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Forklifts at the Forking Point: Evaluating Technology Open Funding Schemes with Dominating Technologies

Session 05 – Companies II: Evaluating Decarbonization Strategies and Support Instruments
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ENERGY EVALUATION EUROPE

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SHOW ME THE EVIDENCE: EVALUATION AS THE DECISION MAKER'S BEST RESOURCE
25 SEP - 26 SEP 2025
BERLIN

University Stuttgart
IER Institute of Energy Economics and Rational Energy Use

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Federal Funding Scheme for Energy and Resource Efficiency in the Economy (EEE)

Cross-cutting technologies	Process heat from renewable energies	I&C, sensors and energy management software	Optimization of plants and processes		Transformations concepts	Electrification in micro and small enterprises
Module 1	**Module 2**	**Module 3**	**Module 4**	**Competition**	**Module 5**	**Module 6**
Grant (BAFA) / Credit (KfW)	Grant (BAFA) / Credit (KfW)	Grant (BAFA) / Credit (KfW)	Grant (BAFA) / Credit (KfW)	(VDI/VDE-IT)	Grant (VDI/VDE-IT)	Grant (BAFA) / Credit (KfW)
Promotion of investments to increase the energy efficiency through highly efficient and commercially available technologies for industrial and commercial applications.	Promotion of systems for the provision of heat from solar collectors, heat pumps, geothermal systems or biomass systems where >50% of the heat is used for processes.	Promotion of software and hardware for enhancing and using energy or environmental management systems.	Technology-neutral promotion of investments in energy- and resource-oriented optimization of industrial and commercial plants and processes and the use of heat from renewal [illegible] and waste heat.		Promotion of transformation concepts to support the planning and implementation of a decarbonization strategy and the transformation towards [illegible]	Promotion of the replacement/conversion of existing production plants that are powered by fossil fuels with new plants that are powered by electricity or renewable energies.

- Module 6: Started in May 2023
- Evaluation : Until end of 2023

[Neusel et al. 2024]

Details on the Scheme for electrification in micro and small enterprises

General aims

- Cost-efficient, effective support for investments contributing to climate protection/energy efficiency targets
- A simple and accessible funding model

Specific aims

- Reduction of fossil fuels in small businesses (especially gas and oil)
- Improving the electrification of small businesses
- From 2023 to 2026:
  - realizing 8,000 funding measures
  - reducing gas demand by 0.6 TWh/a
  - lowering oil demand by 0.24 TWh/a
  - providing 0.17 TWh/a process heat from electricity

Eligible investments	Replacing units/components powered by natural gas, coal, fossil oil and their derivates by units/ components powered by electricity
Requirements	▪ Investment minimum: 2,000 € ▪ System/components for replacing/retrofitting for at least five years in use and still operational ▪ Systems to be replaced/retrofitted is unable to operate exclusively with electrical energy ▪ No hybrid systems (with exceptions)
Funding	Grant: 33% (de minimis)/20% (GBER) of investments (max. 200,000 €); Credit: equivalent value
Financed by	Federal Ministry For Economic Affairs and Climate Protection (BMWK) via the Energy and Climate Fund
Implementing agency	Grant: German Federal Office for Economic Affairs and Export Control (BAFA) Credit: German development bank (KfW)

Based on the Funding Directive of 2023.

What does the investigation aim for?

Aim: Understanding whether the Scheme is on track to achieve its objectives and what implications do the forklifts have?

I: How did the technology-open electrification Scheme perform during the first evaluation period?	Evaluation methodology for the EEE
II: What role do forklifts play in this context?	Investigation of data sheets for forklifts
III: How could their dominant role be addressed?	Structured discussion of strategies

I: How did the Scheme perform during the first evaluation period?

The evaluation methodology consist six blocks of key performance indicators

Key performance indicators (KPI)

(G) General knowledge interest

Use by region, by type of company, by company size, by sector, by funding object etc.

(A) Target achievement

Reduction in
- final and primary energy consumption
- GHG-emissions
- energy and resource costs

(B) Effectiveness

Gross impact
- \- Free-rider and pull-forward effects
- \+ Spill-over and follow-on effects

= Net effect

(C) Economic efficiency

- Total costs (funding and admin. costs)
- Funding efficiency
- Total triggered investments
- Leverage effect

(D) Procedural implementation

- Process from company and implementer's perspective (qualitative)
- Response time and complaints management

(E) Specific knowledge interest

Module-specific questions that go beyond the specified evaluation objectives

Data sources

Administrative data | Online survey

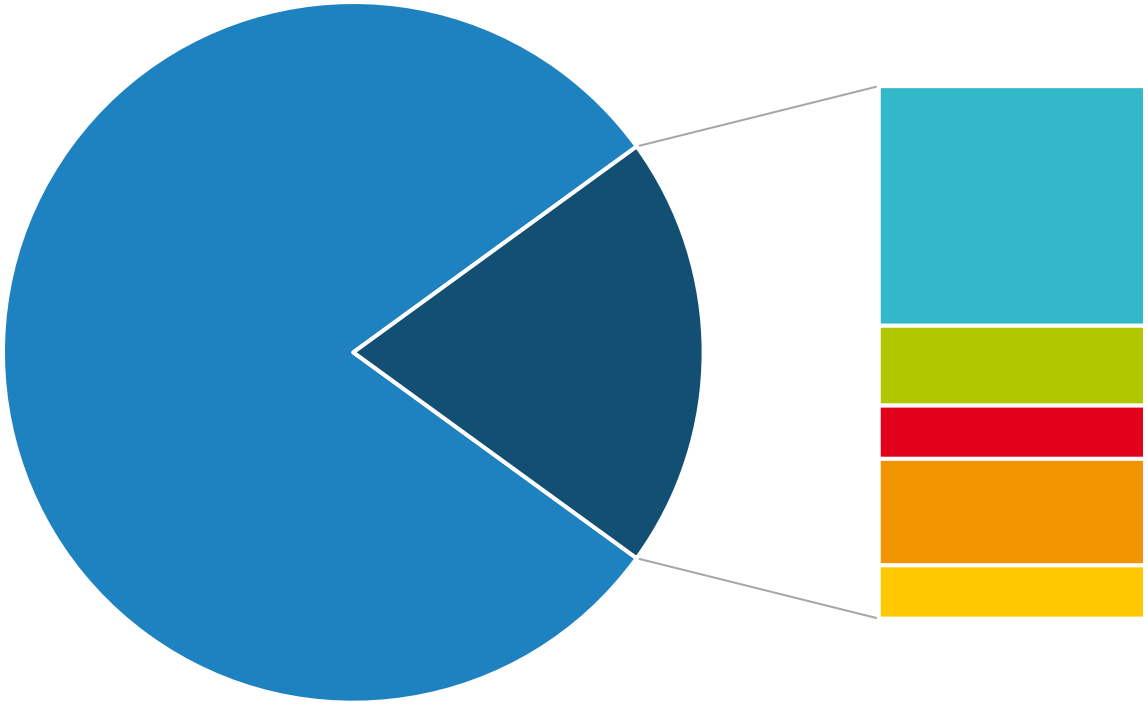
I: How did the Scheme perform during the first evaluation period?

Selected KPIs for the Scheme and the overall EEE for the year 2023

Key performance indicator (Letters denote the group, see methodology)	Unit	The Scheme (=Module 6)	Entire EEE (=All modules)
[G] Number of applications / approvals	[n]	392/251	14,130/13,759
[G] Number of approvals by funding line (grant/credit)	[n]	246/5	13,679/80
[A] Estimated reduction in GHG emissions (gross/net)	[kt $CO_{2\text{-eq.}}$/a]	1.19/1.10	2,128/1,872
[A] Estimated reduction in energy and resources costs (gross/net)	[M€]	0.2/0.2	614.2/506.4
[C] Approved funding / Triggered investments	[M€]	5.3/15.7	1,195.9/3,713.3
[C] Administrative costs	[M€]	0.1	11.0
[C] Funding efficiency (gross/net)	[€/t $CO_{2\text{-eq.}}$]	569/611	71/79

I: How did the Scheme perform during the first evaluation period?

372 applications by topic in the Scheme's grant line.



9%: Kitchen equipment and food processing
(e.g. kettle, kitchen inventory, oven, smoking equipment)

3%: Manufacturing and processing
(e.g. lathe, coater, welder, sieving machine)

2%: Garden and forestry
(e.g. log splitter, lawn mower, robotic lawn mower)

4%: Other vehicles
(e.g. excavator, go-kart, crane, tractor)

2%: Other devices
(e.g. washing machine, mangle, high-pressure cleaner, infrared heater)

II: What role do forklifts play in this context?

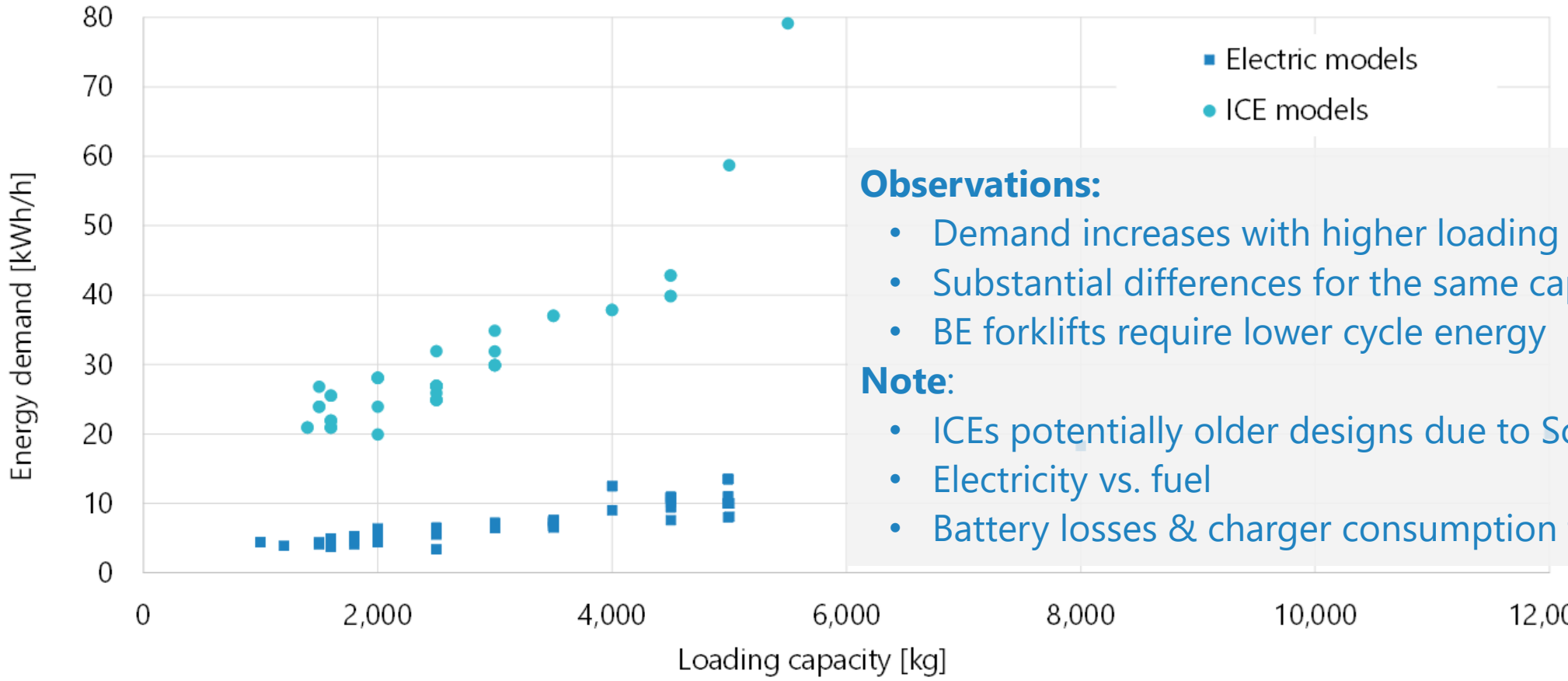
Analysis of forklifts in the Scheme

- internal combustion engines models (ICEs) using gas/diesel vs. battery-electric solutions (BE)
- ICEs dominate for high lifting loads with BE advancing into these ranges
- Initial costs of BEs higher than ICE models, maintenance and operating costs usually lower
- BE models less noisy and without local exhaust gases

Step 1: Analysis of available data sheets	Step 2: Extrapolation for missing models	Step 3: Estimation of use	Step 4: Comparison of energy demand
Energy demand per hour [kWh/h] for the standardized operating cycle		Annual operating hours [h/a]	Energy savings [kWh/a]

II: What role do forklifts play in this context?

Analysis of forklifts in the Scheme



Observations:

- Demand increases with higher loading capacity
- Substantial differences for the same capacity
- BE forklifts require lower cycle energy

Note:

- ICEs potentially older designs due to Scheme setup
- Electricity vs. fuel
- Battery losses & charger consumption to be considered

III: How could the dominant role of forklifts be addressed?

General aims

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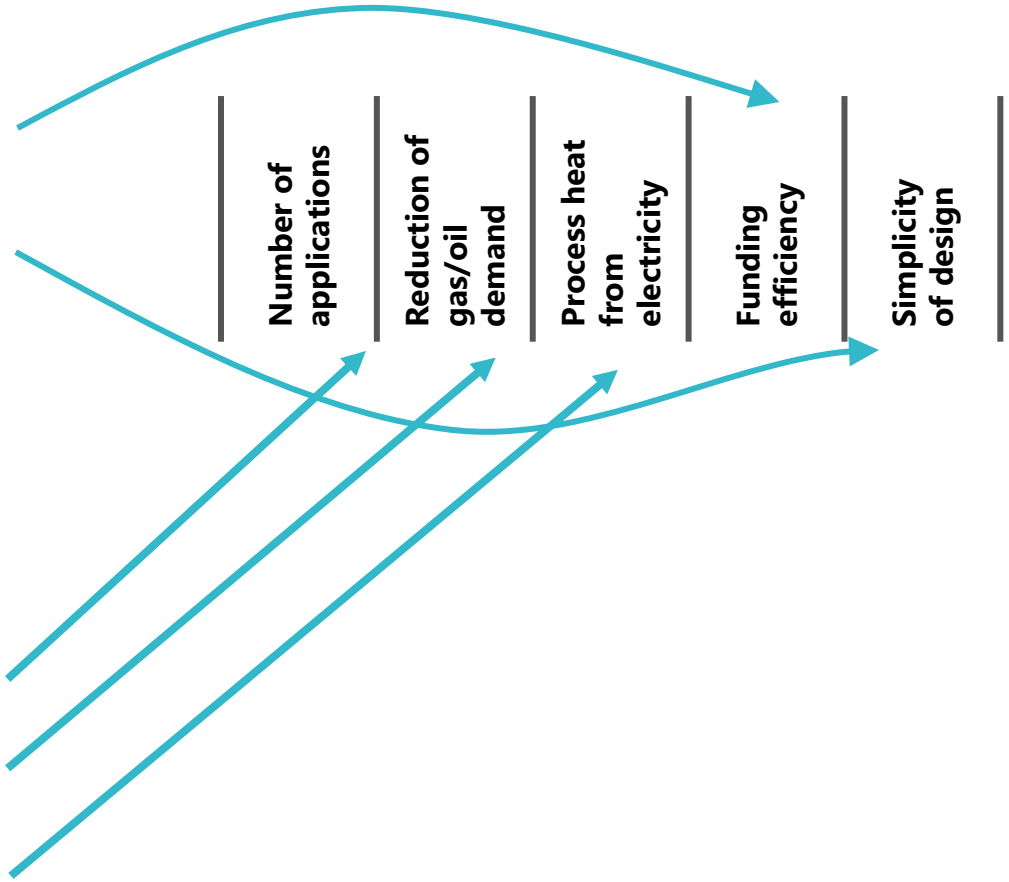

↑: Increasing O: Unaltered ↓: Decreasing ↑↓: Indetermined

III: How could the dominant role of forklifts be addressed?

Strategy		Implementation example	Number of applications	Reduction of gas/oil demand	Process heat from electricity	Funding efficiency	Simplicity of design
I: Status quo strategy	Ia: Maintain unchanged	No modification of the Scheme	O	O	O	O	O
	Ib: Postpone decision	Postpone decision by 12 months	O	O	O	O	O
II: Limitation strategy	IIa: Performance requirements	Upper ceiling for energy demand per load capacity kWh/h*kg to focus on highly efficient models only	↓	↓	O	↑↓	↓
	IIb: Technological limitation	Exclude models below a loading capacity to enhance the uptake of electric model in classes where they are less established	↓	↓	O	↑↓	↓
	IIc: Financial limitation	Electric models are only funded if the payback time of additional costs over ICE models is longer than specified	↓	↓	O	↑↓	↓
III: Exit strategy	IIIa: Sequential phase-out	Gradually reduce the funding rate for forklifts towards zero	↓	↓	O	↑↓	↓
	IIIb: Immediate phase-out	Remove forklifts as an eligible technology from funding	↓	↓	O	↑↓	O
IV: Refocus strategy	IVa: Improve awareness	Activate sellers and other key multiplicators for electric ovens	↑	↑	↑	↑↓	O
	IVd: Extend incentives	Increasing funding rate in the scheme for non-forklift technologies	↑	↑	↑	↓	↓

↑: Increasing O: Unaltered ↓: Decreasing ↑↓: Indetermined

What are the key takeaways?

Aim: Understanding whether the Scheme is on track to achieve its objectives and what implications do the forklifts have?

Limitations

- Scheme not far beyond "roll-out"
- Dataset not comprehensive (similarity assumptions; no consideration of non-forklift savings)

I: How did the technology-open electrification Scheme perform during the first evaluation period?

- Substantial number of applications
- Course towards Scheme's objectives, but not there yet
- General satisfaction with procedural aspects of the Scheme
- Substantial activity of energy consultants

II: What role do forklifts play in this context?

- Scheme attracts a high number of forklift
- Homogenous technology that allows for determining savings
- Despite shift towards electricity, carbon dioxide reduction achieved

III: How could their dominant role be addressed?

- Different strategies that affect target achievement
- Action on forklift may only entail shifts within the EEE
- Status quo strategy

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Thank you!

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