Learning Energy Efficiency Networks (LEEN) – SME audits and follow-up action

5th Plenary Meeting CA EED
Riga, March 24th – 25th 2015

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Agenda

- Preliminary remarks
- 30 Pilot-Networks Project and beyond
- Network course
- Costs and benefits
- Effects
- LEEN-Managementsystem

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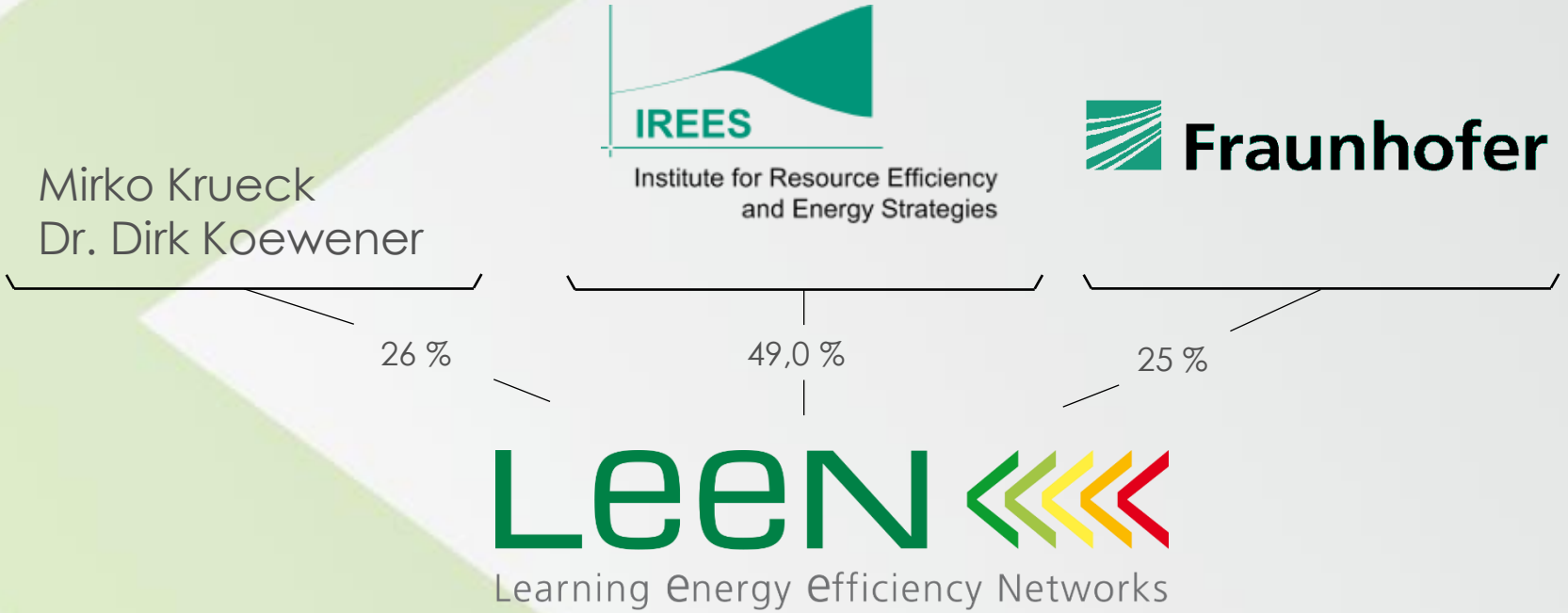
Preliminary remarks – LEEN GmbH



Foundation	Management	Head office	Branch offices		Staff
09.12.2009	Mirko Krück Dr. Dirk Köwener	Schönfeldstraße 8 76131 Karlsruhe	Austria Hamerlingstraße 4 4020 Linz	Japan AHK Tokyo	12

Preliminary remarks

- LEEN works well for SMEs but it is not an exclusive SME instrument and it should not been used as such.
- In LEEN the main criteria to differentiate between participants are the energy costs.
- Participants can be sites of Industrial Companies, SME or public entities (e.g. Zoos, Hospitals or Sport Facilities)
- Most of the following information is based on a research project with 366 participating companies – approx. 30% of them were SMEs.

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30 Pilot Networks and beyond

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30 Pilot Networks and beyond – Timeline

1987:	First network in Switzerland (Zurich)
2002:	First network in Germany (Hohenlohe)
2009 – 2014:	Development of LEEN MS and establishment of 30 pilot networks in Germany (BMU financed project - national climate protection initiative (NKI))
End of 2009:	Founding of LEEN GmbH to develop the LEEN MS
2014:	Projects in various EU countries (Germany, Austria & Belgium)
Dec. 2014:	LEEN 100 Plus started – Part of the National Action Plan on Energy Efficiency (NAPE) / Joint Project of 13 economic associations and the Ministries for the Economy and the Environment
2015:	In Preparation The Netherlands, & Danube Region / Western Balkan, Sweden

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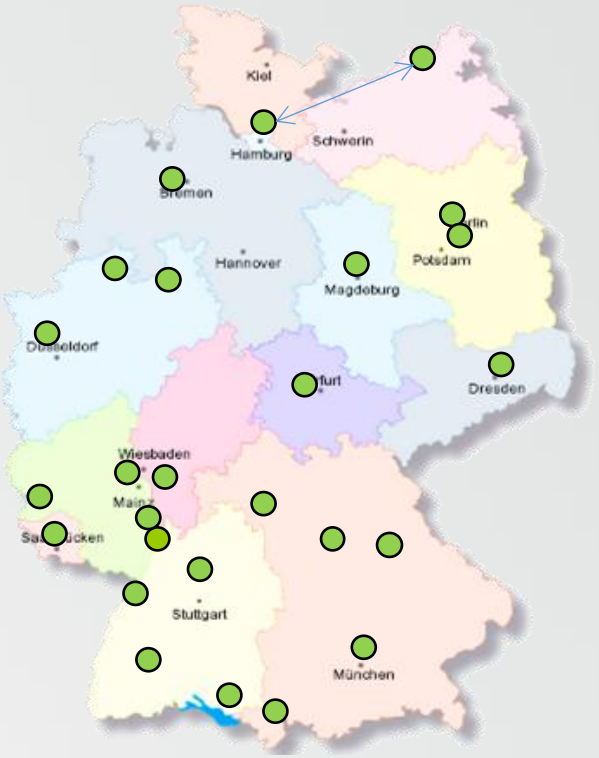
30 Pilot Networks and beyond – Who were the participants

The 30 networks represent

- Total energy costs of 1 billion €/a
- Energy consumption >15 million MWh/a
- CO2 emissions > 5 million t/a



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30 Pilot Networks and beyond – Who were the participants?

- 57 % of the participants were production sites of a industrial company;
- 30% of the participants were SMEs;
- 54 % of the participants had energy costs between 500,000 and 4 million € per year;
- For 75 % of the participants were already active in efficiency.

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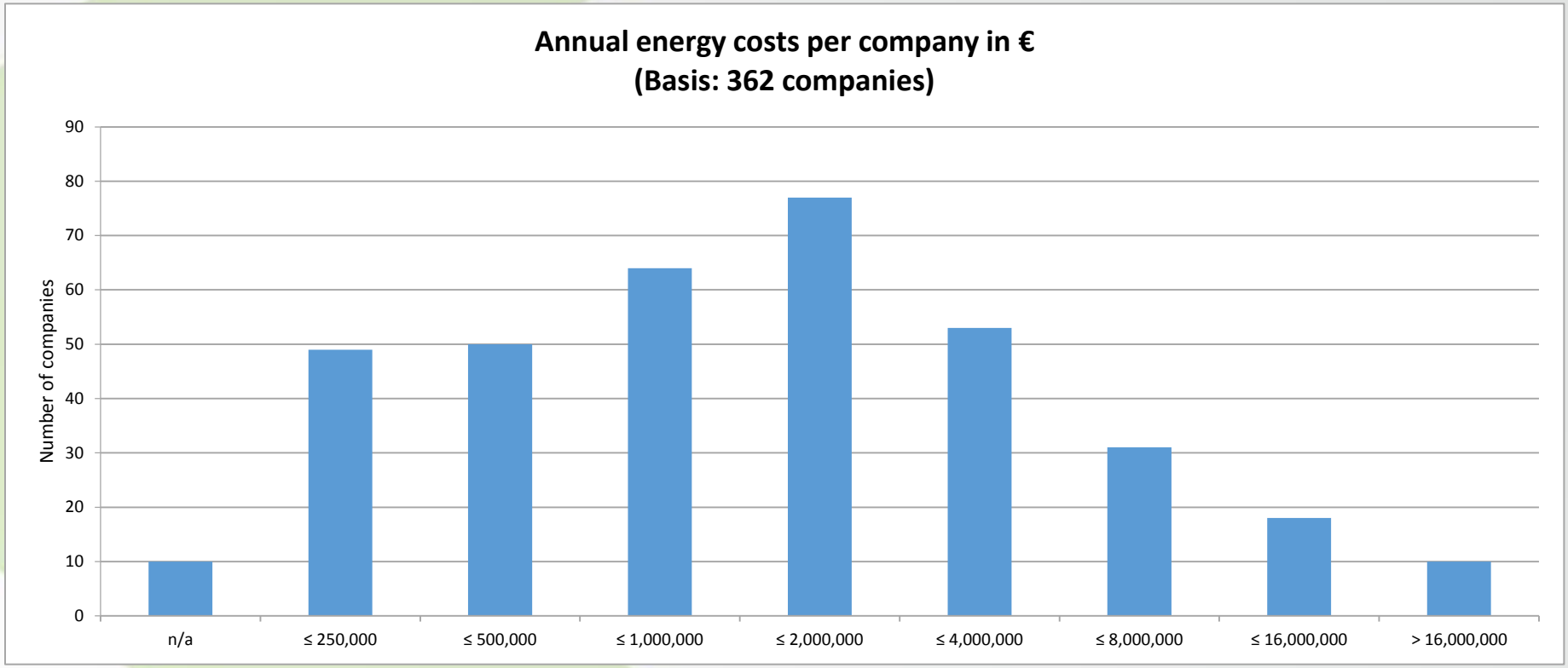
30 Pilot Networks and beyond – Who were the participants?



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30 Pilot Networks and beyond – Subsidies

- In the 30 Pilot Networks
  - Participants were funded with 8.000 EUR;
  - In addition approx. 3 million EUR were invested by the government in the development of the underlying LEEN-Managementsystem
- In LEEN 100 – 10 Networks will be funded with 4.000 EUR per participant and audit;
- For SMEs there is an additional funding from the BAFA of approx. 5.000 EUR per audit (differs according to the size of the company).
- In general LEEN is a market based approach that can work without public funding.

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Network course

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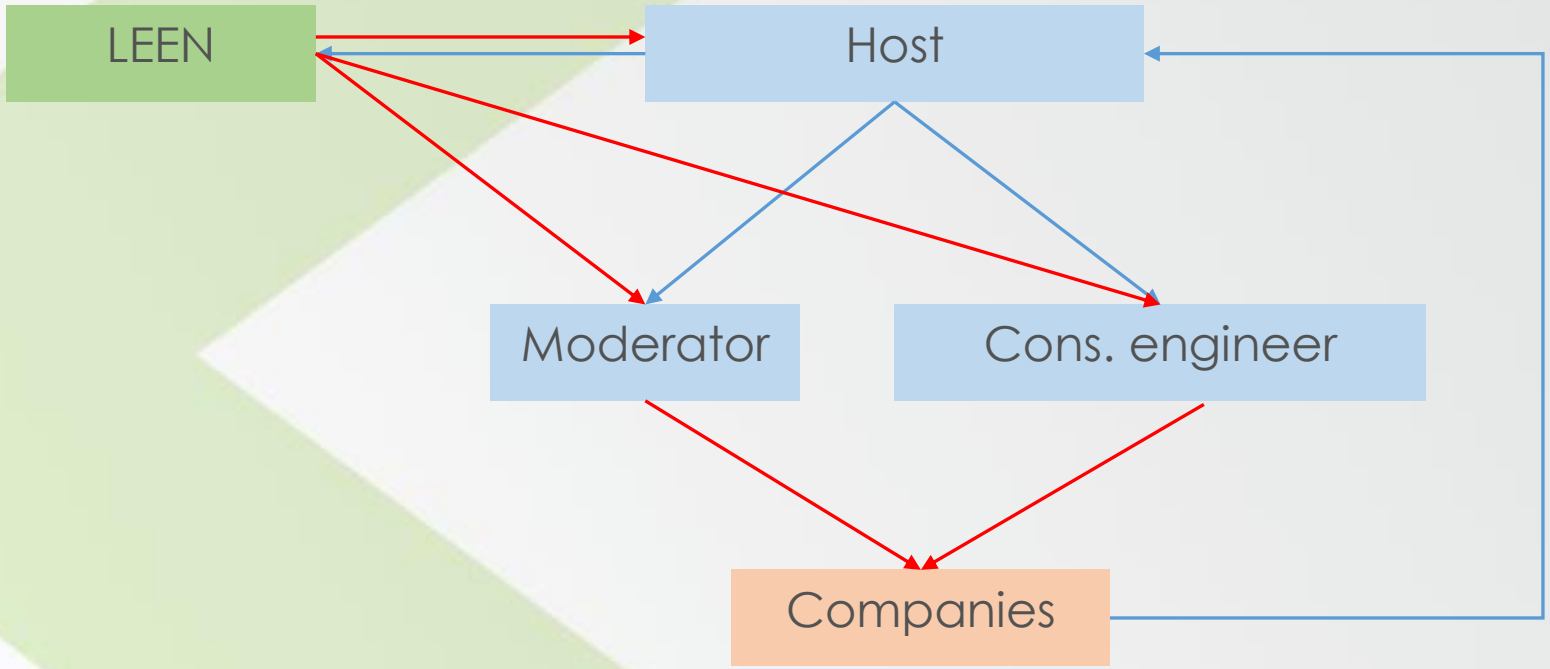
Network course – Organizational structure



Money flow

Service & deliverance of LEEN MS

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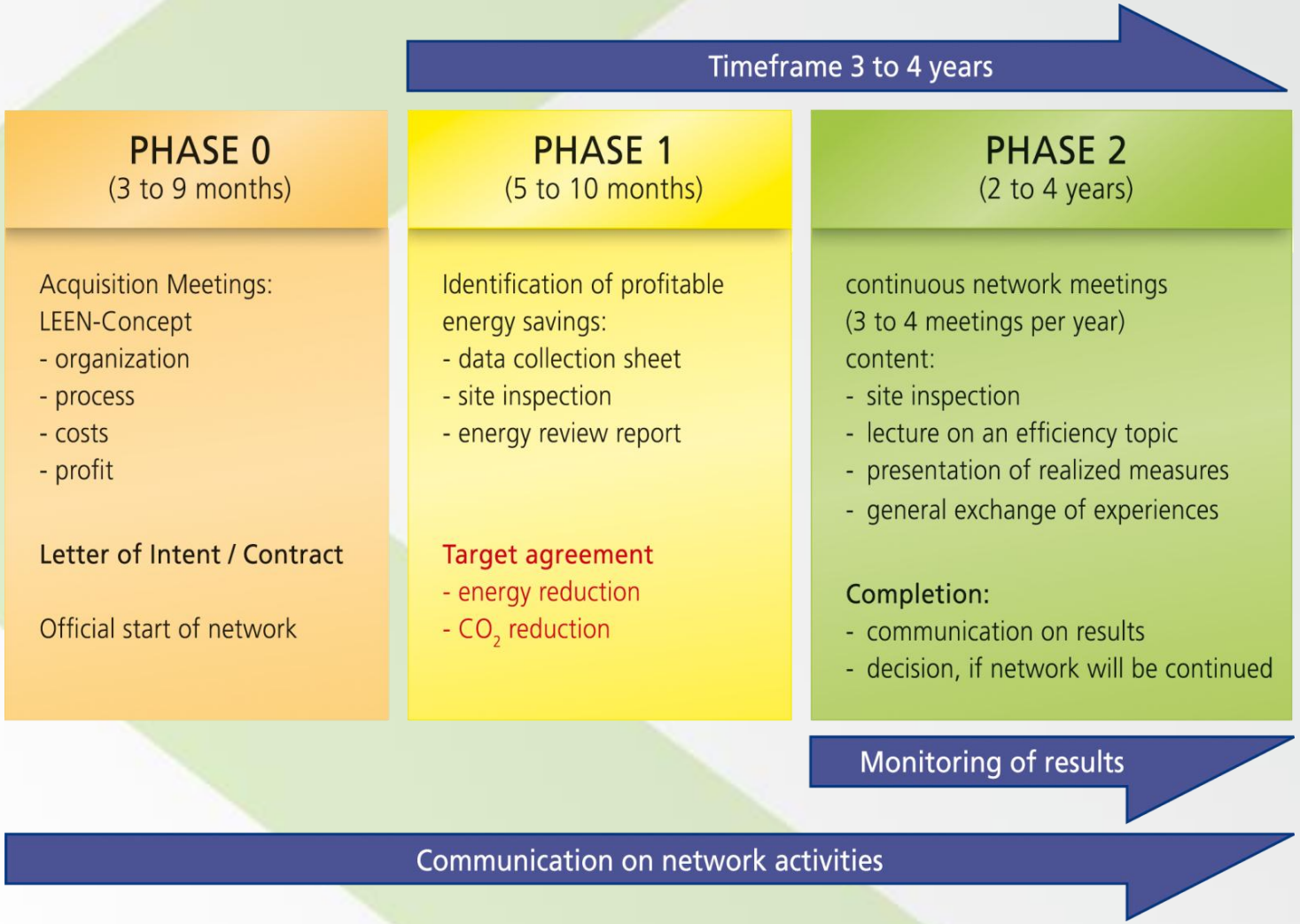
Network course – Main process



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Network course – Audit: Measures Overview

	☐ Round figures New measure / Conversion to MWh / Delete measure Name of measure	Purchased electricity	Light fuel oil	Wood chips	Time of use	Investment eff.	Additional investment (eff.)	Net present value (10%)	Internal rate of return i*	Static amortisation time	Dyn. amortisation time (10%)
	Energy savings [Unit]	[MWh/a]	[MWh/a]	[MWh/a]	[a]	[€]	[€]	[€]	[%]	[a]	[a]
	Investment today eff. (profitable measures)					**110.000**					
	Sum profitable measures	**290**	**600**	**-290**	**15**		**120.000**	**370.000**	**54,0%**	**1,8**	**2,1**
	Sum all measures	**290**	**600**	**-190**	**20**		**340.000**	**330.000**	**23,0%**	**4,3**	**6,0**
E03	Reducing electricity consumption (Base load)	65,0			10	2.000	2.000	41.065	350%	0,3	0,3
V01	free outflow of waste air via roof during summer	15,0			10	500	500	9.438	323%	0,3	0,3
L01	Retrofitting: mirror reflector/ clear screen cpping	30,0			10	3.000	3.000	16.876	108%	0,9	1,0
E04	Retrofitting:Eff1-drives	70,0			10	7.300	7.300	39.077	103%	1,0	1,1
H05	Biomass: Reduction the flow temperatur in the heating circuit		500,0	-500,0	15	25.000	25.000	126.643	80%	1,3	1,4
CA02	Reduction of the pressure in the compressed air network	38,0			10	7.000	7.000	18.176	58%	1,7	2,0
E02	Using standby set to reduce peak loads				10	3.000	3.000	7.446	56%	1,8	2,0
E01	Reduction of peak load				10	5.000	5.000	8.211	42%	2,3	2,8
OR01	Installation of an energy management system	50,0	14,0	11,0	15	20.000	20.000	29.618	32%	3,1	3,8
H06	Utilisation of waste heat from the injection moulding			200,0	10	10.000	10.000	9.137	29%	3,2	4,1
CA01	Retrofit heat recovery for compressor AM-37		85,0		10	15.000	15.000	13.158	28%	3,3	4,2
L02	Retrofitting of energy efficient lamps with electronic ballast	20,0			10	12.000	6.000	4.178	25%	3,6	4,7
C01	Insulation of refrigerant pipes and fittings	1,0			10	500	500	163	17%	4,6	6,5
C02	Utilisation of waste heat from cooling processes		259,0		10	68.000	68.000	17.798	16%	4,9	7,0
REN01	Installation of a photovoltaic system (PV)				20	120.000	120.000	-27.202	7%	11,0	-1
H02	Insulation of burner plate		1,0		10	500	500	-169	1%	9,3	27,5
BG01	Energy-efficient refurbishment of shed roof			100,0	40	150.000	100.000	-83.882	-1	60,7	-1

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Network course – ISO 50001 and DIN EN 16247

- Participants in LEEN
  - get an complete audit according to the DIN EN 16247
  - cover the most important parts of the ISO 50001

- The completion of the ISO 50001 takes 5 additional workshops that can be done in a so called “Convoy”

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Costs and benefits

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Costs and benefits – Cost calculation LEEN-compact

- 9 network meetings (organization, realization): 7,500 €
- 2 x monitoring (without report): 1,000 €

Energy review (10 days) / Audit

- Energy review: 10,000 €
- Energy review (with subsidies): 5,200 €*

- Costs LEEN-compact: 18,500 €
- Costs LEEN-compact (with subsidies): 13,700 €

Additionally: up to 10 working days

* Varies according to the company size

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Costs and benefits – Profitability of LEEN-compact

Annual energy costs:	400,000 €
Annual energy savings (8%):	32,000 €
Investment in efficiency measures:	100,000 €
Add. costs of network participation :	18,500 €
Add. costs of technical staff:	5,000 €
Total costs after 4 years:	123,500 €
Pay back period (investments only):	41 (33) month
IRR, time of use 10 years (investment only)	26 % (34 %)

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Effects

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Effects – Summary of identified measures from the audits

Overview	
Evaluated reports	366
Total number of measures	7,030
thereof quantitatively evaluated measures	6,030
thereof profitable measures (where IRR is greater than 12%)	3,580
Ø IRR of all profitable measures	31%
Ø Static pay back period of all profitable measures	3.2
Ø Investment per measure [EUR]	55,700
Ø Values per company/site (all profitable measures realized; IRR>12%)	
Ø Energy savings [MWh/year]	2,670
Ø CO_2 emission reduction [t/year]	940
Ø Number of quantitatively evaluated measures	19
thereof classified as profitable	10
Ø Total additional investment [EUR]	580,000
Ø Reduction of energy costs [EUR/year]	180,000

Source: participating companies in the 30 pilot-network project

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Effects – Monitoring

Evaluated monitoring reports		
Companies	No	210
Measures	No	1,980
Total consumption	GWh	14,100
Total energy saved	**GWh**	**870**
Electricity	GWh	340
Natural gas	GWh	275
Gasoline	GWh	80
District heat	GWh	39
Others	GWh	85

Extrapolation for 366 companies[1]		
Companies	No	366
Measures[2]	No	3,000
Total consumption	GWh	16,700
Total energy saved[3]	**GWh**	**1,030**
Electricity	GWh	405
Natural gas	GWh	325
Gasoline	GWh	95
District heat	GWh	47
Others	GWh	100

Average operational time of networks until the latest monitoring: 2,7 years

Average yearly efficiency increase: 2,2%/a

1 Number of participating companies in the 30 pilot-network project
2 Estimation based on the energy consumption and the number of companies
3 Estimation based on the energy consumption

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Effects –
Monitoring of realized measures

Category (Ø values per measure)	Value
Total number of measures	107
Ø Investment sum [€]	20,700
Ø Energy cost savings [€/a]	6,750
Ø IRR of all profitable measures	33.0 %
Ø Static pay back period of all measures[a]	3.0
Ø Energy savings [MWh/a]	98.5
Ø CO_2 emission reduction [t/a]	25.6

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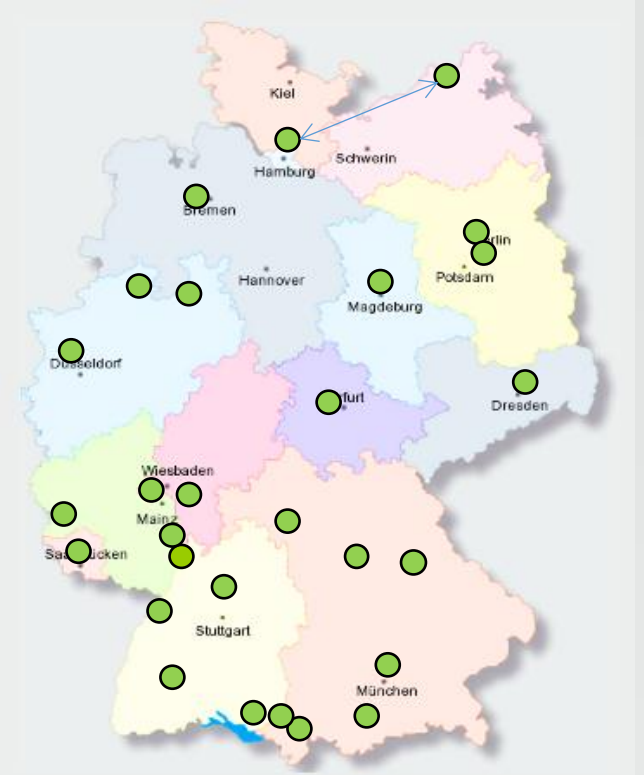
Effects –
Energy savings in the networks

Ravensburg:	12,7 %	(after 5 years)
Franken-Oberpfalz:	8,7 %	(after 4 years)
Süd-West:	7,6 %	(after 3 years)
Hanse:	7,5 %	(after 3 years)
Heilbronn-Franken:	6,9 %	(after 3 years)
Karlsruhe:	6,1 %	(after 3 years)



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LEEN Managementsystem

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Elements of the LEEN MS

- Energy review / Audit (LEEN certified consultant engineer)
  - Data collection sheet
  - 17 technical calculation tools that cover approx. 100 measures
  - DIN EN 16247 / ISO 50001 certified measures summary tool (overall saving potential and economical evaluation)
  - DIN EN 16247 / ISO 50001 certified report
- Network meetings (LEEN certified moderator)
  - Agenda
  - Minutes
  - Checked presentations of experts
  - Prepared site visits
- ISO 50001 certified monitoring tool

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Participants acceptance of the network idea

- 80% rated the benefits of network participation at least as “rather high” in comparison to the effort of participation
- 60% used network contacts outside the meetings
- 90% rated the meeting topics discussed and site inspections at least as good
- 80% rated that the measures identified during the energy review phase fully met their expectations
- More than 60% stated that the network participation increased the attention of the management for energy efficiency

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Questions & Answers

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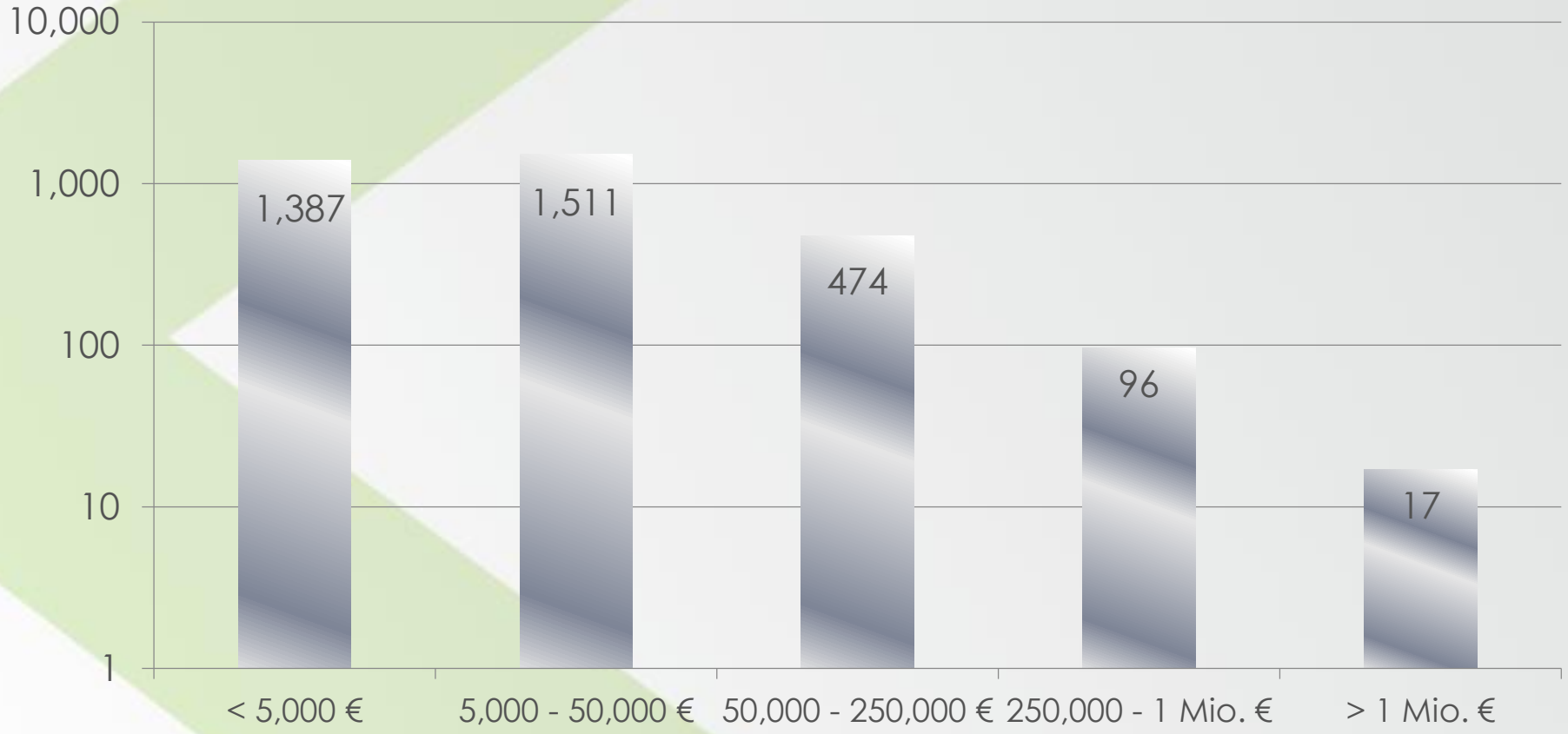
Effects–
Identified measures: investment volumes (profitable measures only)



Source: participating companies in the 30 pilot-network project

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30 Pilot Networks and beyond – Who were the participants?

Classification **NACE**	Economic sector	No. of companies
10	Manufacture of food products	34
28	Manufacture of machinery and equipment n. e. c.	31
22	Manufacture of rubber and plastic products	26
25	Manufacture of fabricated metal products, except machinery and equipment	22
20	Manufacture of chemicals and chemical products	22
29	Manufacture of motor vehicles, trailers and semi-trailers	20
23	Manufacture of other non-metallic mineral products	15
27	Manufacture of electrical equipment	14
11	Manufacture of beverages	13
35	Electricity, gas, steam and air conditioning supply	11
86	Human health activities	11
18	Printing and reproduction of recorded media	10

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Data collection sheet

- Enterprise data (NACE, staff, number of the shifts etc.)
- Building data
- Energy management
- Energy carriers and mediums as well as a measuring point list
- Energy supply
- Heat
- Cooling energy
- CHP
- Ventilation technology
- Compressed air
- Lighting systems
- Electrical drives
- Production
- Information and communication technologies

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Technical calculation tools

Tools	No. of measures that can be calculated
Oil-/gas-fired warm and hot water boilers	8
Oil-/gas-fired steam boilers	10
CHP plant with engine	2
Wood-fired warm and hot water boilers	2
Electric heat pump	3
Service water heating	5
Solar thermal collector for preparing warm water	1
Process waste heat recovery (without electricity generation)	4
Ventilation and air conditioning	7
Lighting	7
Compressed air	23
Refrigeration	8
Free cooling	3
Electric drives – motors	2
Electric drives – control of pumps and ventilators	5
Thermal insulation of piping, air ducts, containers, fittings, etc.	2
Structural thermal insulation	4
17 tools	**96**

Structure of the energy review report

1. The most important information at a glance
2. Preamble
3. Initial situation
   a. General information about the company
   b. Energy consumption and costs
   c. Saving potentials and measures overview
4. Future developments
5. Description of the identified measures
   a. Heating and heat
   b. Ventilation
   c. …
6. Annexes

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Content of the network meetings LEEN-compact (Example Ettlingen)

- The network meetings are organized and carried out by a LEEN certified moderator.
- During three years nine half-day meetings are going to be held from which six are predefined **(to be defined for COUNTRY)**:
  - Monitoring/ profitability calculations
  - Compressed air
  - Lighting systems
  - Heat/ waste heat
  - Heat production/ hydraulic balancing
  - Electrical drives
- The content of the remaining three meetings is determined by the participants.

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Profitability of LEEN-classic

Annual energy costs:	1,5 million €
Annual energy savings (8%):	120,000 €
Investment in efficiency measures:	350,000 €
Add. costs of network participation :	45,000 €
Add. costs of technical staff:	25,000 €
Total costs after 4 years:	420,000 €
Pay back period (investments only):	42 (35) month
IRR, time of use 10 years (investment only)	26 % (33 %)

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Cost calculation LEEN-classic

LEEN-classic

Network participation			
without energy review	**30,000 €** (16 full-day network meetings + 3 x monitoring)		
Energy review	13,500 €	(500,000 –	800,000 €/a)
	15,000 €	(800,000 –	1,500,000 €/a)
	16,500 €	(1,500,000 –	3,000,000 €/a)
	19,000 €	(3,000,000 –	5,000,000 €/a)
	individual	(>5,000,000 €/a)	
Sum	**45,000 €** (energy review €)		
	additionally up to 25 working days (non-cash item)		

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Measure: Fiducia IT AG

- Ventilation: Modernisation of conditioning cabinet
- Investment: 157,000,- €
- Energy carrier: Electricity
- Annual savings: Energy: 820 MWh
  CO_2 emissions: 379 t
  Energy costs: 98,400,- €
- Profitability: Amortisation: 1.6 a
  IRR: 63 %

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Measure: Michelin Reifenwerk AG

- Process heat: Heating with exhaust vapours of the tire cooking
- Investment: 38,000,- €
- Energy carrier: District heat
- Annual savings: Energy: 864 MWh
  CO_2 emissions: 66 t
  Energy costs: 51,800,- €
- Profitability: Amortisation: 0.7 a
  IRR: 136 %

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