TOWARD A SECURE ENERGY SUPPLY IN A NET ZERO-EMISSION SOCIETY

Trends in contract models – from EE to integrated modes and carbon management

| Paris, France | 29. Mai 2024 I Rüdiger Lohse MD DENEFF EDL_HUB, Berlin Ruediger.Lohse@edlhub.org

Intro

Rüdiger Lohse

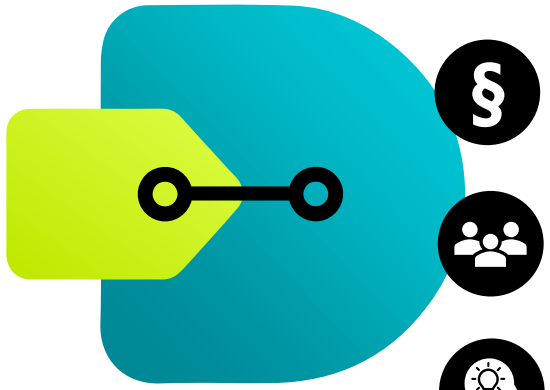
Ruediger.Lohse@edlhub.org

Managing Director

ESCO- Utility 1991-1994
Energy Agency 1994- 2019
DENEFF EDL_HUB: 2020 today

DENEFF EDL_HUB – Policy- and Innovation Hub for the Mayor German ESCOs

Mutual Effort to improve Energy Transition and the Energy Service Market in Germany



Policy: Supporting Policy Framework that enable ESCOs to have non-discriminatory Approach in the German Decarbonization Market

Networking: Complex Challenges require interaction between ESCOs, Designers, Finance and Equipmentproviders along the Chain

Innovation & Market Development and Design: Understanding the Needs of Building Owners, Industry and Public Sector, Adopting Business Models and

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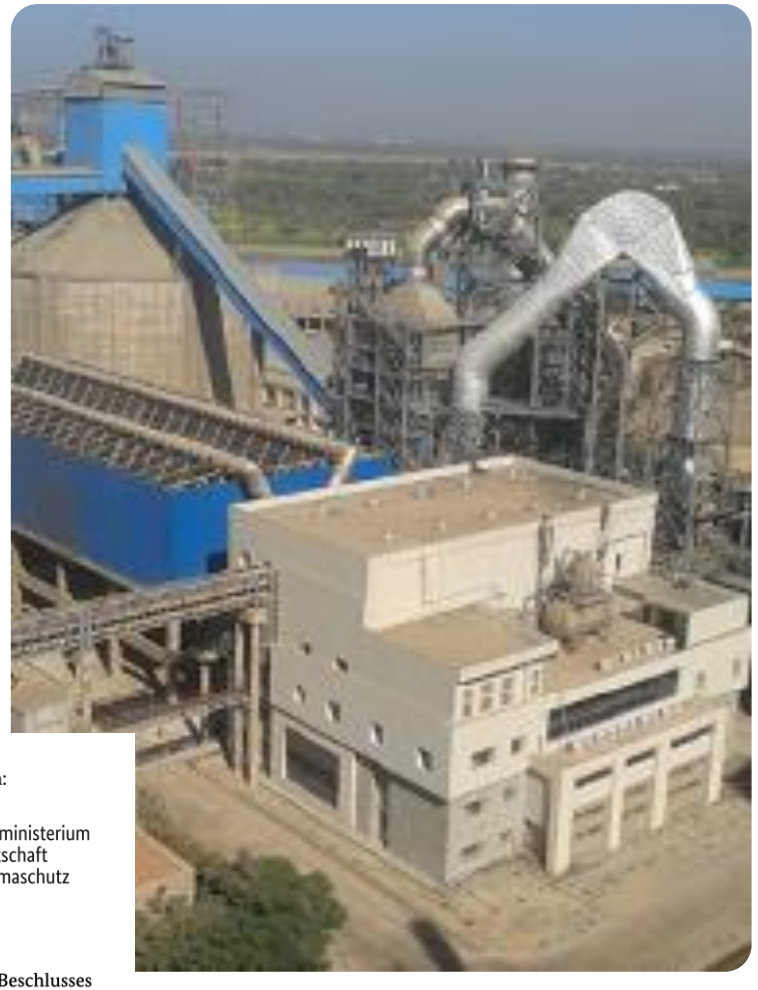
EDL_HUB Broadens the Scope of the German ESCo market: Turning Waste Heat to Green Heating in the Project „AwaNet“

- More than 70% of the Heating in Germany is fossile fuel based- EDL_HUB started project supported by German DoE to initiate a large waste-heat initiative aiming at a broader use of waste-heat in the heating sector.
- Win-Win with Waste Heat Recovery: only 1% of Waste Heat are recovered in Germany
- Until 2030 50% of the district heating is considered to be decarbonized



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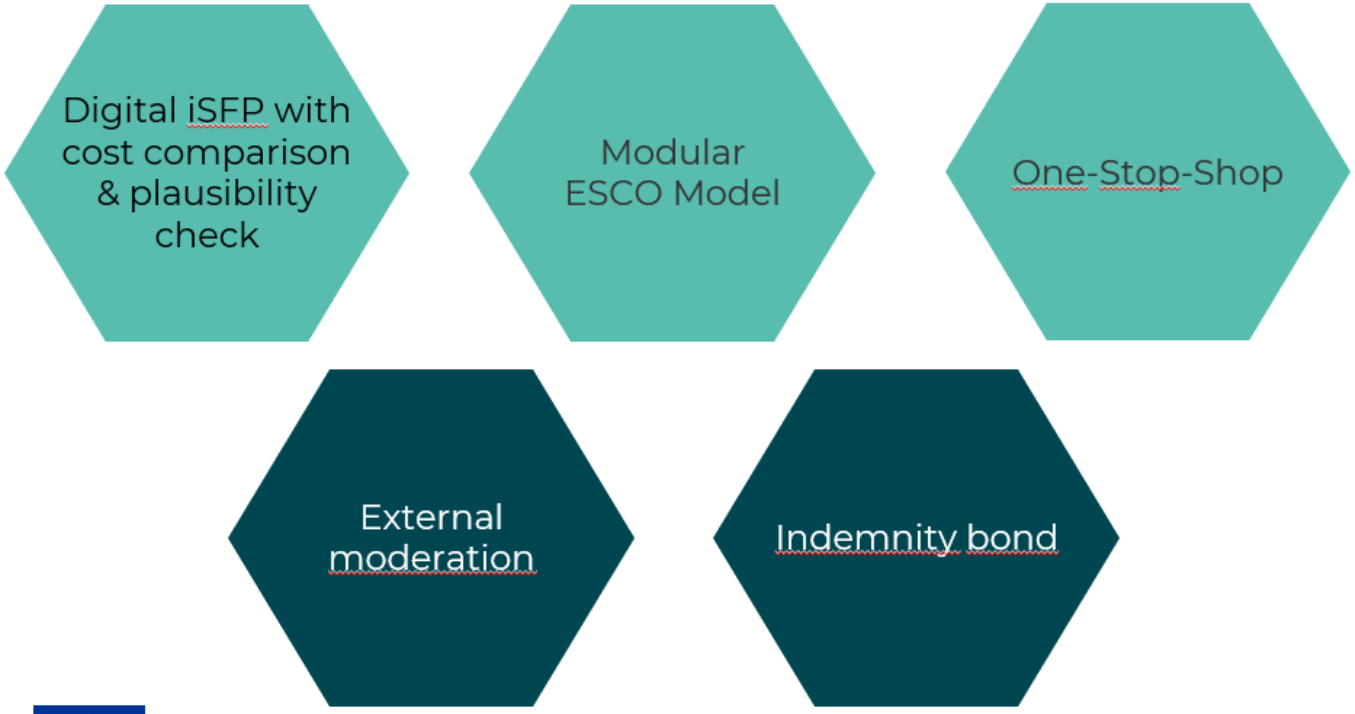
EDL_HUB Broadens the Scope of the German ESCo market: Stimulating the Sleeping Giant: Multiappartment- Buildings (GREEN Home Project)

New Business Opportunities for ESCos :

- Providing guidance by steering the refurbishment process for building management increases the probability of refurbishment projects
- ESCos enter the stage as „One-Stop-Shops“ including design of refurbishment roadmap, moderation of the decision making process, financing and executing the refurbishment aligned with a performance promise

Current results



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Three Major Regulations will Disrupt the Energy and ESCO Market in Germany from 2024

Gebäudeenergiegesetz Building Reg. (GEG II and III)
65%-Renewable Heating 2024, EU- Targets for Energy Management and Optimization, MEPS

Energieeffizienzgesetz (EnEfG): Energy Efficiency Reg.
Minimal Standards for Energy Efficiency in Buildings and Industries

Heating Design Reg.
Standardized Approach for the Energy Desing in Municipalities with regard to increase the number of decarbonized heating grids and supply options

And: Heating Market Regulation will be reviewed 2023

Framework: ESCos are Required to Provide Strategies to Communities, Industries and Quartiers to Manage the Disruptive Energy Transition

Nagy Szabi

The regulation sets up a new frame for the energy market which aims at replacing fossile fuels in the heating sector. ESCos have the following tools to match the challenge:

- **Heating Design** providing the master plan on local and regional level or the **Decarbonization Pathway** for Industry sites.
- **Fuel Switch**: replace Gas&Oil based heating by a reliable Renewable Energy Mix and electric processes in industry
- **Energy Efficiency** to reduce heating demand in buildings and to allow for smaller RE- based heating supply solutions.
- **Least-Cost-Based Decision Making** to streamline the mix of energy efficiency and new renewable supply structures
- **Resilient Supply** enabling Power Grid based Supply

New ESCo Business Models help Communities and Industries to Accomplish Decarb-Targets in a One-Stop-Shop „Low Risk Mode“

ESCos x Energy Performance Contracting and Energy Supply Contracting:

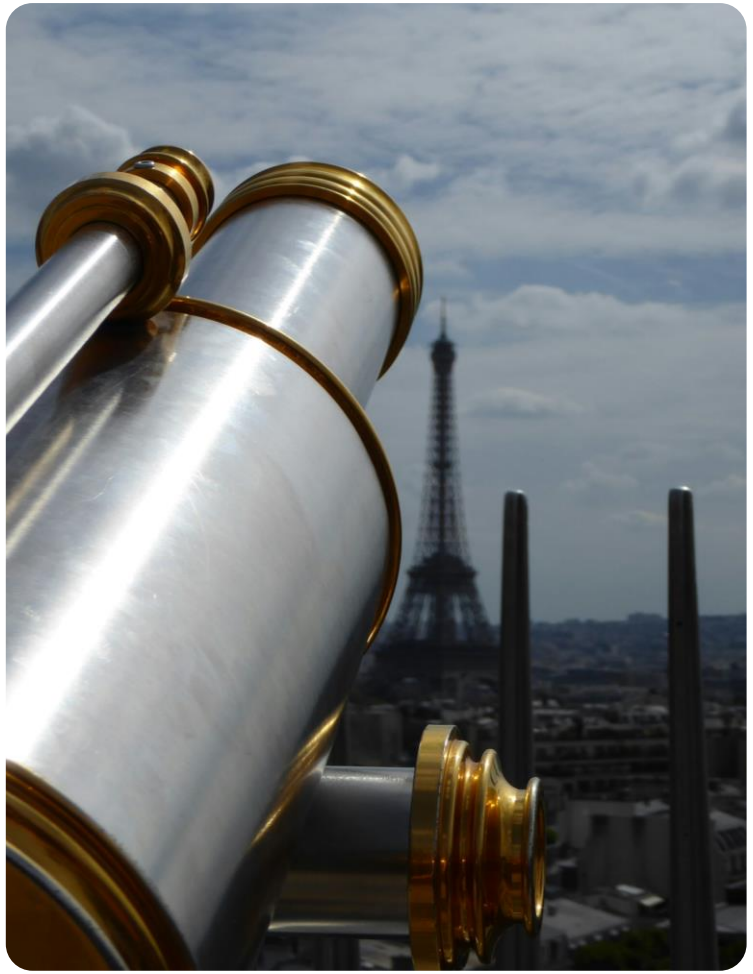
New challenges require new approaches which often don not match with the „Utlity“ oder „ESPC“ Approaches.

Costumer-Fit-Solutions based on a „Lego“ Box of Options are the NEW NORMAL ESCo Business Model

New ESCo Business Models help Communities and Industries to Accomplish Decarb-Targets in a One-Stop-Shop „Low Risk Mode“

ESCos include additional services in the value chain in order to provide low-risk affordable decarbonization as a service models

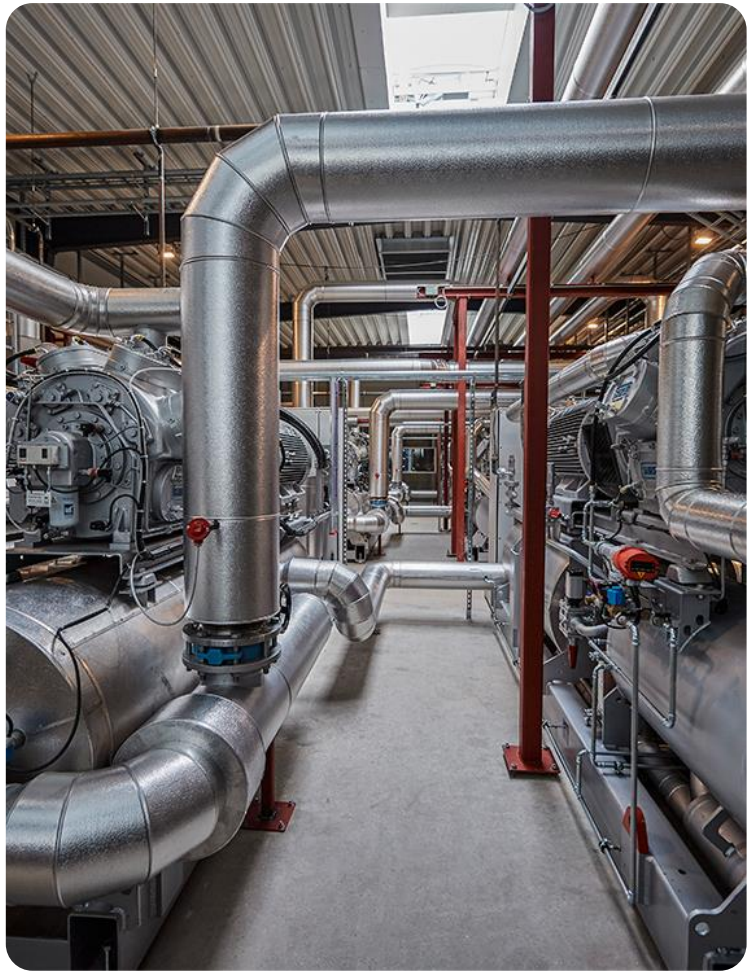
- **ESCos x Energy Performance Contracting and Energy Supply Contracting**: new challenges require new approaches which often do not match with the „Utlity“ oder „ESPC“ Approaches. Costumer-Fit-Solutions based on a „Lego“ Box of Options are the NEW NORMAL ESCo Business Model
- **ESCos x Heating Design:** ESCos include the Heating Design in Municipalities in their SOW to understand and connect renewable and waste heat to costumers striving for „Green Heating“
- **ESCos x Subsidies:** ESCos Take Care to Collect Subsidies for Their Costumers to Increase Cost-Efficiency of their Approaches
- **ESCos x Complexity:** ESCo DNA is to Find Cost-Optimized Solutions for Highly Complex Multi Technology Solutions.



Fuel Switch (1): The Majority of ESCos Uses Electrification Technologies to Answer the Fuel Switch Challenge

Trends for fuel switch in district heating grids in practice:

- Switch to **Surface Geothermal /Heat Pump** combinations (>20 MW therm) lifting RE up to 20-30% in at least 4 projects
- **Deep Geothermal** in at least 3 Projects (risky preparation phase)
- **Waste Heat Usage** in Combination with Heat Pumps in Sewage Stations and Sewers are Used as Decentralized „Injection Solutions“ in larger Heating Grids (> 100 projects, short preparation phase)
- **River Water** in Combination with **Heat Pumps** are used as „Injection Solutions“ in larger Heating Grids
- New Heating Grids (< 20 MW therm) are Set Up with Heat Pumps and Surface Geothermal as a Baseload Provider



Pic: Danfoss

Fuel Switch (2): The Majority of ESCos Uses Electrification Technologies- With Strong Impact on the ESCo Business Models

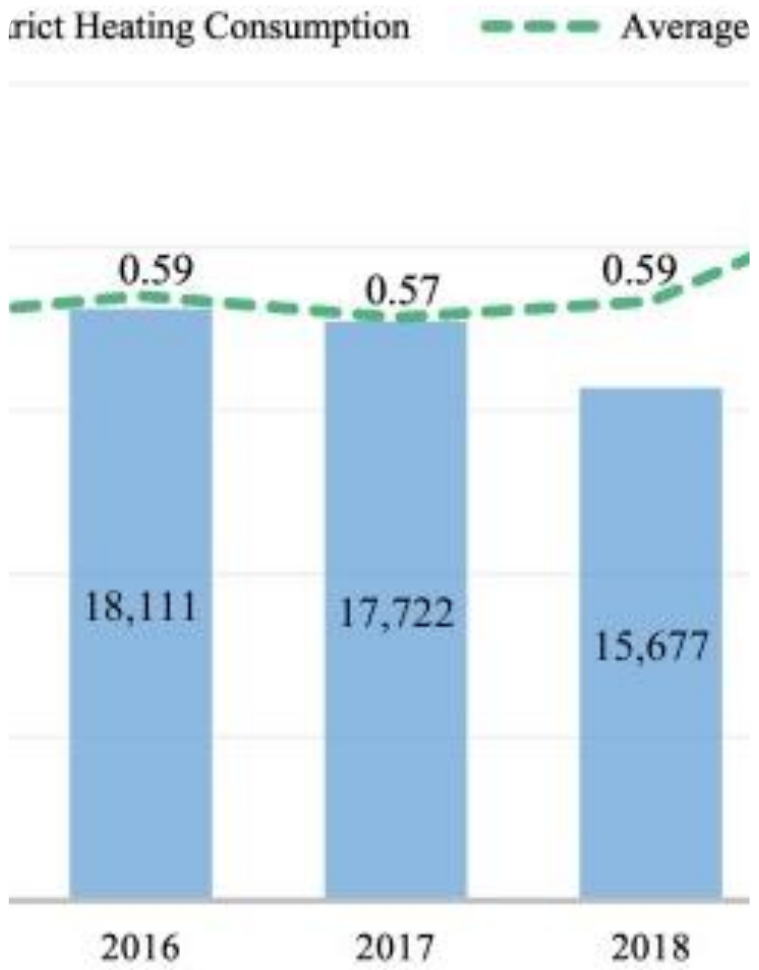
Integration of new pricing schemes

1) Impact of electric systems on the pricing:

- Pricing: Instead of Natural Gas/Oil systems are driven by electricity
- Pricing: Cost intensive first system investments (with investment costs factor 4-6 compared to fossile systems) shift the focus from energy cost (cost/MWh) to investment cost related pricing (cost/kW)
- Limited subsidies to damper the investment cost leaps

2) Trends:

- **Long ESCo- contract periods** to match cost-sensitive decision making vs. short contract periods required in industry
- Business case sensitive to modification of the investment cost related pricing



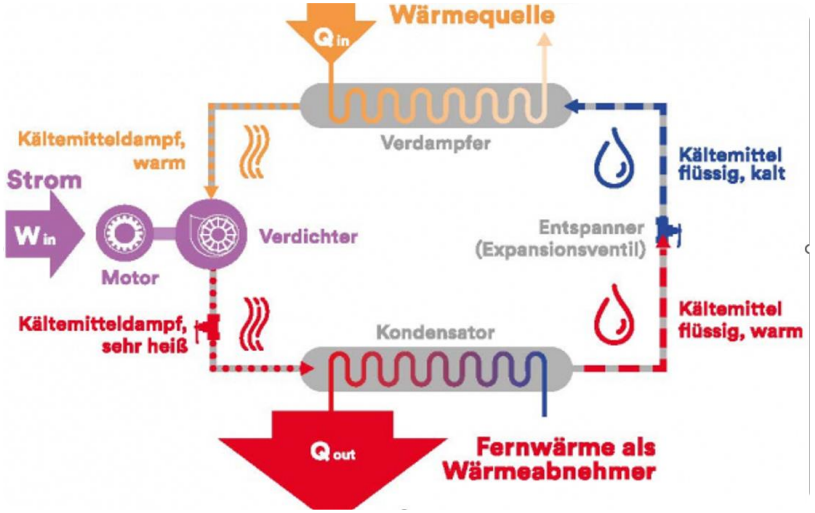
Fuel Switch (2): The Majority of ESCos Have Used Electrification Technologies- With Strong Impact on the ESCo Business Models

1) De-Risking by Integration of "Measures in the Building"

- Physical Principle is, that Heat Pumps are Sensitive to High Return Temperatures – so does the business model

2) Trends:

- Performance risk reduction: **Hydraulic measures** in the heating network are provided by ESCos: Changes of Larger Heat Exchangers, Radiators etc. are Provided to Provide the Necessary Heating System Temperatures for an Efficient Operation of the Heat Pump
- **Low-temperature Systems:** in new heating networks, heat pumps are also used detached for hydraulically suitable consumers via **low-cost "cold local heating networks**



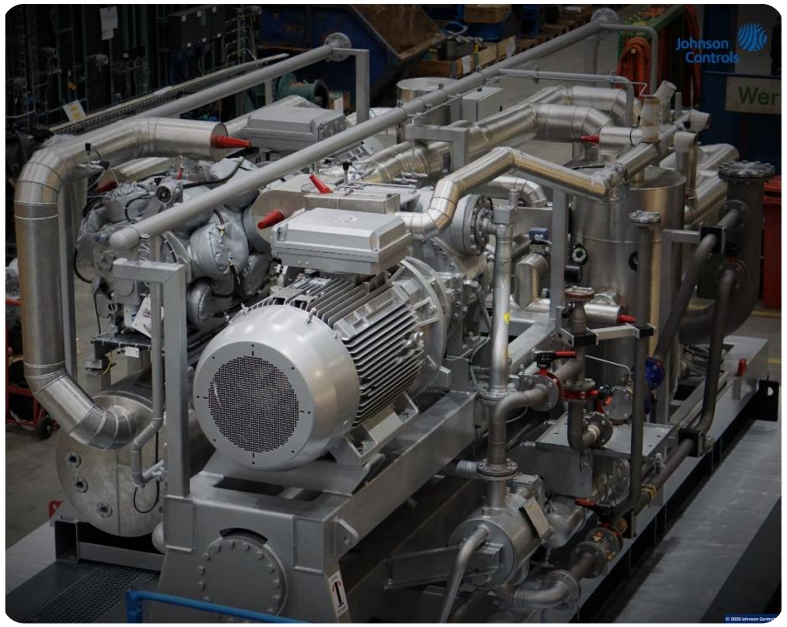
Power: The Increasing Usage of Power for Mobility and Heating Provides New Role Models for CHP-Based Business Models

1) Striving for RE Ba sed Systems puts CHP-models at stake

- Today, small and medium Sized Heating Grids (< 20 MW) use a Mix of Gas CHP (1-5 MW therm) which are partially H_2-Ready. The shift in the energy market towards Renewables imposes this „best-seller“ to new challenges

2) Trends:

- **Grid-Stabilization as a Service:** The increasing loads in local and regional power grids often creates the need for frequency stabilization which can be provided by existing CHPs in combination with new PV and storage
- Besides Grid Stability These Systems are Used as Back-Up Solutions **(Resilience as a Service)** and Peak-Cutting



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valentina.froehlich@edlhub.org

rene.scharr-hochegger@edlhub.org

ruediger.lohse@edlhub.org

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