Carbon Reduction Management Guide for Suppliers

SIEMENS

Carbon Reduction Management Guide for Suppliers
Introduction

Welcome to the Guide

This guide is designed to help suppliers and companies effectively reduce carbon emissions and contribute to a more sustainable future. By targeting different key levers, companies can significantly lower their carbon footprint.

What you will learn

In this guide, you will find comprehensive strategies and actionable insights grouped into six key levers for reducing carbon emissions:

1. Energy Efficiency
2. Purchase & Generate Renewable Energy
3. Optimize Logistics
4. Sustainable Inputs
5. Sustainable Production Technologies
6. Other Emission Hotspots

Each measure within these levers is tailored to specific business segments and types of companies, ensuring that the strategies are both feasible and impactful.

Tailored measures

The specific business segments are:

- Chemicals (Basic Chemicals, Industrial Gases, Specialty Chemicals)
- Construction
- Manufacturing, including
  - Computer, electronic and optical equipment
  - Fabricated metal products
  - Machinery & other electrical equipment
  - Motor vehicles and other transport equipment
  - Rubber and plastics products
- Metals manufacturing: Basic metals
- Services: Business services (ICT, R&D, Administration, Support)
- Transportation

By the end of this guide, you will be equipped with the knowledge and tools to develop and implement a carbon reduction strategy tailored to your specific needs.

SIEMENS

Table of Content
Measures per Key Levers

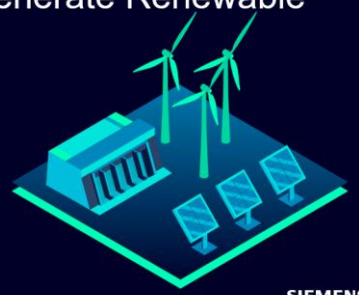
Energy Efficiency

1. Conduct an energy consumption analysis
2. Reduce your electric consumption base load
3. Optimize ventilation systems
4. Optimize heating and process heat
5. Optimize illumination
6. Optimize compressed air costs
7. Implement an Energy Management System
8. Purchase energy-efficient machines and indirect materials

SIEMENS

Purchase & Generate Renewable Energy

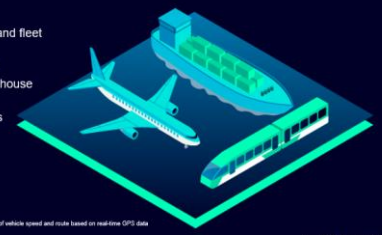
9. Purchase green electricity
10. Generate electricity by solar power
11. Use biomass boilers for heating
12. Use geothermal energy for cooling
13. Generate heat and electricity with CHP
14. Use solar heat



SIEMENS

Logistics

15. Energy efficiency training for drivers and fleet managers
16. Use LPG, LNG & GPS cruise control
17. Use radiant heating systems for warehouse heating
18. Switch to low-carbon transport modes



LPG: Liquefied Petroleum Gas LNG: Liquefied Natural Gas GPS: optimization of vehicle speed and route based on real-time GPS data

SIEMENS

Sustainable Inputs

19. Use recycled inputs – Aluminum
20. Use timber structures, natural insulation materials and recycle concrete in construction

SIEMENS

Sustainable Production Technologies

21. Use emerging technologies to produce low-carbon metal
22. Avoid primary raw materials for producing metal
23. Reduce GHG in the metal production
24. Use green hydrogen for chemical production
25. Use renewable feedstocks for producing chemicals
26. Use ultra-low GHG processes for chemical production

SIEMENS

Other Emission Hotspots

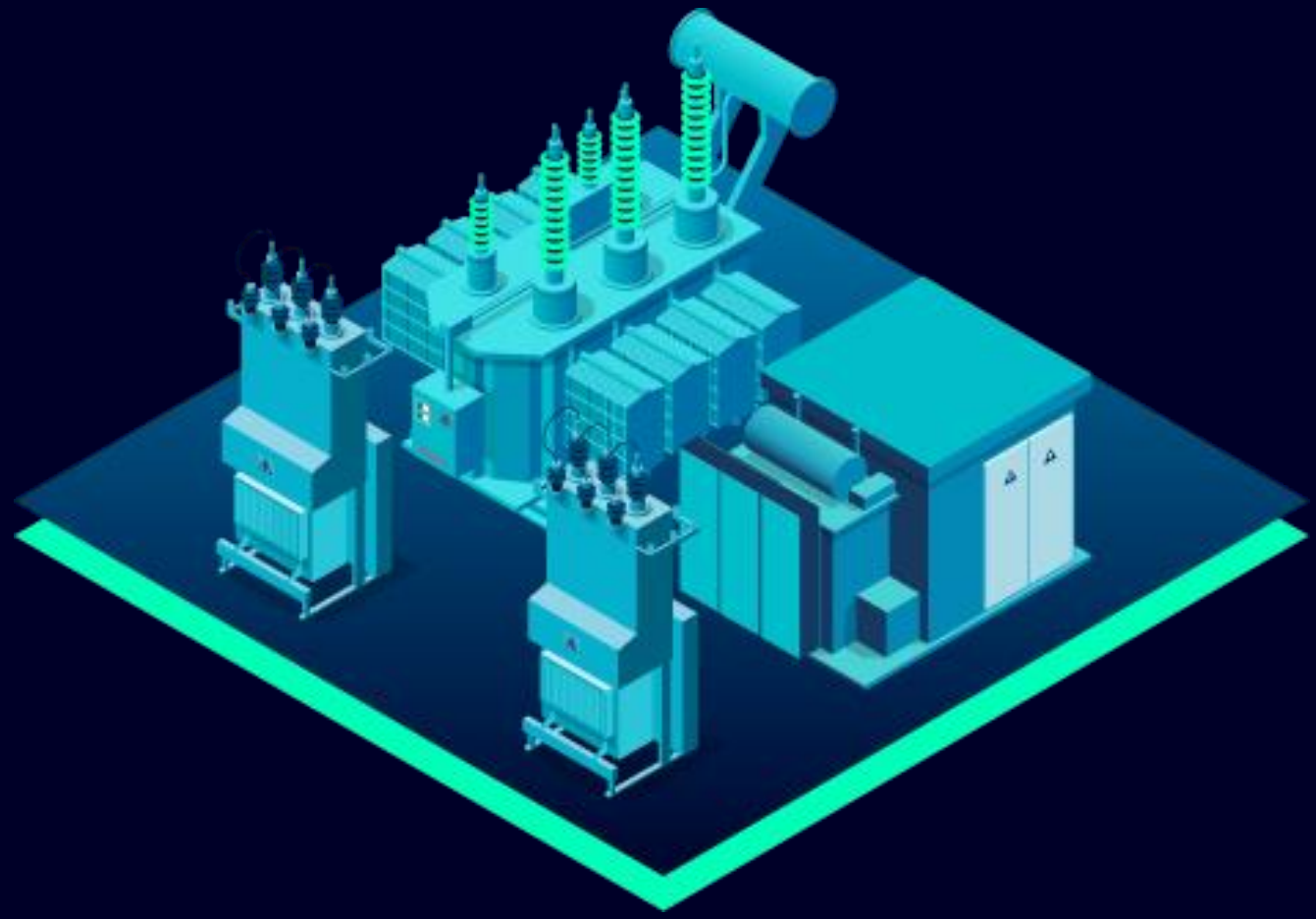
27. Adapt business travel
28. Use green IT

SIEMENS

SIEMENS

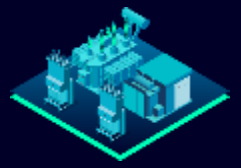
Energy Efficiency

1. Conduct an energy consumption analysis
2. Reduce your electric consumption base load
3. Optimize ventilation systems
4. Optimize heating and process heat
5. Optimize illumination
6. Optimize compressed air costs
7. Implement an Energy Management System
8. Purchase energy-efficient machines and indirect materials



SIEMENS

Key Lever 1: Energy Efficiency
Measure 01: Conduct an energy consumption analysis



Overview

- Identify and focus on the most relevant energy consumers by conducting an energy consumption analysis of production processes, buildings, and supply facilities.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation

Benefits

- Less energy consumption
- Less energy costs
- Improved stability of production processes
- Avoidance of CO_2 emissions
- Abatement of energy taxes

Actions

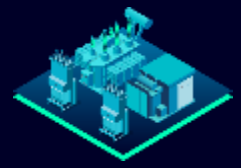
- **Collect energy data:** Gather detailed energy consumption data for each part of your production processes, buildings, and supply facilities.
- **Break down energy use:** Categorize the energy consumption data according to different consumers. This helps in identifying which parts of your operations are the most energy-intensive.
- **Identify relevant consumers:** Determine which consumers (assemblies, parts of plants, entire plants, consumer groups, or auxiliary systems) are relevant for your analysis.
- **Assess efficiency measures:** Evaluate potential efficiency measures for each identified consumer. This could involve technological upgrades, process optimizations, or behavioral changes aimed at reducing energy consumption.

Further Information

A consumer may be an individual assembly (melting furnace), part of a plant (roller mill), an entire plant (cold rolling mill), a consumer group (hall lighting), or an entire range of consumers including auxiliary systems (administration building)

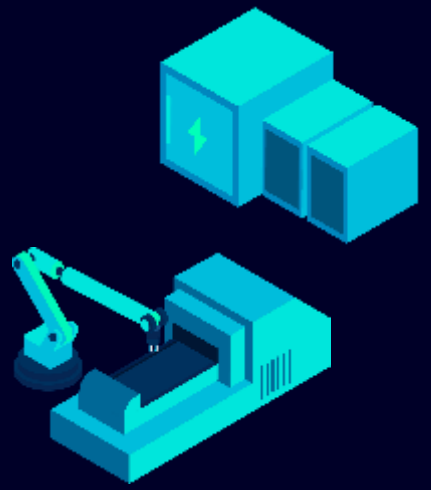
SIEMENS

Key Lever 1: Energy Efficiency
Measure 02: Reduce your electric consumption base load



Overview

- Many electrical consumers such as lighting, compressed air, machine tools, etc., are in standby or operation during shutdown.
- Electric base load can be reduced at weekends and times of shutdown.



Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation

Benefits

- Less energy consumption
- Less energy costs

Actions

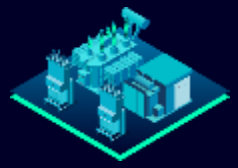
- Analyze load profiles to identify high basic consumption during weekends and shutdown periods
- Disconnect consumers not needed at weekends from the mains

Further Information

- Load profiles often show a high basic consumption for the production facilities at weekends and during shutdown periods that can amount up to 60% of regular production times

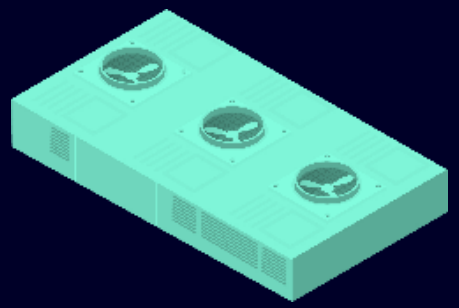
SIEMENS

Key Lever 1: Energy Efficiency
Measure 03: Optimize ventilation systems



Overview

- Often, air exchange rates are not optimized for current processes, leading to higher electricity use and heat loss.
- Room air technology can replace or support natural ventilation, remove unwanted air components, and maintain clean rooms.
- Process air technology creates specific air qualities needed in production, like in paint shops or dryers.



Business Segments

- Construction
- Manufacturing
- Services
- Transportation

Benefits

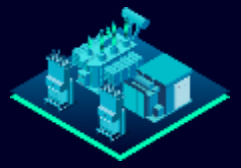
- Less energy costs
- Less heat costs

Actions

- Extract pollutants directly at the point of origin
- Regular maintenance and filter change
- Demand-oriented deployment: Check the ventilation system with regard to the currently required air exchange rates
- Apply indoor air quality control by CO_2-sensors (e.g. in combination with temperature sensing) for control of ventilation
- Apply speed-controlled ventilation motors
- Install heat recovery systems for exhaust air and excess process heat

SIEMENS

Key Lever 1: Energy Efficiency
Measure 04: Optimize heating and process heat



Overview

- The generation of heat for buildings, hot water, and technical processes represents the biggest energy consumer in industry and manufacturing.
- Temperatures should be based on requirements to avoid costs and CO_2 emissions.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Manufacturing
- Metals Manufacturing

Benefits

- Less energy costs

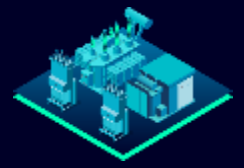
→ 6 % heating cost savings for each 1° C reduction

Actions

- Temperatures should be based on the requirements: Avoidance of overheating of the rooms. 1°C reduction results in a heating cost saving of 6%
- Reduce hall temperatures significantly during the non-production periods
- Utilize waste heat from machines, e.g. compressors
- Install automatic quick-locking gates at hall entrances to avoid heat losses
- Shock ventilation during the heating period instead of continuous ventilation
- Check the ventilation system with regard to the currently required air exchange rates
- Replace old heating systems by biomass boilers or CHP and avoid over dimensioning

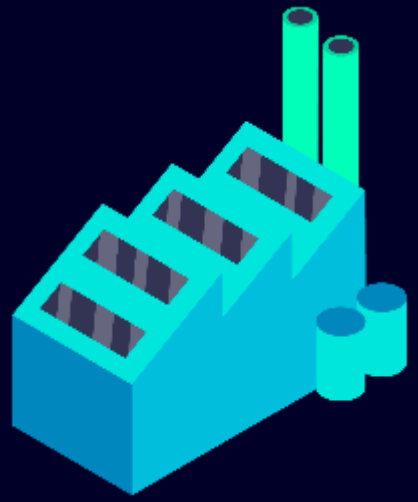
SIEMENS

Key Lever 1: Energy Efficiency
Measure 05: Optimize illumination in offices and production facilities



Overview

- Energy consumption of illumination can amount to up to 45% of the energy consumption of an office location.
- LEDs perform best in terms of efficiency and light yield compared to other types of lighting.



Business Segments

- Construction
- Manufacturing
- Services
- Transportation

Benefits

- Reduces energy consumption and costs
- Improves safety and productivity

Actions

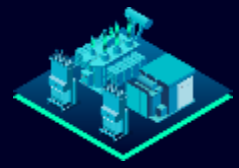
- Maximum utilization of available daylight through daylight-dependent lighting control.
- Install workspace specific illumination
- Retrofit reflectors above lamps → 30% fewer lamps required
- Replace light bulbs and replace T12 and T8 fluorescent tubes by T5
- Regular cleaning of lamps and reflectors
- Use of motion switchgear and time switches in rarely used areas
- Replace old illumination by efficient fluorescent tubes or LEDs
- Install central lighting control system to avoid unnecessary lighting operating times

Further Information for Calculation

Illuminant	Efficiency	Light yield
LED	25 – 40%	80 – 150 lm/W
Low energy lamp	15 – 25%	40 – 60 lm/W
Halogen lamp	8 – 12%	15 – 20 lm/W
Light bulb	3 – 5%	10 – 15 lm/W

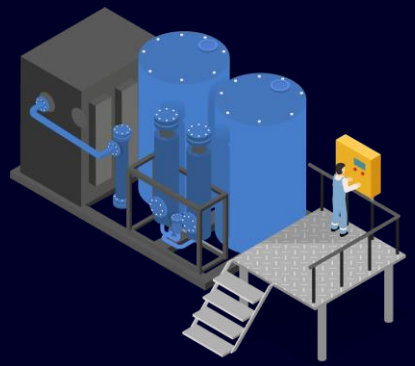
SIEMENS

Key Lever 1: Energy Efficiency
Measure 06: Optimize compressed air costs



Overview

- Energy consumption of compressed air generation can be up to 7–10% of total energy consumption of production sites.
- Compressed air is the most expensive energy
- 94% of consumed electricity is transferred to waste heat, and only 6% to compressed air.
- Besides consumption net pressure is cost driver



Business Segments

- Manufacturing

Benefits

- Less energy costs

Actions

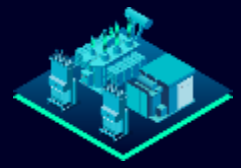
- Conduct regular leak detection and sealing of the distribution network
- Use the lowest possible network pressure and decentralized pressure boosting for individual consumers with higher pressure demand
- Use compressed air only for manufacturing purposes, not for cleaning or drying
- Switch off the compressed air system during non-production times
- Utilize waste heat from compressors for heating

Further Information

- A leakage of only 3 mm diameter costs approximately 3,700 € per year
- In companies with a large number of compressed air tools and machines, hose connections and valves often cause considerable compressed air losses of up to 50%

SIEMENS

Key Lever 1: Energy Efficiency
Measure 07: Implement an energy management system (EMAS)

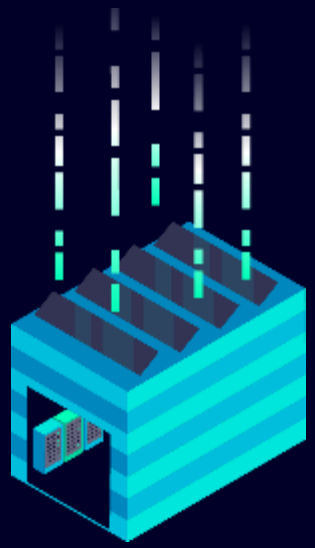


Overview

- Energy-intensive production sites benefit from a continuous energy management process.
- Energy management according to ISO 50001 can be integrated into existing Environmental management systems (ISO 14401)
- Energy Management ISO 50001 generally pays off when the energy costs exceed 750k€/a.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation



Benefits

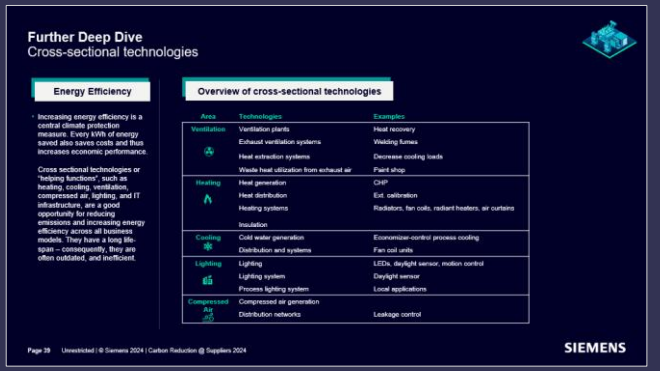
- Up to 20% of energy costs and CO_2 emissions can be reduced by a continuous improvement process
- Cost savings pay off for implementation and operational efforts of the management system
- External certified energy management systems foster the sales position of suppliers

Actions

- Implement an energy management system according to ISO 50001
- Continuously monitor and improve energy consumption

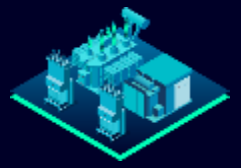
Further Information

An overview of Energy Management System components is available in Further Deep Dive



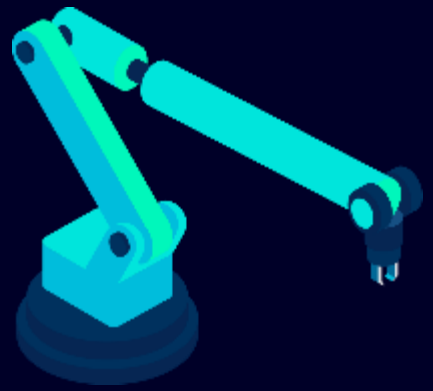
SIEMENS

Key Lever 1: Energy Efficiency
Measure 08: Purchase energy-efficient machines and indirect materials



Overview

- Energy costs are often the reason that the cheapest offer is not the most economic.
- Over the lifetime of equipment, energy costs are often up to 10 times higher than initial costs.
- An evaluation of Lifecycle Costs (LCC) helps to find the most economic option, as it includes both **invest** and **operating costs**.



Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing

Benefits

- Significant reduction in energy costs if energy-efficient technology is selected

Actions

- Utilize Life cycle costs (LCC = initial costs + energy costs) as the base for procurement for initial costs >10.000 €
- **Request following specifications from suppliers**
  - Highest energy efficiency class for machines and installed components
  - Requirement for minimum compressed air consumption
  - Automatic switch-off to avoid standby
  - Machine lighting as LED
  - Frequency converters in motor-pump combinations in hydraulic systems

Further Information for Calculation

For products with an invest volume of 10.000 € reduction in energy costs from up to 8.000 € are feasible if energy efficient technology is selected.

Life cycle analysis example*

- 11kW drives
- Lifetime 15 years IE2

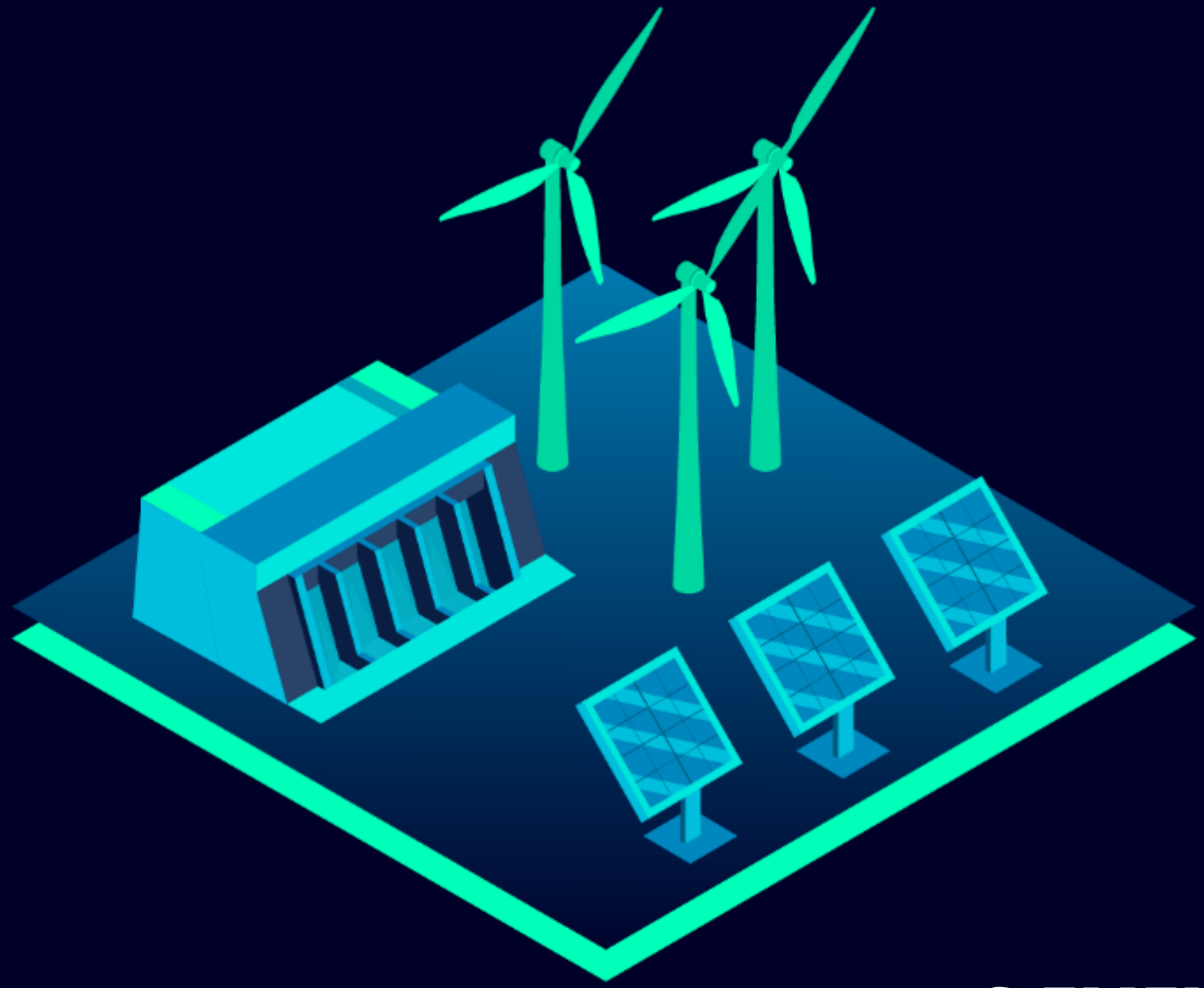
	2.000 h	4.000 h	6.000 h
Initial cost	3,8 %	1,9 %	1,3 %
Maintenance	1,0 %	1,0 %	1,0 %
Energy costs	95,2 %	97,1 %	97,7%

*Preparatory Studies, EUP-Lot 11 Motors

SIEMENS

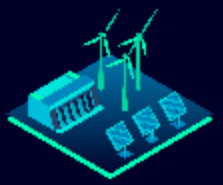
Purchase & Generate Renewable Energy

9. Purchase green electricity
10. Generate electricity by solar power
11. Use biomass boilers for heating
12. Use geothermal energy for cooling
13. Generate heat and electricity with CHP
14. Use solar heat



SIEMENS

Key Lever 2: Purchase & Generate Renewable Energy
Measure 09: Purchase green electricity



Overview

- Electricity consumption is often the biggest source of CO_2 emissions since it is generated by combustion primary energy carriers such as coal, natural gas or heating oil.
- Purchase green electricity from renewable resources and certificates of origin.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation

Benefits

- Avoidance of CO_2 emissions
- Abatement of energy taxes
- Increase in brand reputation and mitigation of business risks
- Respond to increasing public awareness of CO_2 emissions

Actions

- Purchase green electricity from renewable sources (wind-power, solar, hydropower) **and** certificates of origin in deregulated markets

Further Information

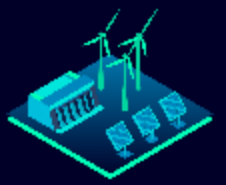
- Both conventional and renewable power plants feed electricity into the grid
- Certificates which guarantee origin (RECs/GOs) are issued for units of produced renewable electricity
- Customers of "green" electricity purchase both electricity and certificates

Further Information for Calculation:

- Conventional production of 1 kWh electricity results in CO_2 emissions of: **350–820g CO_2/kWh** depending on the utilized primary energy sources
- Generation of 1 kWh from renewable energy: **0g CO_2/kWh**

SIEMENS

Key Lever 2: Purchase & Generate Renewable Energy
Measure 10: Generate electricity by solar power

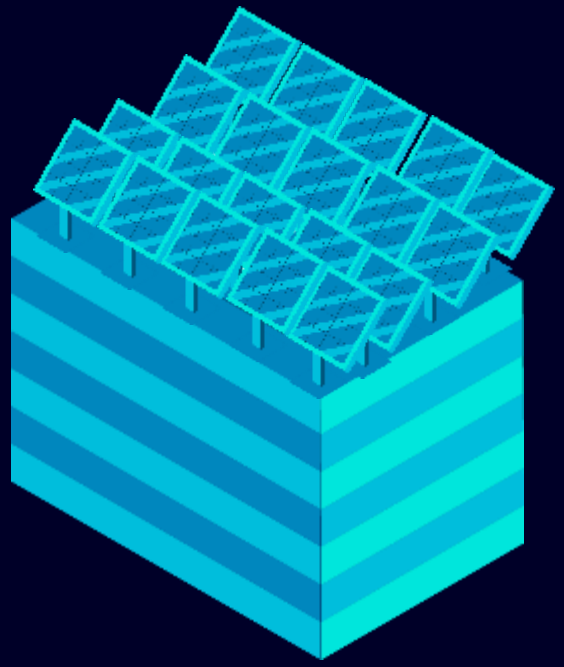


Overview

- Photovoltaic panels convert sunlight into electricity.
- Solar modules have a lifespan of over 25 years.
- The location, solar irradiation, orientation, and type of module determine energy yield.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation



Especially suitable for

- Facilities with unshakable roofs or open spaces
- Locations with long-term usability and sufficient roof statics

Benefits

- Long lifespan of solar modules (>25 years)
- Mitigated purchase cost of electricity
- National tax incentives can increase economic feasibility
- Additional benefits as shading for parking lot or rooftop

Actions

- Install photovoltaic panels on suitable locations such as rooftops or open spaces
- Ensure the additional load capacity of roofs for the weight of solar panels (approx. 25 kg/m²)
- Utilize on-site consumption of produced electricity

Further Information:

- Can be implemented as contracting

Further Information for Calculation:

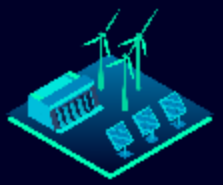
- Under good conditions, 6–8 m² solar panels generate 700–1000 kWh annually

Site Requirements:

- Unshakable roofs or open spaces with long-term usability
- Additional load capacity of roofs for the weight of solar panels (approx. 25 kg/m²)

SIEMENS

Key Lever 2: Purchase & Generate Renewable Energy
Measure 11: Use biomass boilers for heating



Overview

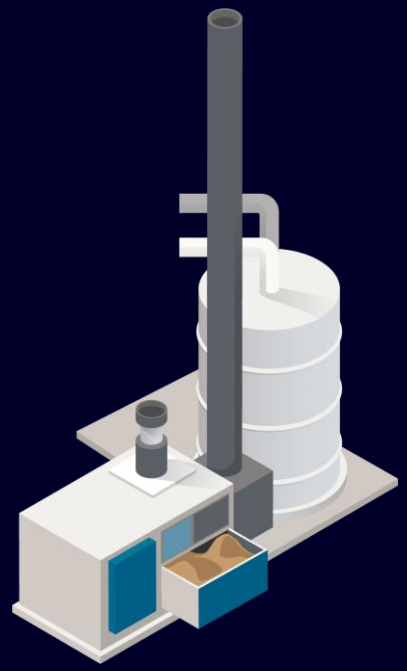
- Old heating systems can be replaced by heating with biomass boilers.
- Biomass boilers are operated with wood chips, wood pellets, or biogas.
- They offer a reduction of CO_2 emissions by using renewable resources and reduce energy prices.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation

Especially suitable for

- Facilities with regional fuel purchasing options
- Locations with upcoming substitution of an old heating system



Benefits

- Reduction of CO_2 emissions
- Lower energy prices
- Fully automated operation

Actions

- Replace old heating systems with biomass boilers
- Ensure regional fuel purchasing options via long-term contracts
- Comply with legal requirements (emission protection, fire safety)
- Provide space for fuel storage

Further Information

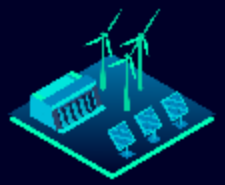
- Can be implemented as contracting
- Wood chips require 3–10 times the storage space of fuel used for oil fired heating

Site Requirements:

- Regional fuel purchasing options via long-term contracts with lower fuel prices [€/MWh] than fossil fuel
- Legal requirements (emission protection, fire safety)
- Space requirements for fuel storage
- Upcoming substitution of an old heating system

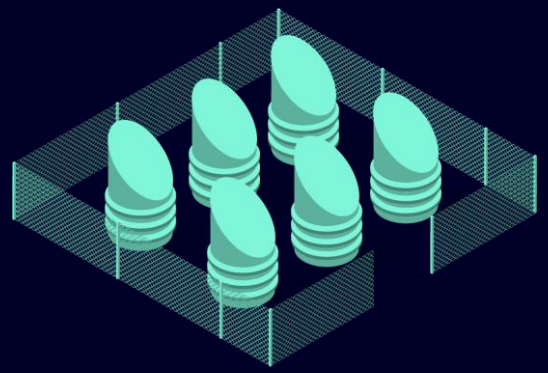
SIEMENS

Key Lever 2: Purchase & Generate Renewable Energy
Measure 12: Use geothermal energy for cooling



Overview

- New buildings often must be built on deep foundations to handle difficult building site conditions or support heavy loads.
- The use of energy piles is an option not only as a foundation but also as a geocooling source, e.g., for cooling production and office space.
- In existing buildings, high-performance energy piles can be installed in open areas.



Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation

Especially suitable for

- Certain geographical conditions
- New buildings with deep foundations
- Existing buildings with open areas

Benefits

- Dual-purpose use of energy piles for foundation and cooling
- Efficient cooling for production and office spaces

Actions

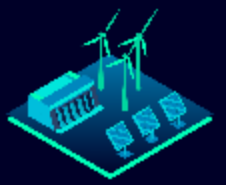
- Use energy piles as a geocooling source
- Install high-performance energy piles in open areas
- Cylindrical tanks made of pre-stressed and high-strength spun concrete

Site Requirements

- Ability to sink a borehole (geological conditions) e.g., 20 m and legal permission
- High heat loads from production or cooling demand for office space

SIEMENS

Key Lever 2: Purchase & Generate Renewable Energy
Measure 13: Generate heat and electricity with CHP

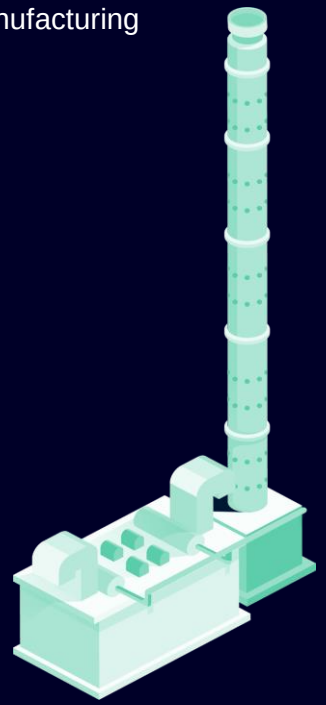


Overview

- Heat and electricity can be generated by combined heat and power generation (CHP).
- CHPs combine the production of heat and electricity or cold and electricity.
- They consist of a combustion engine coupled with a generator.
- Overall efficiency amounts up to 90%, significantly higher than conventional separate heat and power generation.

Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Manufacturing
- Metals Manufacturing



Especially suitable for

- Facilities with year-round heat or cold demand
- Locations with low fuel costs (natural gas, biogas)

Benefits

- High overall efficiency (up to 90%)
- Lower power generation cost compared to purchase price for electricity
- National tax incentives can increase feasibility

Actions

- Implement CHP systems for combined heat and power generation

Further Information

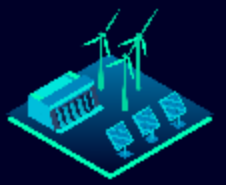
- Can be implemented as contracting

Site Requirements:

- Facility has a constant need for heating or cooling and the energy generated on-site is enough to cover this basic, ongoing demand
- Low fuel costs (natural gas, biogas)

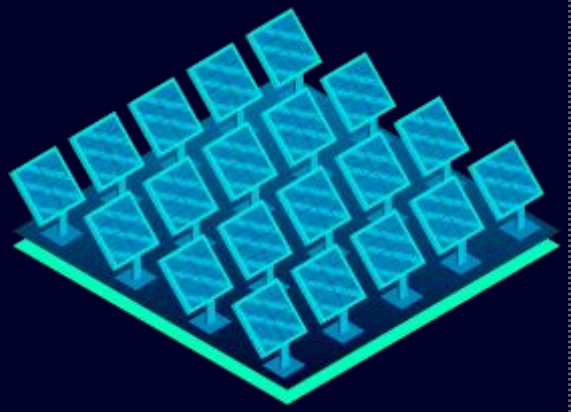
SIEMENS

Key Lever 2: Purchase & Generate Renewable Energy
Measure 14: Use solar heat



Overview

- With solar heat, the sun's radiant energy heats up a heat carrier, which is passed through a heat exchanger.
- Solar heat installation consists of solar collectors, a heat exchanger, pipes, a pump, a control unit, and a hot water tank.



Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)
- Construction
- Manufacturing
- Metals Manufacturing
- Services
- Transportation

Especially suitable for

- Facilities with facades, rooftops, or open spaces with long-term availability

Benefits

- Zero fuel costs
- Proven technology
- Long lifespan of more than 25 years

Actions

- Install solar collectors on facades and rooftops
- Ensure roof load-carrying capacity for the weight of solar collectors

Site Requirements:

- Collectors can be installed on facades and rooftops, provided they can support the weight
- Facades, rooftops, or open spaces with long-term availability
- Roof load-carrying capacity
  → 1m² module weighs up to 40 kg
- Collectors in Central Europe with a southern orientation, 30-45° inclination
- High solar radiation and irradiation (min. 4 h/day), no shading

SIEMENS

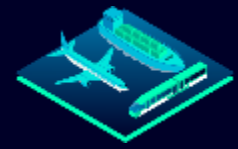
Logistics

15. Energy efficiency training for drivers and fleet managers
16. Use LPG, LNG & GPS cruise control
17. Use radiant heating systems for warehouse heating
18. Switch to low-carbon transport modes

LPG: Liquefied Petroleum Gas LNG: Liquefied Natural Gas GPS: optimization of vehicle speed and route based on real-time GPS data

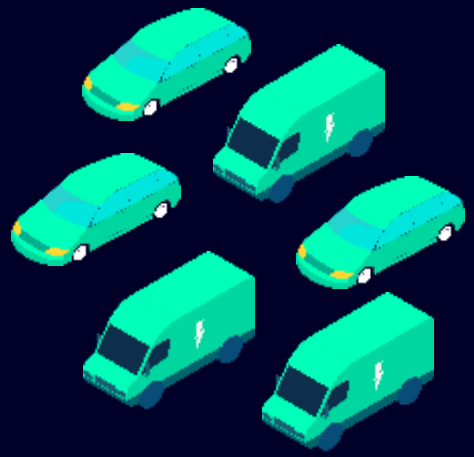
SIEMENS

Key Lever 3: Logistics
Measure 15: Energy efficiency training for drivers and fleet managers



Overview

- Energy saving training leads to significantly lower consumption and emissions.
- Changes to journey planning, how drivers operate their trucks, and how they use the brakes can have a major impact on fuel consumption and profitability.



Business Segments

- Transportation

Especially suitable for

- Companies with fleets of vehicles

Benefits

- Positive effect on wearing parts such as brake pads and discs, clutches, and tires
- Potential savings of around 10% for every 100 km traveled

Actions

- Conduct regular efficiency training for fleet managers and drivers
- Set fuel efficiency as an agreed target
- Implement an internal awards scheme for efficient drivers

Further Information for Calculation:

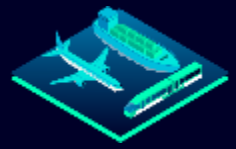
- 10% savings can be achieved by efficiency training
  - → With a mileage of at least 100.000 km per year, this equates to 4.000 liters of fuel saved (MAN TGX 40 l/100 km).
  - → With diesel at an average net cost of 1,18 EUR/l
  - → This could lead to savings of as much as **4.720 EUR** and an emission reduction of **10,566 kg CO2**

Further References:

- Truck manufacturers (MAN, Volvo, Mercedes) suggest that the potential savings to be gained by taking an eco-training course work out at around 10% for every 100 km traveled.

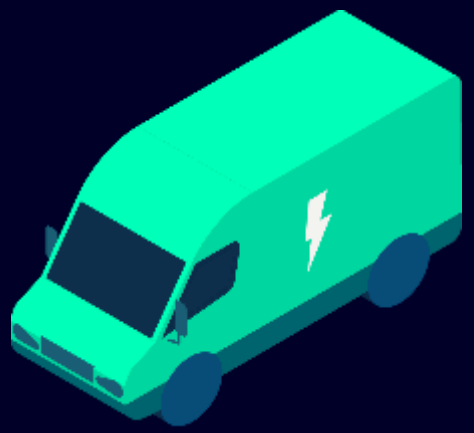
SIEMENS

Key Lever 3: Logistics
Measure 16: Use LPG, LNG & GPS cruise control



Overview

- Heavy goods vehicles can use alternative drive systems and smart technology to reduce CO_2 emissions.
- LNG and LPG are used as alternative fuels for regional and long-distance travel (e.g. at Volvo)*)
- GPS cruise control can optimize fuel consumption.



Business Segments

- Chemicals (Specialty)
- Construction
- Manufacturing
- Transportation

Especially suitable for

- Companies with fleets of heavy goods vehicles

Benefits

- Up to 20% lower CO_2 emissions with LNG
- Reduced operating costs
- Potential savings of around 35,000€
- Improved fuel efficiency with GPS cruise control

Actions

- Consider LNG or LPG-powered vehicles when leasing or purchasing new trucks
- Utilize national subsidy schemes for low CO_2 emission trucks
- Include national road toll exemptions in cost calculations
- Offset higher vehicle outlay with reduced fuel and AdBlue costs
- Check GPS cruise control for new purchases or ability to retrofit on existing vehicles

Further Information for Calculation:

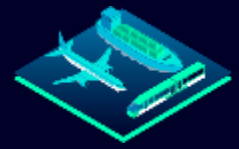
- LNG is used as an alternative fuel for regional and long-distance travel, with diesel engines burning 90-95% LNG and 5-10% diesel.**
- This provides a range of up to 1,000 km, reduces CO_2 emissions by about 20%, and saves around 35.000 EUR in operating costs.
- LPG can also replace diesel, burning up to 40% LPG and reducing CO_2 by approximately 5%.
- Vehicles with GPS cruise control can reduce fuel consumption by up to 5% by optimizing fuel use on gradients.

* Volvo FH

** How LPG works

SIEMENS

Key Lever 3: Logistics
Measure 17: Use radiant heating systems for warehouse heating



Overview

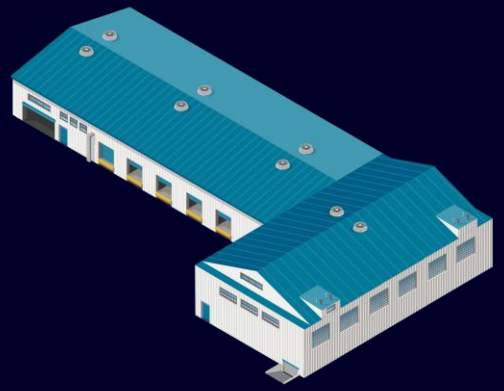
- By using a radiant heating system, warehouses can be heated efficiently.
- Radiant heating systems provide targeted heat supply for parts of warehouses where staff are working, reducing overall heating costs and CO_2 emissions.

Business Segments

- Chemicals (Specialty)
- Construction
- Manufacturing
- Transportation

Especially suitable for

- Logistics buildings and warehouses



Benefits

- Targeted heating without distribution losses
- Lower air temperature in heated parts of the warehouse
- Fuel savings of around 6% can be achieved every time the air temperature is reduced by just 1 degree.
- Potential savings in excess of 50% compared to conventional heating systems

Actions

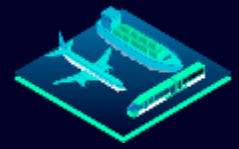
- Heat warehouses with radiant heating systems
- No need to heat warehouse areas where staff are not working (or minimal heating)
- Use electric radiators and green energy to eliminate CO_2 emissions

Further Information

- Due to their large volume, logistics buildings are ideally suited to radiant heating systems. Radiant tube heaters are widely used.
- These heaters can heat occupied work zones without distribution losses, while not heating the air in the roof space or the entire warehouse.
- The long-wave infrared rays only heat the areas where they fall, thus increasing the surface temperature of the surfaces surrounding the room and the warehouse infrastructure
- This means that the air temperature in the heated parts of the warehouse can be 2 to 3°C lower

SIEMENS

Key Lever 3: Logistics
Measure 18: Switch to low-carbon transport modes



Overview

- Switching to less CO_2-intensive modes of transport can significantly reduce emissions.
- Options include avoiding air transport and using inland waterways or rail instead of road transport.

Business Segments

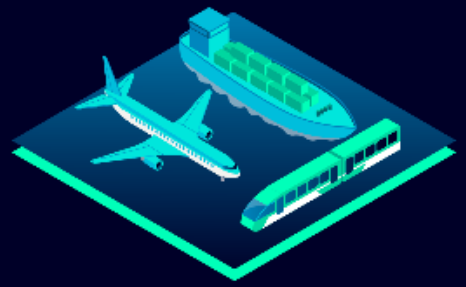
- Chemicals (Specialty)
- Construction
- Manufacturing
- Transportation

Especially suitable for

- Companies involved in freight traffic

Benefits

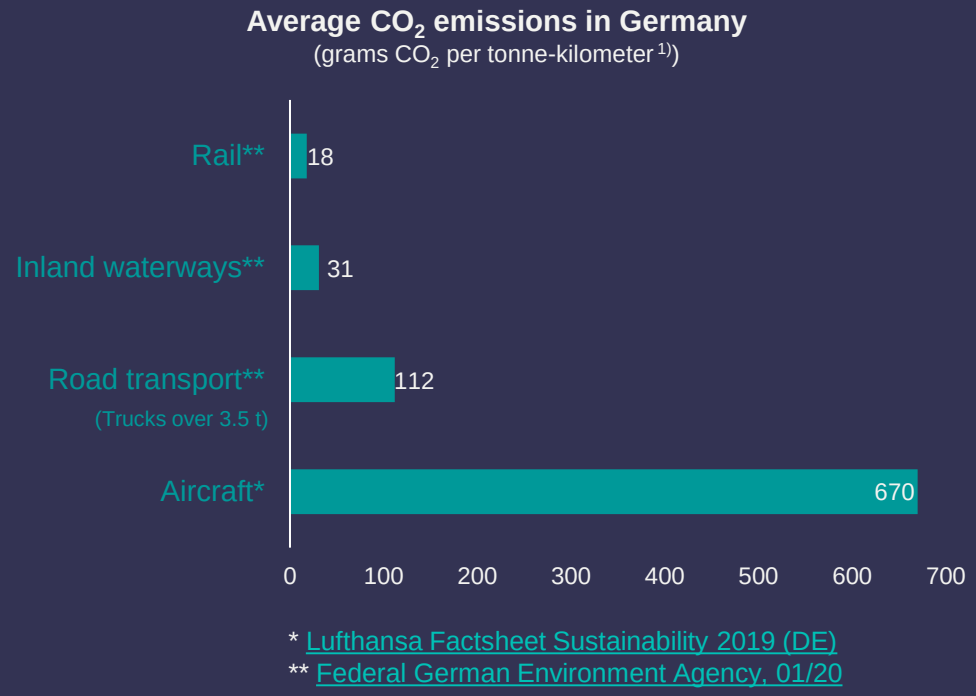
- Reduced CO_2 emissions
- Potential cost savings



Actions

- Avoid air transport wherever possible
- Switch from road transport to inland waterways or rail
- Compare CO_2 emissions when selecting carriers as a criterion for awarding transport contracts

Calculation example



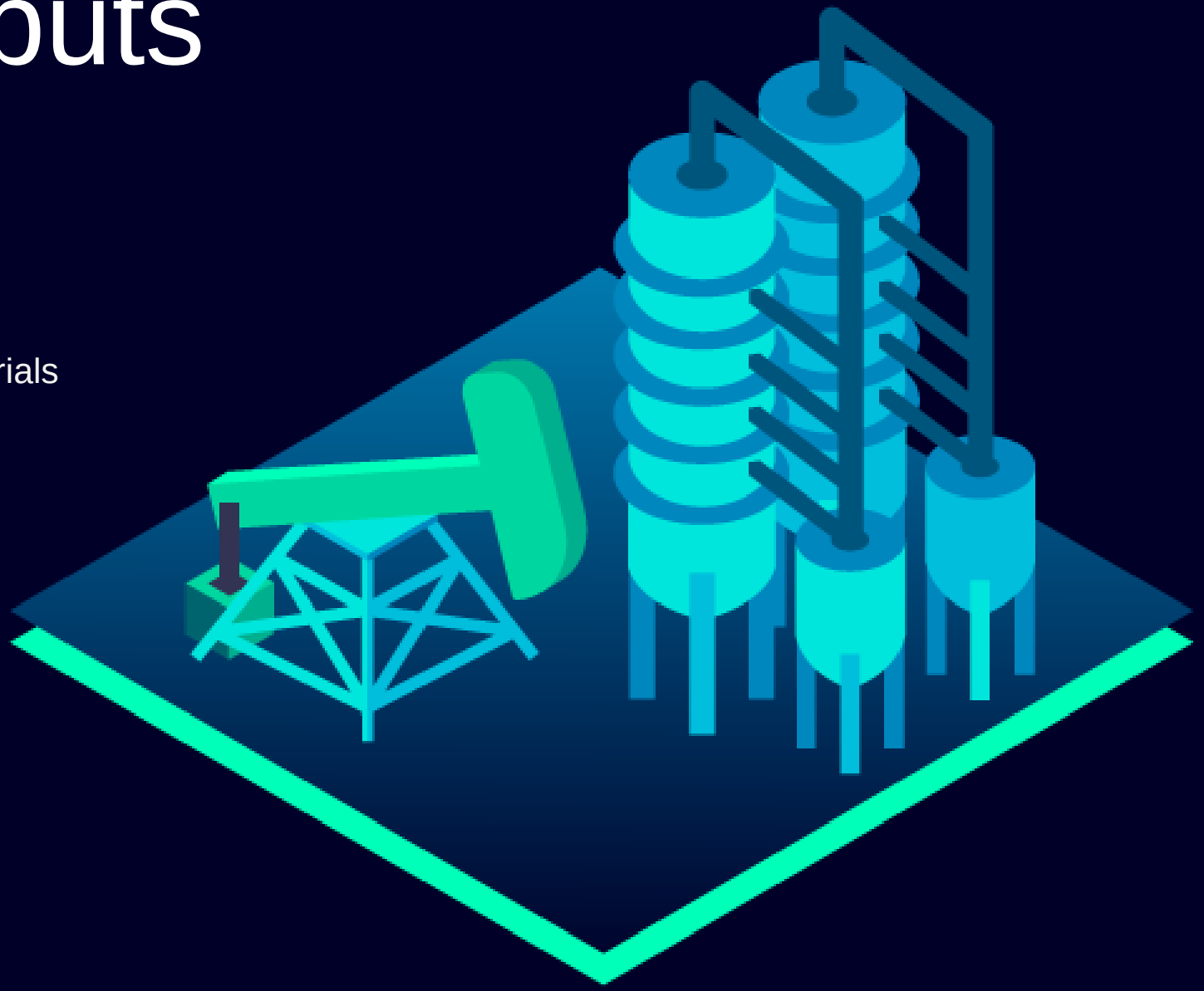
* Lufthansa Factsheet Sustainability 2019 (DE)
** Federal German Environment Agency, 01/20

1) Represents the transport of one tonne of goods over one kilometer

SIEMENS

Sustainable Inputs

19. Use recycled inputs – Aluminum
20. Use timber structures, natural insulation materials and recycle concrete in construction

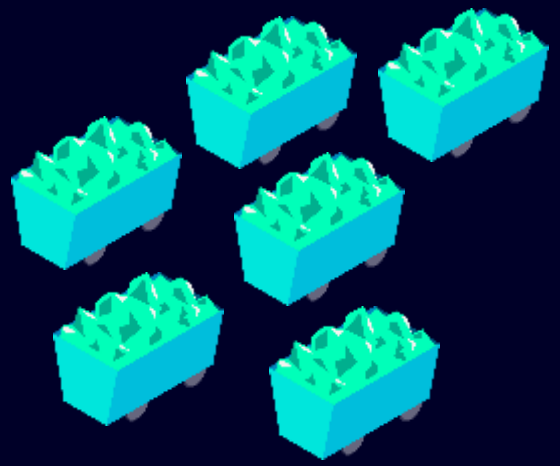


SIEMENS

Key Lever 4: Sustainable inputs
Measure 19: Use recycled inputs - Aluminum

Overview

- CO_2 emissions can be achieved by applying methods such as recycling aluminum.
- Aluminum manufacturing is extremely energy-intensive and environmentally harmful.
- Using secondary aluminum components and renewable energy sources can significantly reduce CO_2 emissions.



Business Segments

- Construction
- Manufacturing

Benefits

- Up to 80% CO_2 savings per ton of aluminum
- Reduced energy consumption

Actions

- Increase the proportion of secondary aluminum components
- Use aluminum manufactured using renewable energy sources

Further Information for Calculation:

- It takes around 25 times as much energy to manufacture aluminum as glass and about 10 times as much as to produce tinplate.
- 80 - 90% of the energy used and the CO_2 emissions are due to the fused salt electrolysis process.
- The emissions and energy associated with breaking down bauxite (2 to 3%) and the production of aluminum oxide (10 to 15%) are less important.*

1 t primary aluminum: approx. **13 t CO_2**
1 t secondary aluminum: approx. **1,5 t CO_2****

*) *Recycling processes in Austria (DE)*

***) based on the Austrian power market*

SIEMENS

Key Lever 4: Sustainable inputs

Measure 20: Use timber structures, natural insulation materials and recycle concrete

Overview

- Using recycled concrete and timber structures can reduce CO_2 emissions in the construction industry.
- Natural insulation materials also contribute to CO_2 savings.

Business Segments

- Construction

Benefits

- Up to 15% CO_2 savings per ton of recycled concrete
- Up to 35% CO_2 savings compared to conventional office buildings
- Reduced transport costs
- Reuse of materials

Actions

- Use demolition material to manufacture recycled concrete
- Use less fresh concrete
- Use renewable raw materials for insulation and building purposes (timber)

Further Information

- Up to 20% recycled material from demolition sites can be added to concrete and aggregates used for manufacturing purposes
- Building timber structures and using natural insulation materials such as cellulose, flax, hemp, coconut fiber, and cork can save up to 35% CO_2 compared to a conventional office building.

SIEMENS

Sustainable Production Technologies

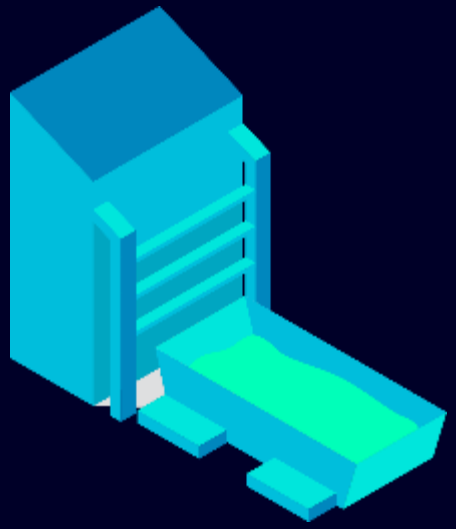
21. Use emerging technologies to produce low-carbon metal
22. Avoid primary raw materials for producing metal
23. Reduce GHG in the metal production
24. Use green hydrogen for chemical production
25. Use renewable feedstocks for producing chemicals
26. Use ultra-low GHG processes for chemical production

SIEMENS

Key Lever 5: Sustainable Production Technologies
Measure 21: Use emerging technologies to produce low-carbon metal

Overview

- Due to the high energy demand, metal production causes high CO_2 emissions.
- To achieve notable CO_2 reductions, innovative changes in production processes are required, as conventional cross-sectional energy efficiency measures only have limited impact.



Business Segments

- Metals Manufacturing

Benefits

- Up to 20 % CO_2 savings (or more)
- Enhanced efficiency in production processes

Actions

- Top gas recycling in blast furnaces with CO_2 injection in steel production
- Reduce iron ore directly:
  - Transition from traditional blast furnaces to direct reduction processes using natural gas
  - Use electric arc furnaces for steel production
- Adopt the HIsarna process for advanced steel smelting
- Implement bipolar electrolysis cells with inert anodes and wettable cathodes in aluminum production
- Transition to carbothermic processes for aluminum production
- Employ Carbon Capture and Storage (CCS) technologies to capture and store remaining CO_2 emissions from production processes.

SIEMENS

Key Lever 4: Sustainable inputs
Measure 22: Avoid primary raw materials for producing metal

Overview

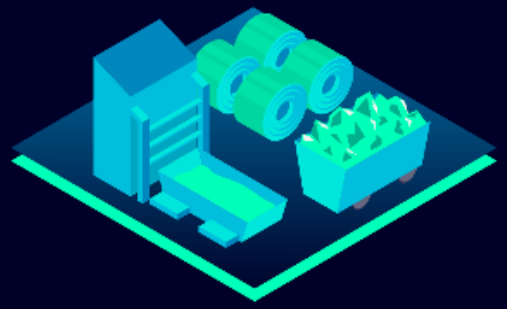
- Purchasing input materials from renewable or low-GHG sources plays an essential role in reducing upstream emissions.
- Especially in metal production, avoiding primary raw materials leads to significant CO_2 savings.
- Mines using electric vehicles and green electricity for drilling, blasting, bolting, and grinding save considerable emissions compared to conventional mines.

Business Segments

- Metals Manufacturing

Benefits

- Significant reduction in upstream CO_2 emissions
- Independent from fossil resources → stable supply chain
- Reduced environmental impact



Actions

- Avoid primary raw materials
- Instead, use end-of-life metal scrap
- Use raw material from GHG-free electrified mines

SIEMENS

Key Lever 5: Sustainable Production Technologies
Measure 23: Reduce GHG in the metal production

Overview

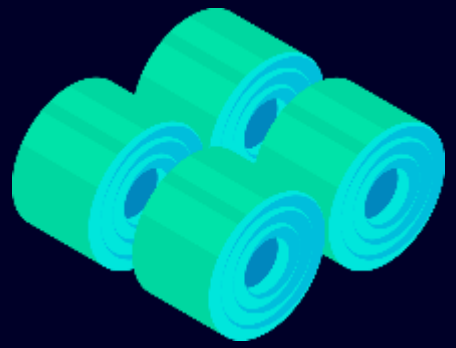
- Due to the high energy demand, metal production causes high CO_2 emissions.
- Conventional cross-sectional energy efficiency measures have limited impact.
- To achieve notable CO_2 reductions, innovative changes in production processes are required.

Business Segments

- Metals Manufacturing

Benefits

- Potential for completely CO_2-free metal production
- Enhanced efficiency in production processes



Actions

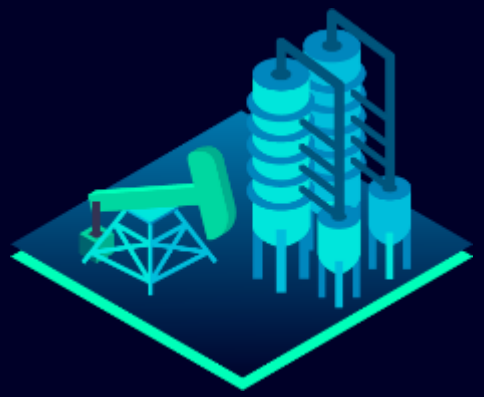
- For a completely CO_2-free metal production following measures are impactful:
  - Use GHG-free hydrogen for direct reduction of iron ore; produce steel in GHG-free powered electric arc furnaces
  - Implement electrolysis processes using GHG-free electricity for CO_2-free steel production

SIEMENS

Key Lever 5: Sustainable Production Technologies
Measure 24: Use green hydrogen for chemical production

Overview

- The chemical industry is a major contributor to CO_2 emissions due to its high energy demand.
- Conventional energy efficiency measures have limited impact.
- Emerging technologies can save significant on-site emissions from production processes and, in some cases, also reduce upstream emissions of inputs.



Business Segments

- Chemicals (Basic, Specialty, Industrial Gases)

Benefits

- Potential for completely CO_2-free production processes
- Enhanced efficiency in production processes

Actions

- Implement Hydrogen production via
  - water electrolysis with GHG-free electricity
  - or gasification of biomass residues with GHG-free electricity
- Use green hydrogen…
  - …for Methanol production
  - …for Ammonia production (and a GHG-free electrified air separation unit)
  - …as basis for Methanol-to-Olefin technologies and Methanol-to-Aromatics technologies

SIEMENS

Key Lever 4: Sustainable inputs
Measure 25: Use renewable feedstocks for producing chemicals

Overview

- In the chemical industry, conventional fossil feedstocks can be replaced by renewable sources and waste streams.
- Specialty chemical producers can also buy basic chemicals with ultra-low emissions.

Business Segments

- Chemicals (Basic, Specialty)

Benefits

- Significant reduction in upstream CO_2 emissions
- Independent from fossil resources → stable supply chain
- Reduced environmental impact

Actions

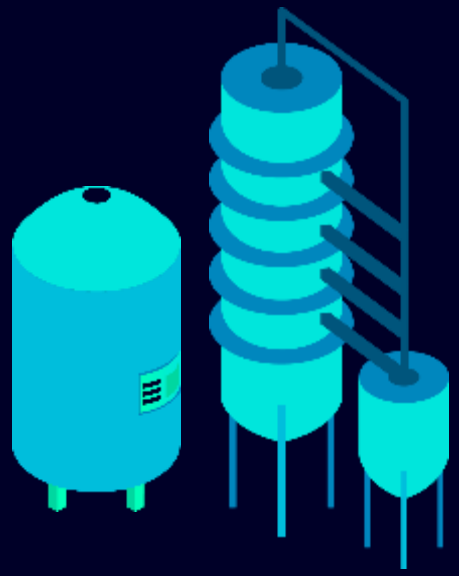
- Use renewable feedstocks synthesized from green hydrogen (e.g., renewable naphtha)
- Recycle feedstocks through gasification or pyrolysis of waste
- Purchase basic chemicals with ultra-low CO_2 emissions:
  - GHG-free hydrogen
  - Chemicals generated with or based on green hydrogen
  - Olefins and aromatics produced
    - from biomass residues
    - from waste
    - via Methanol-to-X technologies
    - Chlorine
    - Industrial gases produced with GHG-free electricity
- Chemicals produced with GHG-free electrified crackers
- Chemicals produced with Carbon Capture and Storage (CCS) CCS or Carbon Capture & Utilize (CCU) technologies

SIEMENS

Key Lever 5: Sustainable Production Technologies
Measure 26: Use ultra-low GHG processes for chemical production

Overview

- The chemical industry is a major contributor to CO_2 emissions due to its high energy demand.
- Conventional energy efficiency measures have limited impact.
- Emerging technologies can save considerable on-site emissions from production processes.



Business Segments

- Chemicals (Basic)

Benefits

- Up to 20 % CO_2 savings
- Enhanced efficiency in production processes

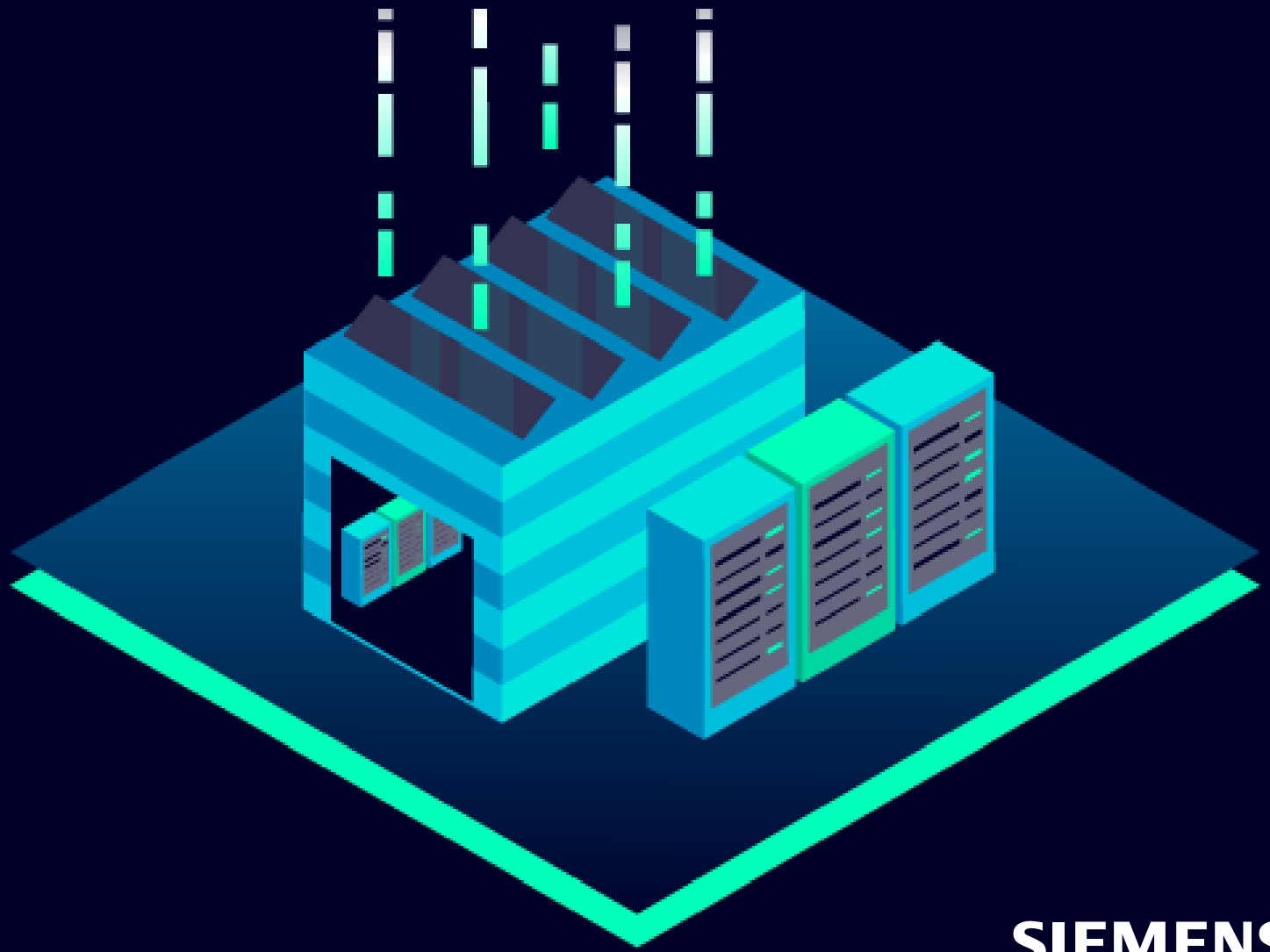
Actions

- Use ultra-low GHG electrified crackers
- Generate or use ultra-low GHG electrified process heat
- Implement a ultra-low GHG Chlor-Alkali-process
- Implement Methane pyrolysis with ultra-low GHG electricity
- Implement Carbon Capture and Storage (CCS) CCS or Carbon Capture & Utilize (CCU) technologies to capture and store or utilize remaining CO_2 emissions from production processes.

SIEMENS

Other Emission Hotspots

27. Adapt business travel
28. Use green IT



SIEMENS

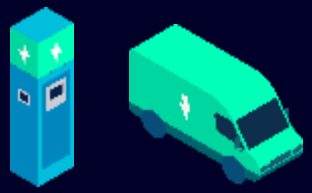
Key Lever 6: Other Emission Hotspots
Measure 27: Adapt business travel

Overview

- Reducing business travel and choosing less CO_2-intensive modes of transport can significantly cut CO_2 emissions.
- Buses and trains generate the least CO_2 per person per kilometer

Business Segments

- Services

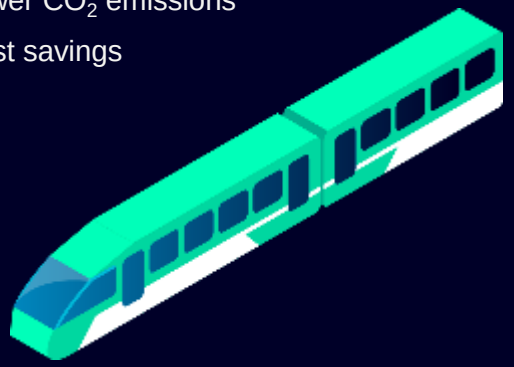


Especially suitable for

- Companies with frequent business travel

Benefits

- Lower CO_2 emissions
- Cost savings

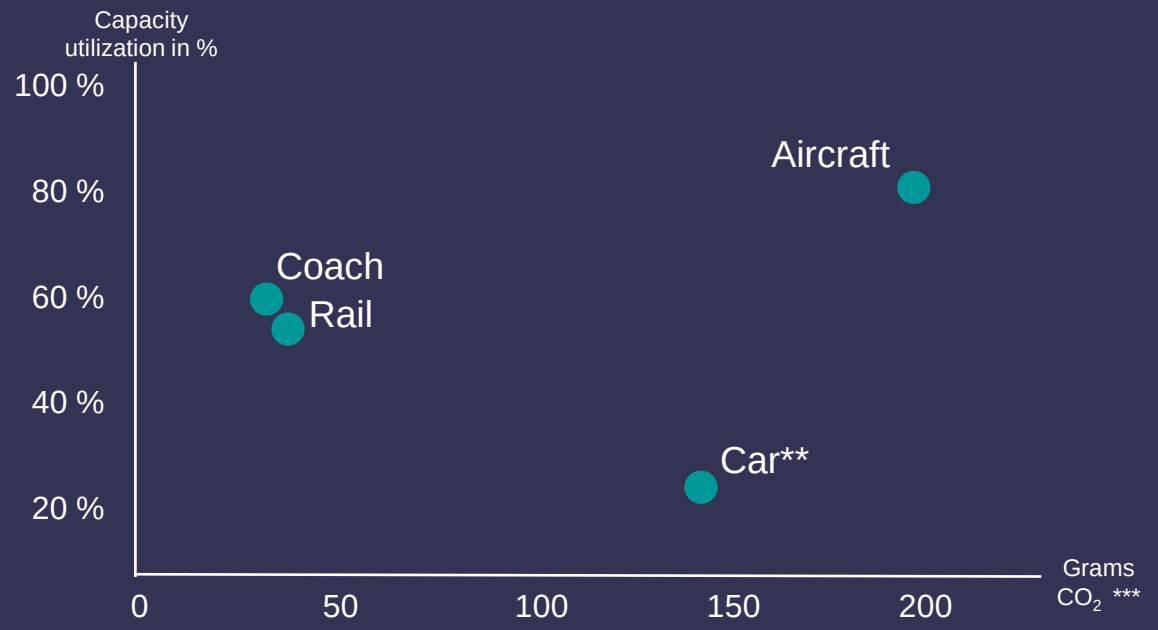


Actions

- Use digital meetings instead of travel
- Avoid domestic air travel
- Use trains and busses whenever possible
- Consider alternative drive systems for company vehicles

Calculation example*

Coaches and rail are the least co2 emitting, since they have lower CO2 emissions (in grams per person per km) with a mid to high utilization capacity



* Die Zeit, Carbon Balance Edition, 2019 (DE)
** 1,5 person/car
*** Per person and km

SIEMENS

Key Lever 6: Other Emission Hotspots
Measure 28: Use green IT

Overview

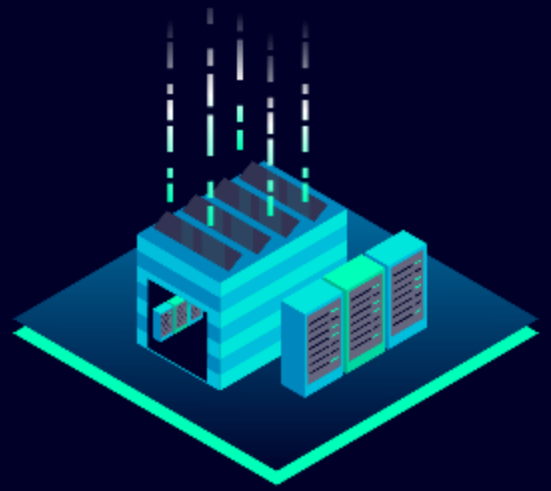
- Computer centers and server rooms are often systems that have developed over many years and thus have considerable potential for savings.
- Optimizing IT infrastructure and using green energy can significantly reduce CO2 emissions and energy costs.

Business Segments

- Services

Especially suitable for

- Companies with computer centers and server rooms



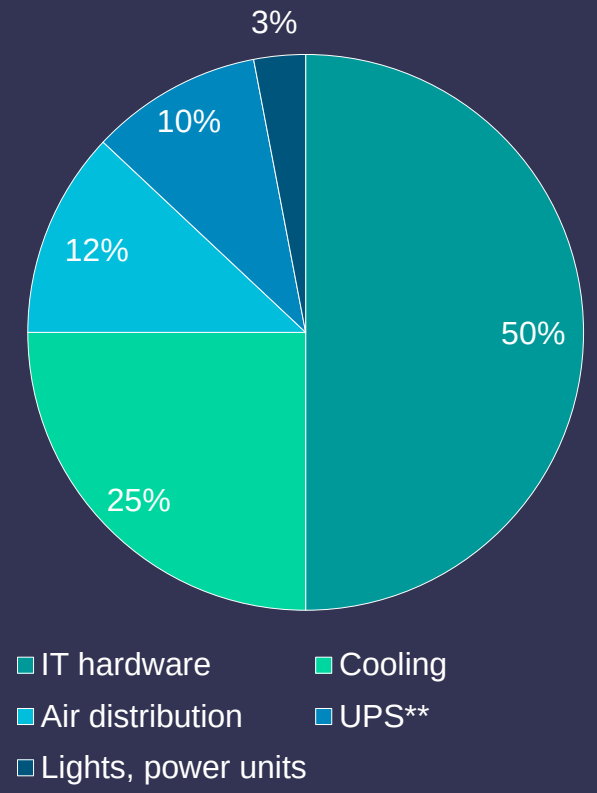
Benefits

- Up to 20% energy savings with low-cost investments
- Up to 40% energy savings with more extensive measures (incl. IT architecture)

Actions

- Use green energy
- Use ultra-efficient UPS systems
- Increase the operating temperature: power consumption falls with every degree centigrade that you do not need to cool your computer center. Observe the manufacturer's specifications
- Optimized cooling: use free cooling, geothermal systems for new developments
- Optimized ventilation systems: separate warm and cold air zones when installing and separating racks
- Optimize server load by disconnecting servers which are not in use

Example: Computer center energy costs*



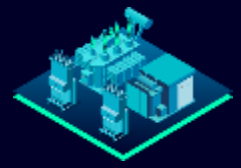
* Deutsche Energie-Agentur, Energieeffizienz in Rechenzentren
** UPS = Uninterruptible power supply

SIEMENS

Further Deep Dive

SIEMENS

Further Deep Dive
Cross-sectional technologies



Energy Efficiency

- Increasing energy efficiency is a central climate protection measure. Every kWh of energy saved also saves costs and thus increases economic performance.

  Cross sectional technologies or “helping functions”, such as heating, cooling, ventilation, compressed air, lighting, and IT infrastructure, are a good opportunity for reducing emissions and increasing energy efficiency across all business models. They have a long life-span – consequently, they are often outdated, and inefficient.

Overview of cross-sectional technologies

Area	Technologies	Examples
Ventilation	Ventilation plants	Heat recovery
	Exhaust ventilation systems	Welding fumes
	Heat extraction systems	Decrease cooling loads
	Waste heat utilization from exhaust air	Paint shop
Heating	Heat generation	CHP
	Heat distribution	Ext. calibration
	Heating systems	Radiators, fan coils, radiant heaters, air curtains
	Insulation	
Cooling	Cold water generation	Economizer-control process cooling
	Distribution and systems	Fan coil units
Lighting	Lighting	LEDs, daylight sensor, motion control
	Lighting system	Daylight sensor
	Process lighting system	Local applications
Compressed Air	Compressed air generation	
	Distribution networks	Leakage control

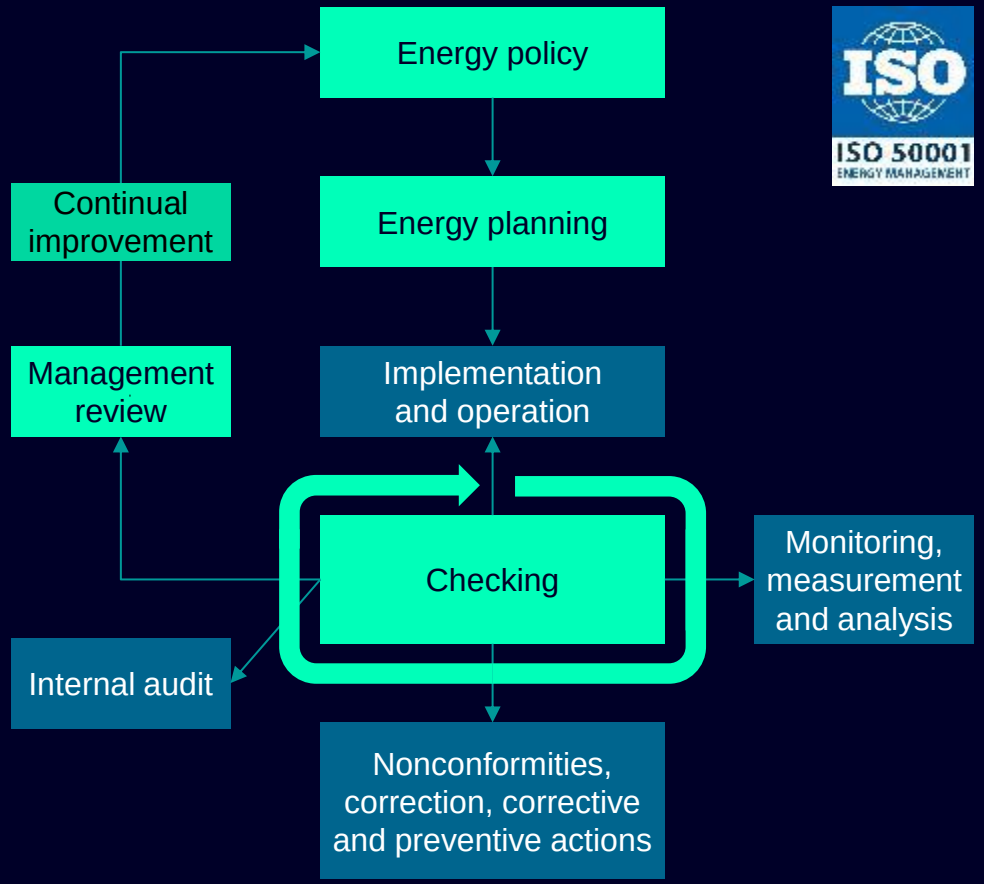
SIEMENS

Further Deep Dive
Energy Management Systems

EMAS

- An energy management system (ISO 50001) or an environmental management system (ISO 14001) can also help to regularly identify drivers and continuously implement the above-described measures.

Energy Management System Overview



Contact

Published by Siemens SCM & EHS

Siemens AG
Supply Chain Management
Otto-Hahn-Ring 6
91739 Munich
Germany

E-mail: carbon-reduction.scm@siemens.com

https://www.siemens.com/carbon-suppliers

Issue 3, September 2024

SIEMENS