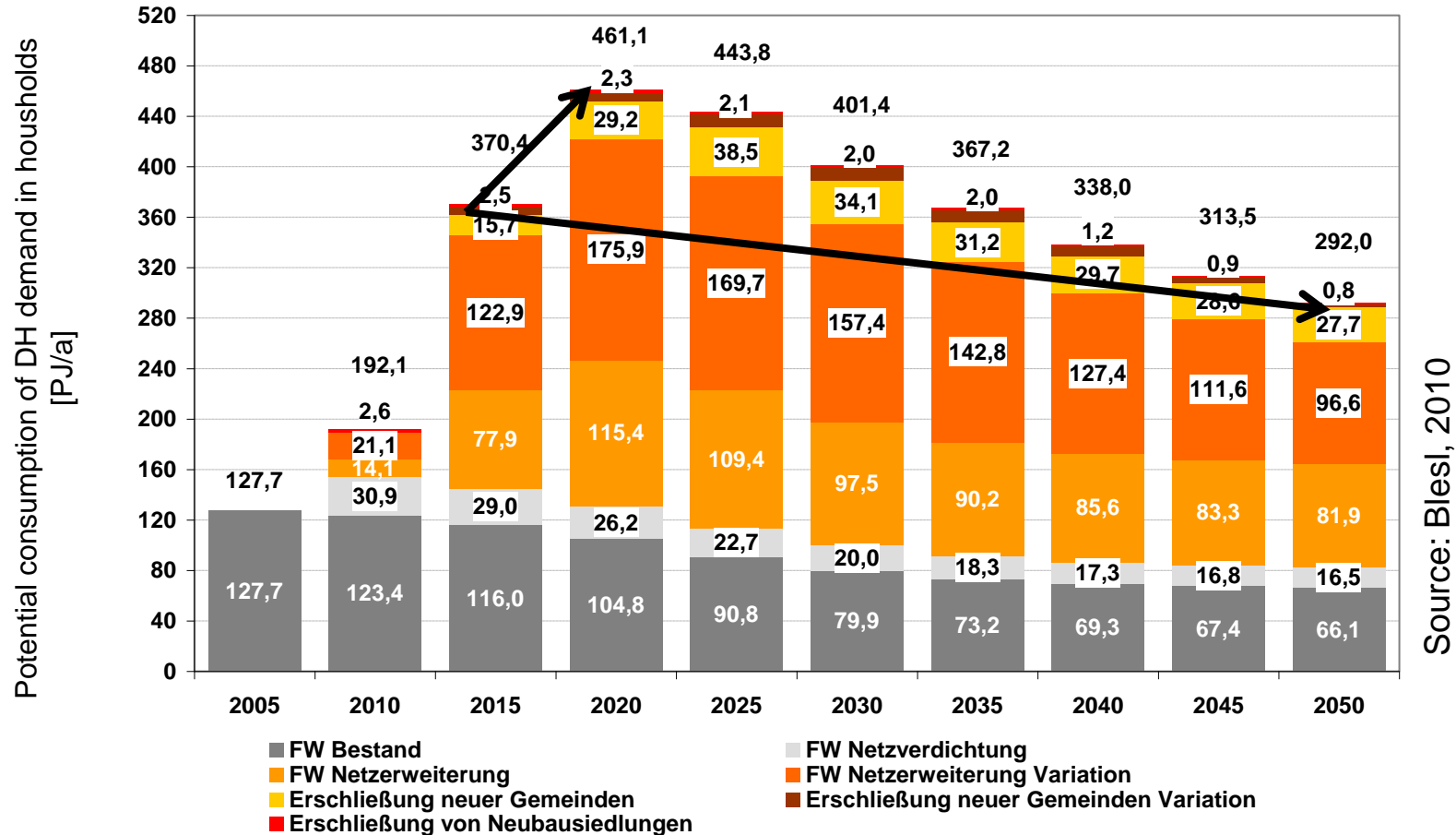
Power output in MW



Source: Amprion

Source: Amprion

# Background – Heating concept



**Combined heat and power (CHP) act (KWKG)**  
**Target: Increase the share of CHP to 25% until 2020**

# What is trenchless Technology?



Source: Dr. Hans-Joachim Bayer

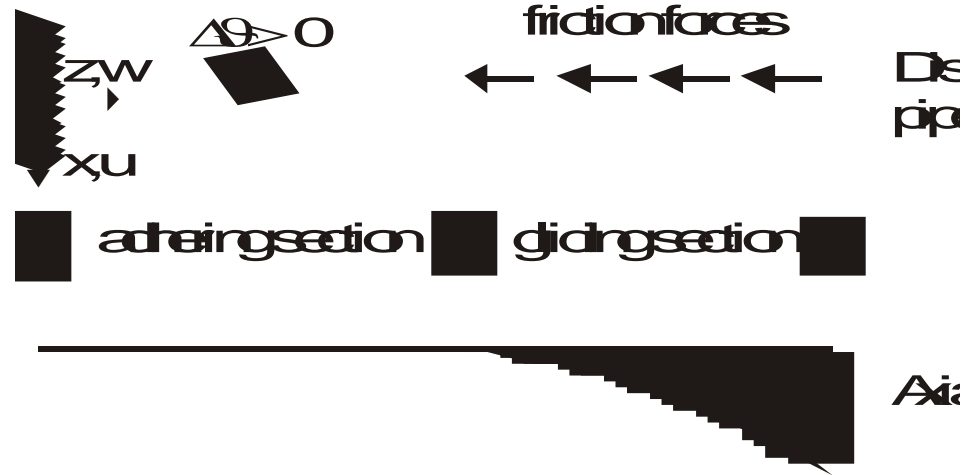
# What is trenchless Technology?



Source: Dr. Hans-Joachim Bayer

- All power cables from 1 kV to 220 kV are approved (380 kV to 400 kV are not approved for HDD)
- 1 kV, 5 kV, 10 kV, 20 kV, 30 kV are possible in bundles in one drilling
- 60 kV, 110 kV and 125 kV need pilot drilling and backreaming (3 times boring)
- 220 kV are single drillings (attention to distance), this means 3 times boring for one cable
- Direct laying and laying in protective pipe
- 380 kV today only by micro tunneling, with a special cable channel
- New 400 kV are tested, Minimum distance 25 m, no experiences for HDD (heavy cables)

## Stress-strain analysis:



- Normal force:  $N_H = -EA\alpha_t \left( \Delta\vartheta_M - \Delta\vartheta_M^{(0)} \right)$
- Length of gliding section:  $l_G = \frac{EA\alpha_t \left( \Delta\vartheta_M - \Delta\vartheta_M^{(0)} \right)}{F_{Ru}^{(0)}}$
- Maximum displacement:  $w_{max} = \frac{F_{Ru}^{(0)} l_G^2}{EA \cdot 2}$



# Trenchless District Heating Pipeline

Quality control of delivered pipes and the constructed joints.



## Results – point of view FFI:

Horizontal Directional Drilling is the most economic method in many cases, because no excavation is needed. But risk of soil, blow ups and curvature have to be taken into account.

The complete filling of the gap between pipe and surrounding soil is not granted. Thus the contact area is not constant among the pipe length. The approach for the friction forces should be carefully done.

Eurocode 7 should be respected in terms of field investigation.

The thickness of the coating should be increased.



Source: AGFW, Eichhorst

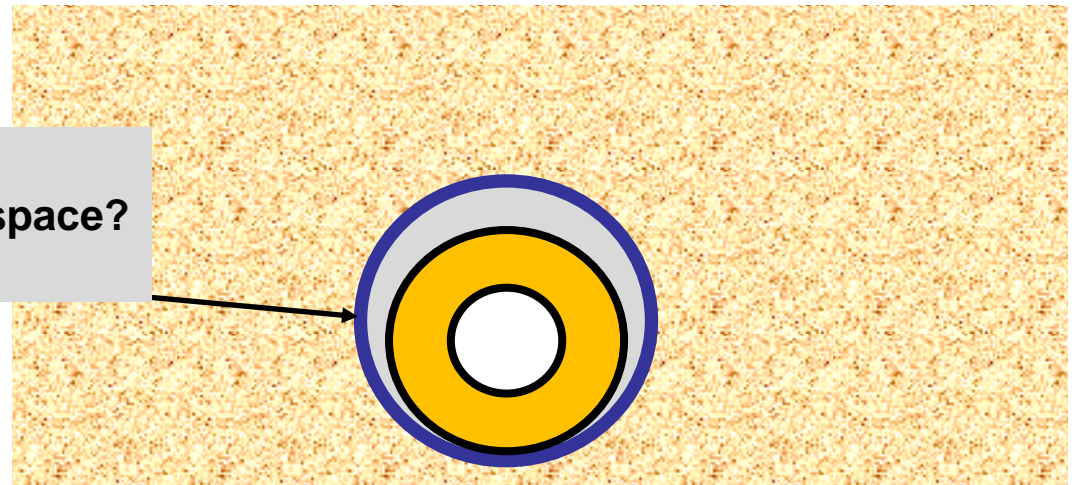
## Examples next research possibilities:

Development of a coupling joints for the trenchless district heating construction.

Optimisation of bentonit suspension.

Load bearing characteristics of the district heating pipe by using of the protective pipe.

Interaction PE Pipe – ring space?  
Interaction Protective pipe – ring space?  
Interaction Protective pipe – soil?



**Thank you for your attention!**

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