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for Economic Affairs
and Climate Action

MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

Solar Thermal Potentials in Jordan

Maen Ali Ayasrah - Jordan Chamber of Industry

15-09-2022, Amman-Jordan

Facilitator

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Who We Are …..

Jordan Chamber of Industry, Established In 2005 As an Umbrella Organization for the industrial sector and the local Chambers Of Industry (Amman, Zarqa, Irbid), To Represent their Interests Inside And Outside Jordan

Vision

Strong And Influential voice Of The Industrial Sector

Mission

Contributing To National Policy Making And Fostering The Interests Of Its Members Through Active Representation

Objectives

- **Participating in formulating relevant national policies**
- **Supporting the growth and development of the industrial sector**
- **Looking after the interests of industrial SMEs and supporting their growth and prosperity**

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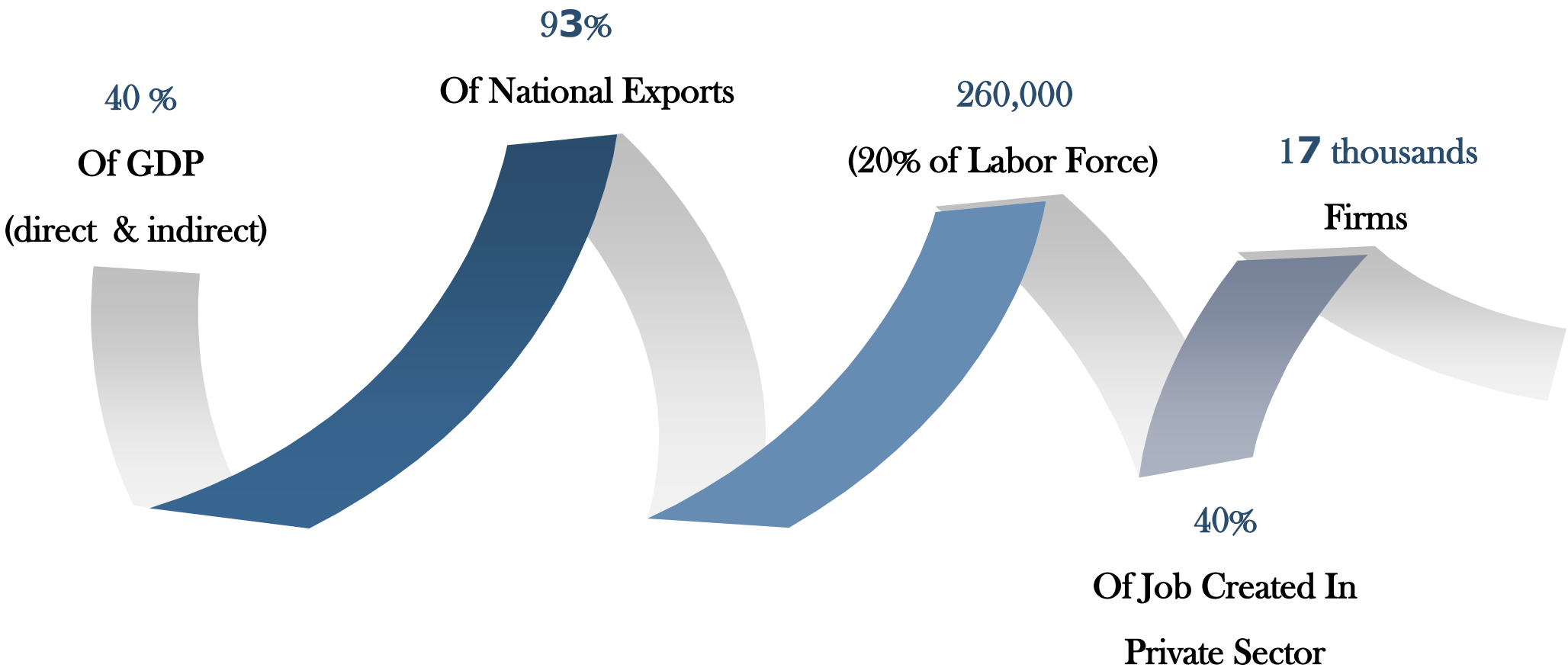
Serving A Strategic Sector ……



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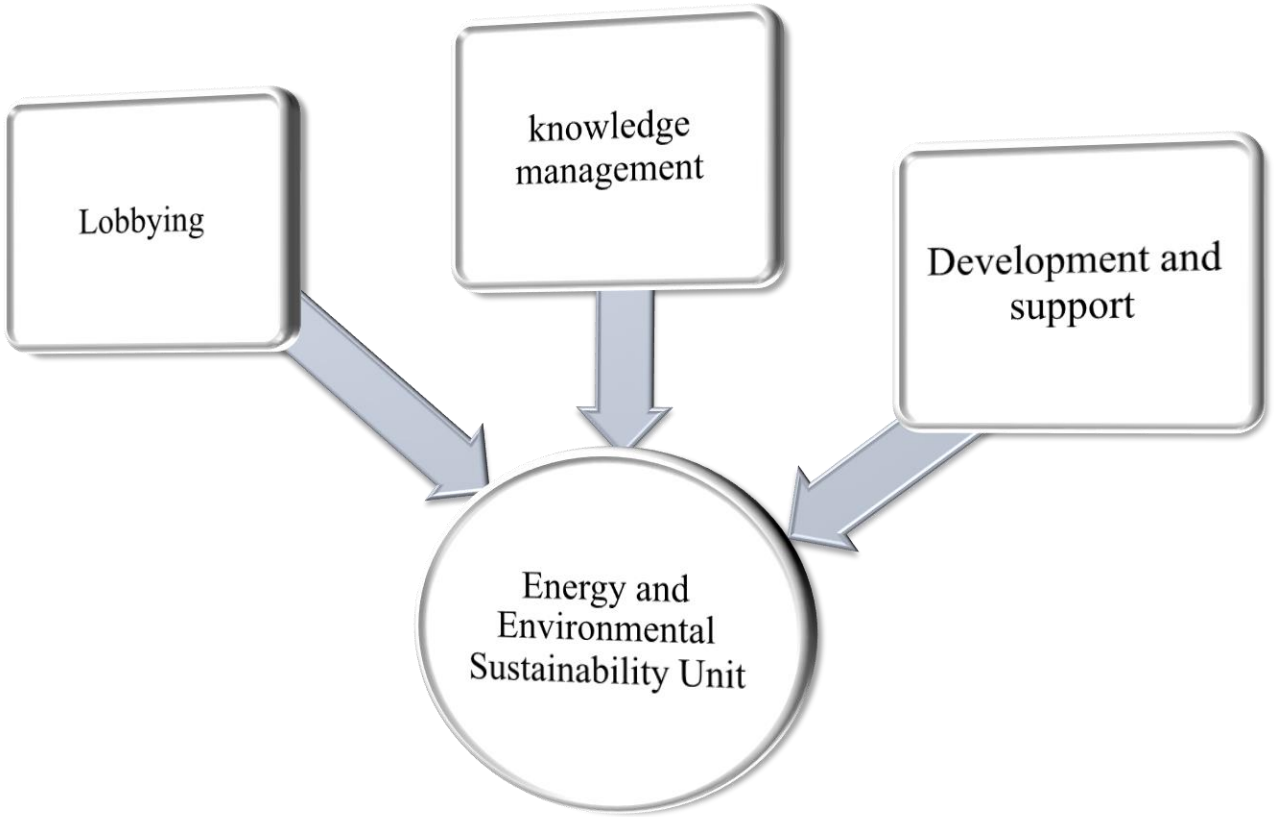
Energy and Environmental Sustainability Unit

The unit aims to help industrial enterprises and enable them to practice the principles of energy management and environmental sustainability by representing them, defending their interests, providing them with the required knowledge and designing programs that enable them to achieve sustainable development.



Energy in the Industrial sector

- The Third Largest Energy Consuming Sector

Around 15% of Total energy Usage in Jordan

- The Second Biggest Electricity Consuming Sector

Around 22% of the Total Amount of Electricity Used

- Average Electricity Cost from the total production cost

Around 31% of the Total Production Cost

- Average Potential Energy Savings through Energy Efficiency Practices

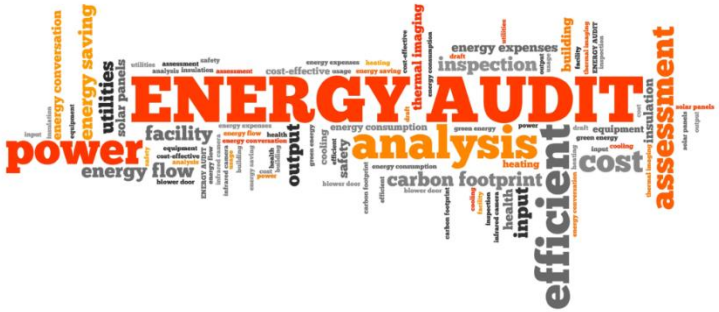
Around 23% of the Total Energy Cost

Energy in the Industrial sector

• Energy is a major component of economies in the industrial sector, so because of the raising of energy and electricity costs, energy efficiency and energy saving are important requirements for industry to be competitive at local and regional and global levels.

• Most of the industries have high thermal energy demands and their competitiveness is threatened due to high energy prices in Jordan.

• Around 66% of the industrial energy demand is for heat. Thus, industrial process heating is responsible for around 12% of the total final energy demand in Jordan.



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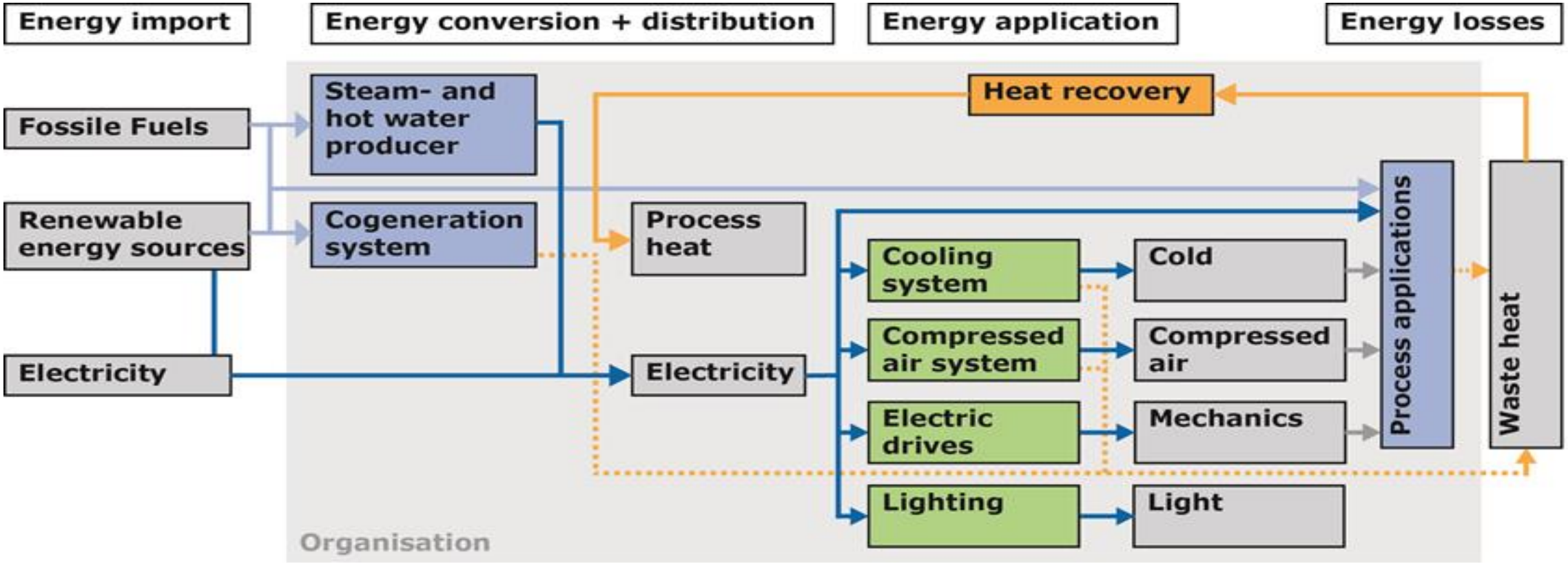
Energy in the Industrial sector

The electricity cost as a percent of all operating costs for some industrial sectors:

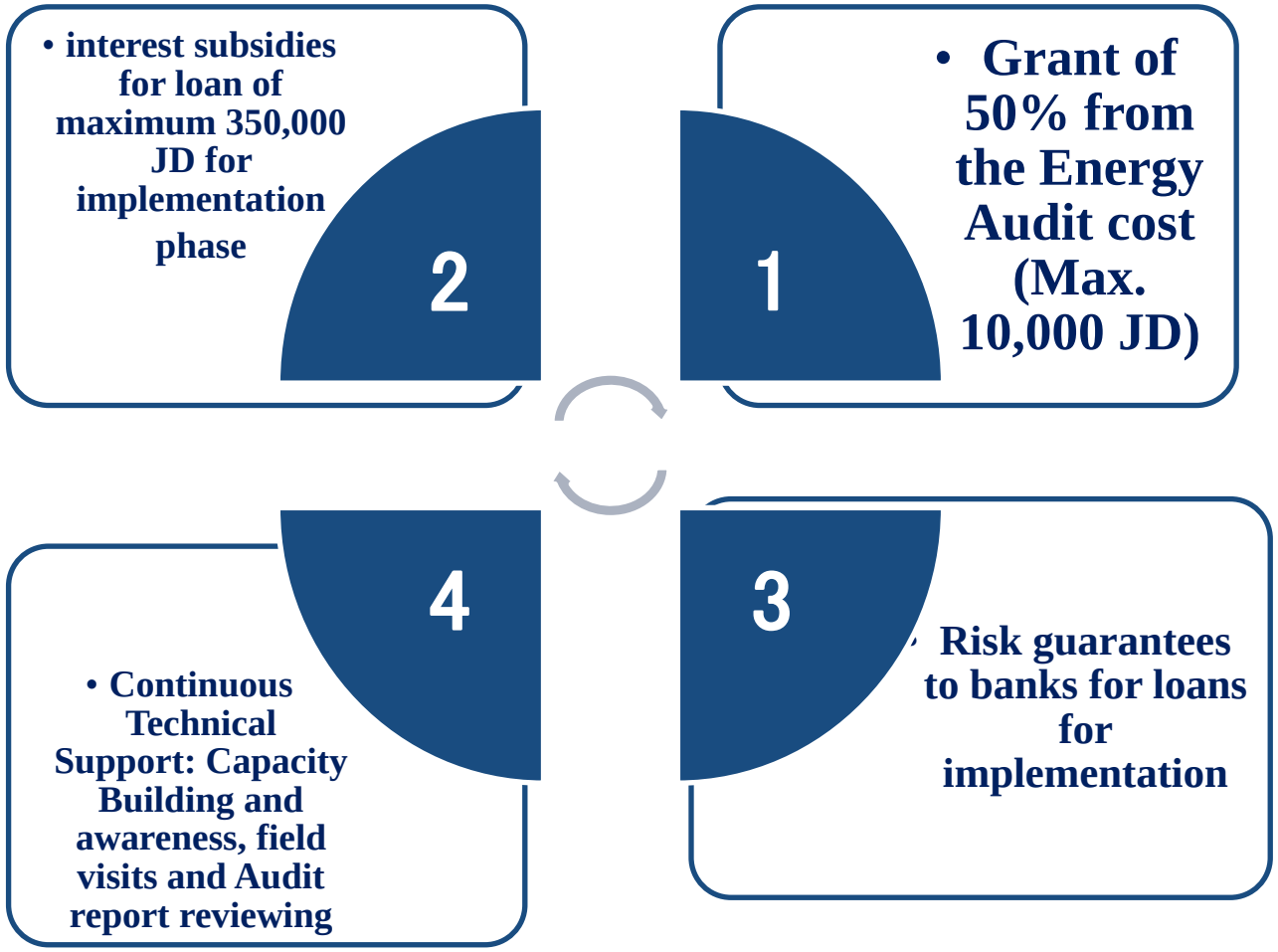
No.	Industrial Sector	Electricity cost as a percent of all operating costs
1	Plastic and Rubber Sector	50.5 %
2	Construction Industry Sector	35.1 %
3	Food Sector	34.8%
4	Packaging Sector	32.3%
5	Furniture Sector	31.9%
6	Mining Sector	27.3%
7	Leather and Garments Sector	26.6%

Energy in the Industrial sector



Source: Arqum GmbH, 2015

Support Program for Energy Efficiency Technologies in Industrial SME's in Partnership with JREEEF



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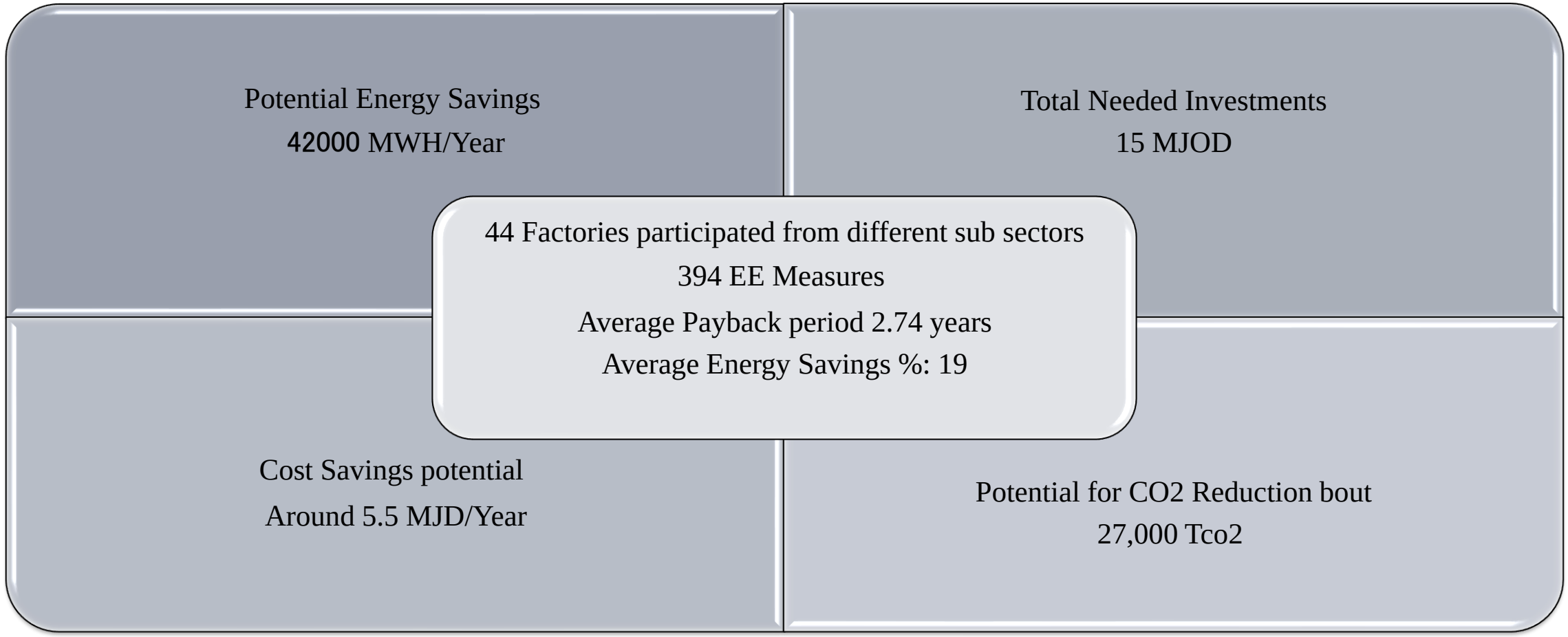

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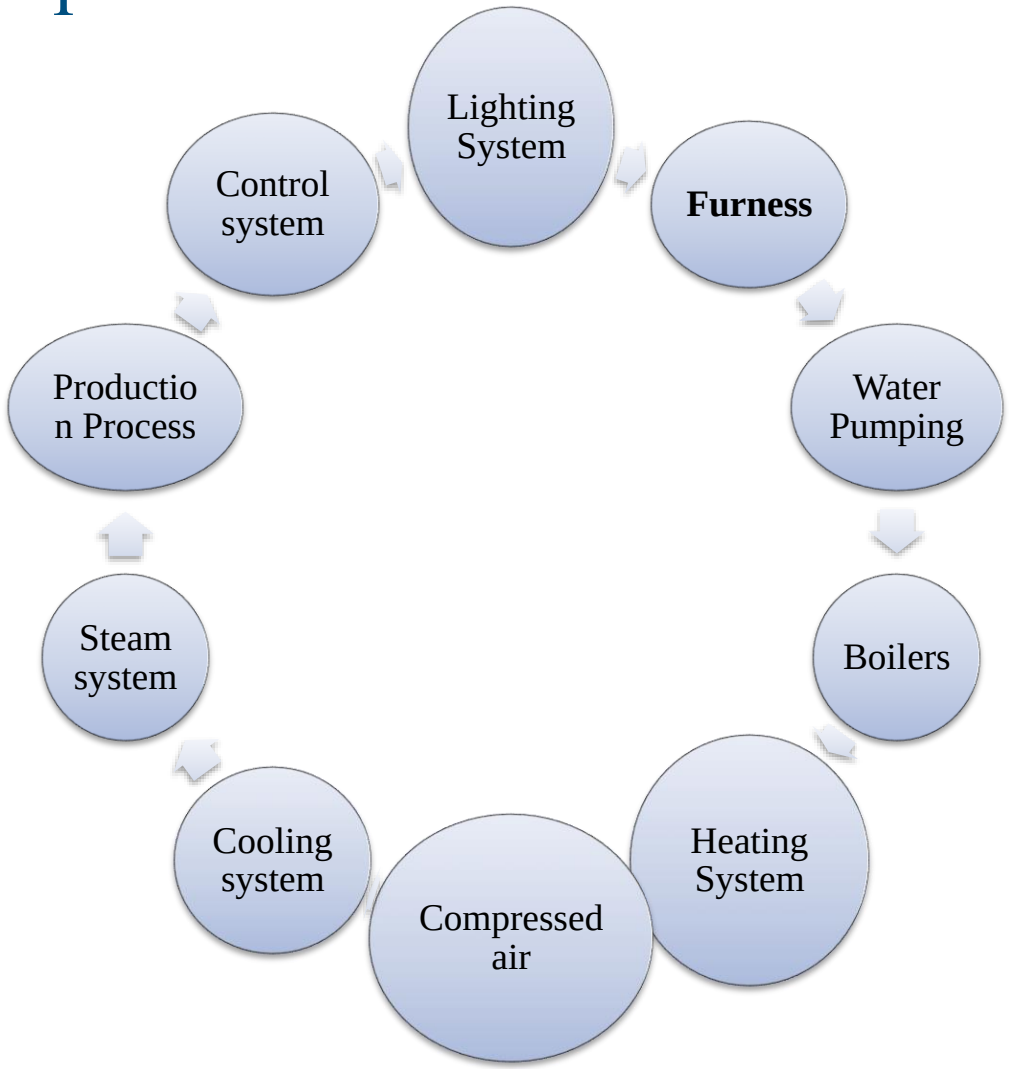

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Support Program for Energy Efficiency Technologies in Industrial SME's in Partnership with JREEEF

Sector	Plastic	Chemical	Construction	Food sector
Number of factories	10	9	4	6
Number of Measures	96	86	24	60
Investment (JOD)	2.1 Million	5.6 Million	1.8 Million	2.5 Million
Energy Saving (MWh/year)	5600	16000	5850	4000
Energy Saving (JOD/Year)	900,000	1.6 Million	1.9 Million	600,000
CO2 Reductions (tCO2)	3200	8500	9700	1200
Average Payback	4.05	2.34	1.76	2.5
Average Energy Saving % (Per Year)	14.96%	28.6%	18.09%	13 %

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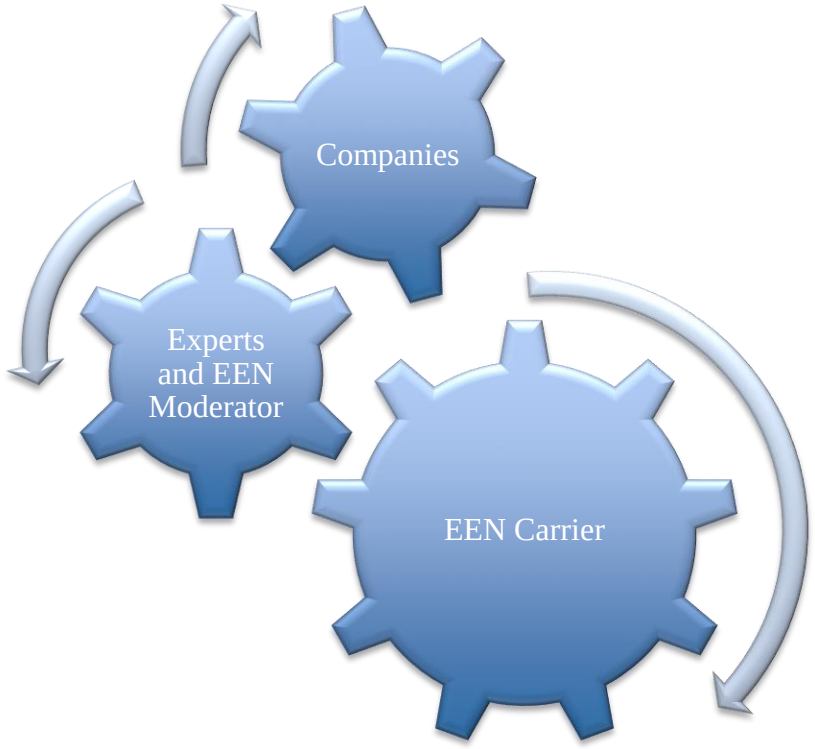
Energy Efficiency Networks in The Industrial Sector

The networks function as platforms for the analysis of EE potentials in sub-sectors, that bring Companies together (from a region, sector,) to exchange experiences and undertake steps together to improve energy efficiency and implement the measures effectively.

Share knowledge	Exchange experience	Practical examples regarding implementation
Motivation by setting a common voluntary targets	Access to experts consultation	Avoid expensive learning by doing
Policy recommendations	Generating Energy Profiles	Reduce the risk of decision failures

Energy Efficiency Network Structure



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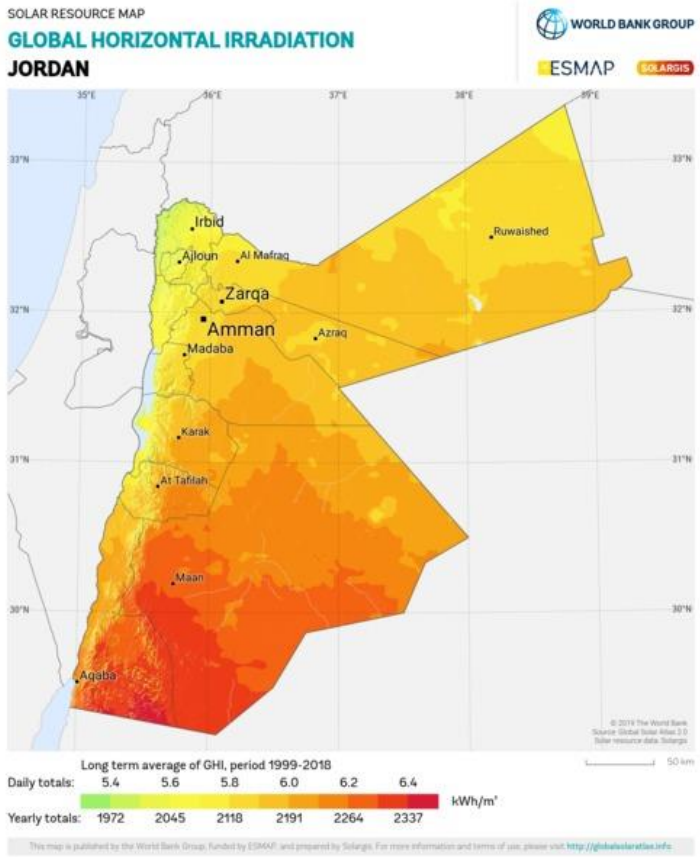
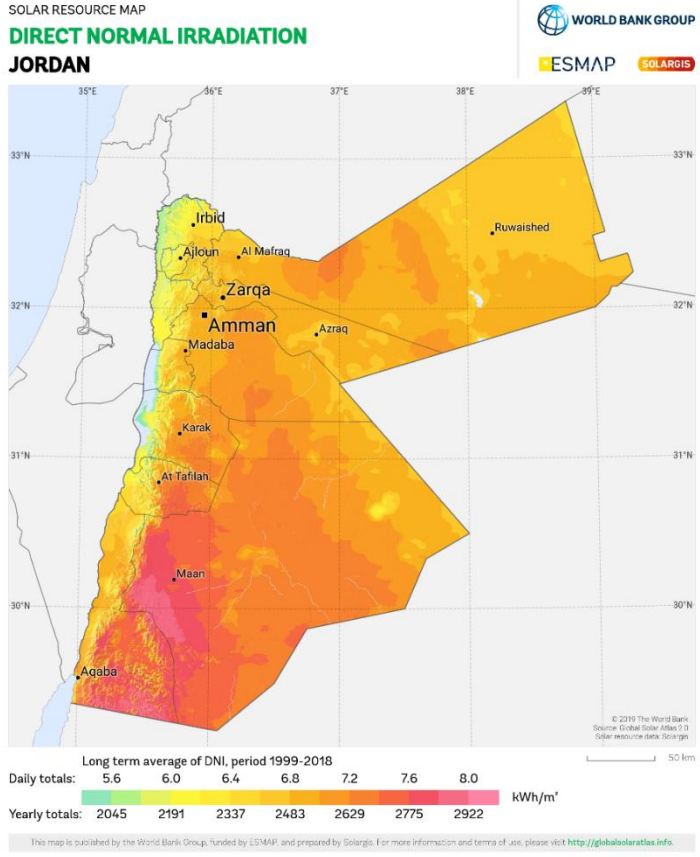
Solar Irradiation Potential

Solar energy is by far the most abundant renewable resource available in Jordan. Both, GHI and DNI in Jordan are very high, mainly due the high altitude and low humidity. In respect to DNI Jordan is one of the countries with the highest irradiation worldwide.

Global Horizontal Irradiation (GHI) as well as Direct Normal Irradiation (DNI) is used in non-concentrating solar technologies, while for PV technology GHI is only relevant.





For high temperatures thermal applications such concentrating solar thermal technologies, DNI is more important than GHI

PV Systems →

← Concentrating Systems

Non-Concentrating Systems

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Solar Thermal and Heat Recovery Market Potential

Solar Thermal

- Mass water heating
- Process water heating
- Steam Generation
- Cooling (Absorption Chillers)

Heat Recovery

- Exothermic processes
- Exhaust gases
- Residual heat from hot water
- Residual heat from the steam

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Sectoral Heat Requirement Overview

Food Sector

Process	Temperature Range
Blanching	60 – 100° C
Cleaning	60 – 90° C
Drying	40 – 200° C
Evaporating	40 – 130° C
Sterilization	100– 140° C

Chemicals Sector

Process	Temperature Range
Biochemical reaction	20 - 60° C
Compression	105 – 165° C
Cooking	80 – 100° C
Thickening	110 – 130° C

Textile Sector

Process	Temperature Range
Bleaching	40 – 100° C
Coloring	40 – 130° C
Drying	60 – 90° C
Fixing	160 – 180° C
Pressing	80 – 100° C
Washing	50 – 100° C

Pharmaceutical Sector

Process	Temperature Range
Sterilization	7 – 180° C
Drying	7 – 180° C
Fermentation	7 – 180° C

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Reference Project - Al Bashir Hospital

Capacity	**≈ 750 kW_{th}**
Heat carrier	**Hot water**
Technology	**Flat-Plate Collectors Non-concentrating**
Installation Year	**2018**
Technology provider	**GreenOneTec**
Local supplier	**Millennium Energy Industries**

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Reference Project - Japan Tobacco International Manufacturing Jordan

Capacity	**705 kW**
Heat carrier	**steam**
Technology	**Liner Fresnel Collectors Concentrating**
Installation Year	**2017**
Technology provider	**Industrial Solar (Germany)**
Local supplier	**Industrial Solar (Germany)**

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Challenges facing CSP and CSH in industry

- Less Common technologies – limited used until now.
- Low awareness about the technology.
- needs for skilled and experienced local suppliers.
- needs skilled operators, engineers and technicians .
- High investment cost needed.
- Higher pay back period in comparison with other technologies.
- Suitable and feasible for specific applications in the industry.

Potential for CSP and CSH in the industry

- Jordan represents a very promising market for the technology

- Valid and suitable for different industrial sub-sectors for specific applications such as :

1. Food and beverage industry
2. Textile and leather industry
3. Paper industry
4. Pharmaceutical industry.
5. Chemical industry.
6. Plastics and rubber industry

- Financial schemes initiatives would be an attractiveness for the industries

- Awareness campaigns would be an additional factor for raising the awareness about the technology

- Success stories are now available

Recommendation for Implementation

- **Project development support for thermal projects funded by donors –** this lowers the development risks for involved parties (end-users and suppliers)
- **Awareness raising and capacity building –** in both public and private sector to advocate for benefits
- **Setting of specific targets and concrete actions –** to accelerate the market development by the government in order to give a strong sign to the market.
- **Large heat demand –** companies with greater heat demand (in terms of MWh) are more attractive than smaller ones
- **High specific fuel costs –** focus should be on companies which use higher specific fuel costs (JD/MWh)
- **Flat load profile –** as thermal energy has to be consumed on site and storage is also constrained and expensive the focus should be on companies with rather constant demand
- **Available space –** the availability of suitable space should be checked in the very beginning with special reference to size, shading, roof carrying capacity and distance to integration point
- **Motivation of the company –** focus should be on companies with a higher intrinsic value for CO2 emission reduction
- **Synergies with JREEEF –** Focus should be set on companies which already have implemented energy audits supported by JREEEF as mostly those companies have better data available, already an increased level of awareness and in some cases easier access to capital through JREEEF

Recommendation for Market Entry

- **Comprehensive solutions –** Industry prefers turn-key solutions over single technologies. Thus, technology provider should either offer complete solutions or focus on partner companies for integration.
- **Trust building in own solutions –** Industry is risk averse, especially since some renewable thermal projects did not operate as successfully as planned. Thus, suppliers should focus on trust building, e.g. by provision of references or preferably performance guarantees.
- **Service and reliability –** Suppliers should stress reliability of technology and availability of long-term support services.
- **Capitalize on existing projects / programmes / initiatives –** There are various initiatives and programmes in Jordan which foster renewable / energy efficient process heating which should be used for market entry.
- **Capitalize on donor projects –** There are numerous international donors active in Jordan which mostly also address climate change mitigation and / or industrial competitiveness. Donor funded projects can help to build up capacities or even to realize demonstration projects.
- **Investment incentives –** Within Jordan there are special “Free Trade Zones” and “Development Zones” with special conditions. These can be favourable for companies planning to open a company in Jordan.

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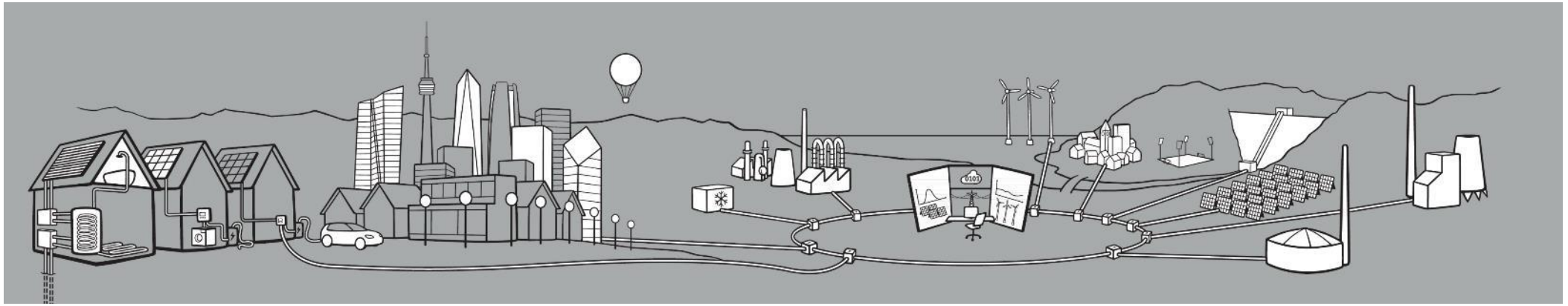

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