The critical role of 'As-A-Service' models in **decarbonizing the commercial and industrial sector**

SIEMENS

Index

1. Abstract

Organizations in the Commercial and Industrial (C&I) sector need to invest in decarbonization or face punitive measures that will add significant costs to their businesses.

A number of regulations like the European Energy Efficiency Directive, which promotes ‘energy efficiency first’ and mandates audits every four years are enacted to enforce industry compliance to meet overall carbon reduction targets. However, the industry also has the opportunity to leverage positive drivers such as new innovations in technology and ‘As-A-Service’ contracts that help companies initiate effective carbon reduction programs.

Outcome-based models from expert decarbonization solutions providers offer flexible financing options with performance guarantees that remove key obstacles companies face in addressing decarbonization. Further, investing in more sustainable products allows companies to build brand equity with consumers who are increasingly sustainability-centric and willing to pay more for goods. It also gives them the ability to attract investors who are driven by sustainability credentials.

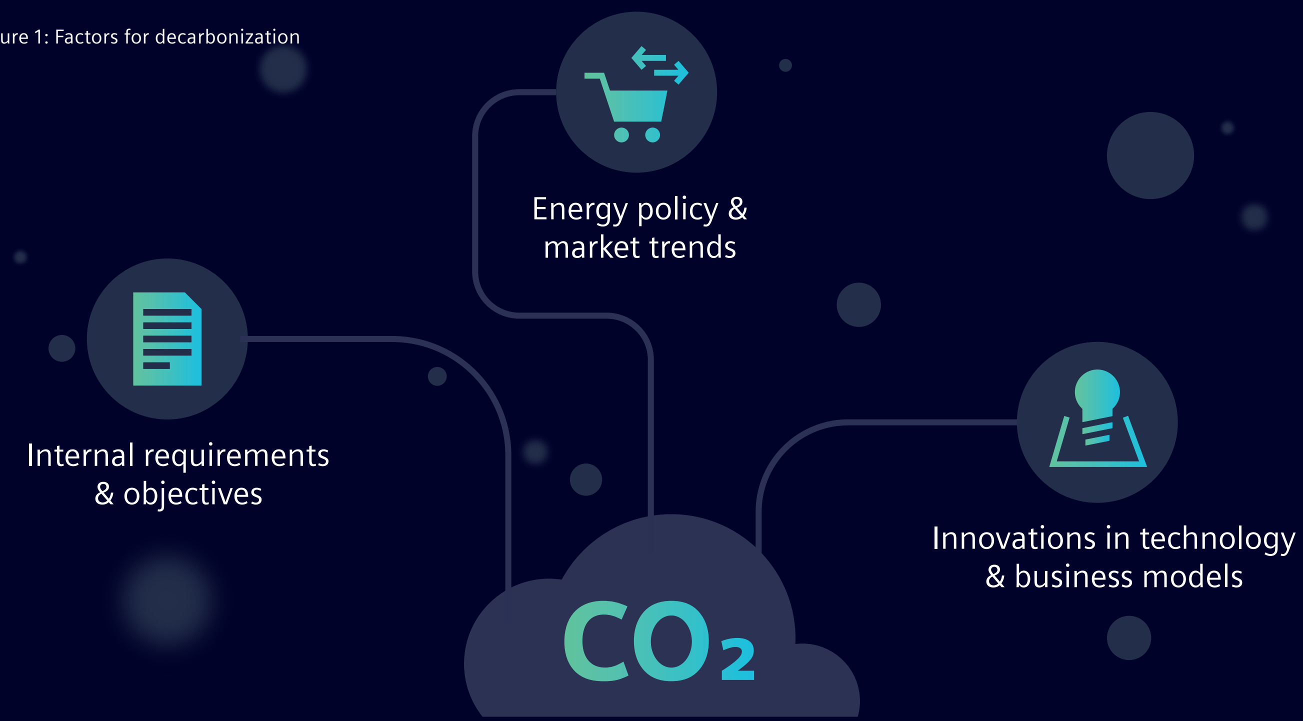
2. Key decarbonization trends and driving forces

The shift towards decarbonization is being driven by three key levers:

- A company's internal requirements and objectives
- Regulatory policy and trends
- Innovations in technology and business models.

Combined, these factors will increasingly enable organizations to invest in lower carbon emitting technologies.

Figure 1: Factors for decarbonization



Internal organizational requirements

High carbon intensity industries are most pressed to decarbonize.

The Commercial and Industrial (C&I) sector is highly diverse in terms of infrastructure and industry needs for carbon mitigation, and the measures required for decarbonization vary significantly. Carbon dioxide abatement is easier to achieve in commercial buildings given the low temperature requirements and relatively low costs of decarbonization solutions, for example switching to efficient LED lighting or space heating solutions.

However, in heavy industries such as cement and chemicals production, high temperature requirements (e.g. 1,600 degrees Celsius required to heat cement kilns which emit 60% of the CO_2) and highly integrated processes require more intensive measures. These can include using environmentally friendly feedstocks for heat generation, or the electrification of processes by switching to electric equipment (e.g. furnaces, boilers, heat pumps) that use renewable energy sources.

These high CO_2 emitters are therefore under considerably more pressure to decarbonize, and due to technical and economic challenges, are compelled to implement innovative measures to reduce their carbon footprints. Less heat intensive industries, such as Food & Beverage have an easier decarbonization pathway as electricity use in a factory is driven by refrigeration, freezing and automation, while milling/crushing, baking/cooking, pasteurization, fermentation, and washing (hot water) use thermal energy from steam boilers, natural gas, fuels.

Further, changing customer needs and substitution effects in certain industries are leading to more CO_2 intensive production processes. For example, in the automotive industry, the transition from internal combustion engines to electric vehicles will increase the share of manufacturing operations and, as a result of battery manufacturing, carbon intensity is set to grow. These companies will need to invest in additional CO_2 abatement technologies.

Decarbonization initiatives focus on Scope 1 and 2 emissions

The Greenhouse Gas Protocol, which provides universally accepted accounting standards to measure and manage greenhouse gases (GHGs), defines emissions in three scopes. This framework is accepted and used by more than 9 out of 10 Fortune 500[1] companies reporting to the Carbon Disclosure Project, a not-for-profit charity that runs the global disclosure system to manage environmental impacts.

The location of emissions, therefore, has significant influence on the solutions that can be employed by a company to reduce its carbon footprint. Scope 1 and 2 emissions are easier to address as they are directly controlled by the company.

In many industries, Scope 3 emissions account for the biggest amount of GHG emissions as many activities are procured from suppliers across the industry value chain.

The relative quantity of Scope 1 to Scope 2 emissions can also vary significantly between companies in the same industry. In the chemicals industry for example, companies that rely on processes such as electrolysis (like the chlor-alkali process) have the highest proportion of Scope 2. While scope 2 emissions are lowest for companies with low reliance on electrochemical processes and those that have invested heavily in in-house electricity generation (where they also need heat and have very efficient CHP plants).

Scope 1

is defined as emissions produced from sources owned or controlled by an organization that are directly created from the operation of its activities onsite.

Scope 2

comprise those emissions generated by the supplier of the energy (electricity, heat/cooling, steam) that is purchased by the company.

Although the emissions are emitted offsite by the energy supplier, the consuming party is still responsible.

Scope 3

relate to those sources not controlled by the company but related to the company's activities, for example vendors within its supply chain, commute of employees, etc.

Growing importance of sustainability for company reputation and brand equity

Environmental, Social, and Corporate Governance (ESG) is becoming an integral to competitive advantage. Many companies are marketing it to increase brand equity and gain loyalty, especially from the younger generations.

Frost & Sullivan research shows that sustainability and environmental awareness is high in the Gen Z generation (born after 2000) and 75% of them are willing to pay extra for brands that are more sustainable.

Sustainability also has an increasing role in the investment community with indices being developed by leading organizations, (e.g. The Dow Jones Sustainability Indices – developed jointly with S&P) to provide best-in-class benchmarks for investors wishing to target the most sustainable companies[2].

Climate Action 100+ is another investor-led initiative that assesses companies against 10 key criteria to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change[3]. The implication is that the most sustainable companies will be better placed to raise funds to grow their business, so are mindful to reduce their carbon footprint.

Increasing accountability for emissions across product supply chains

There is growing pressure for companies to take accountability for emissions across their operations and supply chain, and Scope 3 emissions are becoming increasingly important to address. Accountability for Scope 3 leads to a higher carbon burden for companies; this makes achieving Scope 1 and 2 decarbonization targets more urgent, given the complexities of policing and managing suppliers.

A case in point is Unilever who is targeting a 100% reduction from a 2015 base line for Scope 1 and 2 emissions by 2030 (70% by 2025) and plans to achieve net zero (including Scope 3 emissions) by 2039. These targets have been validated by the Science Based Targets Initiative (a partnership between CDP, the UN Global Compact, World Resources Institute and the World Wide Fund for Nature) that defines and promotes best practice in emissions reductions and net-zero targets in line with climate science.

Organizations are beginning to exploit and monetize sustainability credentials

The energy transition and the road to net zero does not only create challenges for companies, but more importantly provides opportunities. Companies are developing customer value propositions centered on sustainability. This is becoming a key area for competitive differentiation and creates long-term value as it is difficult to replicate.

More environmentally aware consumers are willing to pay more for products that are sustainable and embrace circularity. Recent research by consumer global strategy and pricing consultancy Simon-Kucher & Partners reveals that, globally, 34% of consumers are willing to do so[4].

Organizations will therefore shift to more sustainable practices knowing that additional compliance costs can be passed on to the consumer.

Energy policy and market trends

Markets are encouraging decentralization

- Small scale distributed generation models
- Option to sell back to grid when idle
- Encouragement from market instruments
- Transfer of risk from customers to suppliers

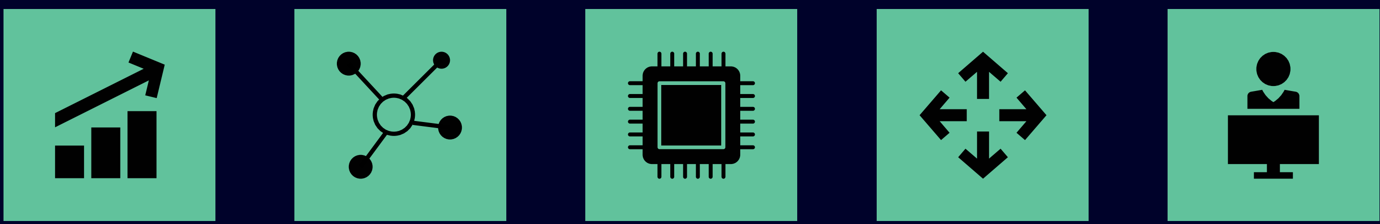
Industry 4.0 technologies uptake is set to soar

- AI and edge-based process transformation
- Shift toward real-tme machine monitoring
- Traditional utilities increase investments
- Digital offerings by OEMs and start-ups catches attention

80% of capacity to be added by 2025 will be renewables

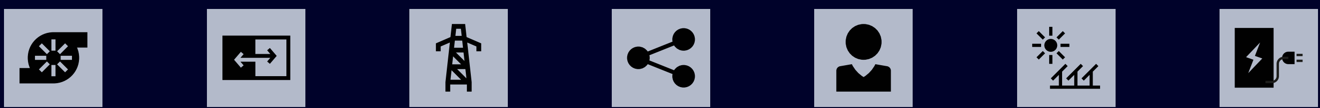
- Wind and solar capacity pipeline remains strong
- Coal downturn continues in mature markets
- Coal phase-outs announced in mature markets
- Levelized cost trend incline towards solar and wind

Enablers



Market instruments | Connectivity | Artificial intelligence | New Business models | Consumer applications

Aspects of an Energy System



Generation | Trading | Transmission | Distribution | Supply | Decentralized Generation | V2X

Figure 2: Energy market trends driving decarbonization

Emissions and energy efficiency regulations are increasing

The Paris Agreement of 2015 was a landmark moment for climate action. A binding agreement was signed by 196 countries to undertake ambitious actions to limit global warming to below 2 degrees (preferably 1.5 degrees Celsius) compared to pre-industrial levels by 2100[5]. As part of this agreement, countries are required to submit increasingly bold targets, known as nationally determined contributions, to reduce greenhouse gas emissions every 5 years.

In addition, the European Commission recently submitted a set of proposals termed 'The Green Deal' to achieve climate neutrality in the EU by 2050, with at least a 55% net reduction in greenhouse gas (GHG) emissions by 2030[6].The Commission has since put forward proposals for a new directive on energy efficiency that promotes 'energy efficiency first' as an overall principle[7].

The Energy Efficiency Directive has already been amended to ensure GHG emissions are reduced more aggressively - by at least 55% in 2030 compared to 1990. Under this directive, Article 8 requires Member States to promote and ensure the use of high-quality, cost-effective energy audits and energy management systems for all enterprises, with large enterprises being subject to an audit every 4 years.

Further, Energy Performance of Buildings Directive[8], is aimed to promote highly energy efficient and decarbonized building stock by 2050.

The use of policy to curb CO_2 emissions will continue to intensify globally as governments abide by their commitments to the Paris Agreement. A case in point are carbon taxes, which are based on 'the polluter pays' principle and are costs that emitters must pay for each ton of carbon emitted. According to the World Bank, 45 countries have implemented, or are scheduled to implement, carbon taxes or 'cap and trade' systems such as the EU's emission trading scheme (EU-ETS). These initiatives cover 11.65 $GtCO_2e$, representing 21.5% of global greenhouse gas emissions.[9]

There have been some setbacks, for example, France and Australia had to shelve plans to increase carbon prices but, overall, there is increased global momentum towards the roll out of carbon taxes. Israel and Singapore have both recently introduced taxes, and Canada extended its carbon-pricing program nationwide by imposing a tax on fossil fuels in four provinces that had declined to write their own climate plans. Failure to comply with regulations will result in high fines for companies, so they are incentivized to reduce their carbon emissions.

On-site power generation will experience significant growth

Energy systems will continue to shift away from large, centralized fossil fuel power plants to cleaner distributed energy resources (DERs). Frost & Sullivan estimates that $540 billion will be invested globally in new DER capacity in the C&I sector between 2020 and 2030[10] - most of these investments will be in gas engine and turbines and solar photovoltaics. Investments are driven by a combination of:

- Favorable regulations
- Declining project and technology costs (e.g. energy storage costs are expected to decrease by 35% over the period)
- High electricity and demand charges
- Availability of funding
- New financing models that offset initial investment barriers.

Solutions are evolving from pure pay-and-purchase models to output-based operation contracts that include maintenance and performance guarantees.

A key benefit of DERs is that they strengthen the resilience of energy infrastructure. They increase system security by using bridging technologies, such as energy storage or combined heat and power units (turbines or engines) to reduce the effect of supply shocks from electricity shortages or excesses. Companies may also invest in efficient DER systems to reduce energy costs if the price of electricity is high.

A trend in the automotive industry is to install wind turbines and solar panels directly at production facilities to reduce CO_2 emissions. Some manufacturers, such as Volkswagen, are also converting significant on-site power generation capacities from coal to gas technology, which will reduce emissions by 60%.

Renewable energy corporate power purchase agreements will increase

Power generation capacity continues to shift away from polluting fossil fuels, such as coal and oil, to cleaner alternatives like gas and renewable energy sources, including wind and solar.

Frost & Sullivan research shows that by 2030, 85% of power investments will be in renewable energy sources and 93% will be in low carbon technologies[11].

The implication is that C&I consumers can have better access to cleaner power sources to address their Scope 2 emissions by procuring electricity via power purchase agreements (PPAs) with renewable energy producers at an agreed price and period of time.

This is a practice that is gaining momentum across industries such as automotive and chemicals. In other industries such as Food & Beverage, the practice of signing long-term PPAs with renewable energy providers is widespread through the processed F&B ecosystem from the top down.

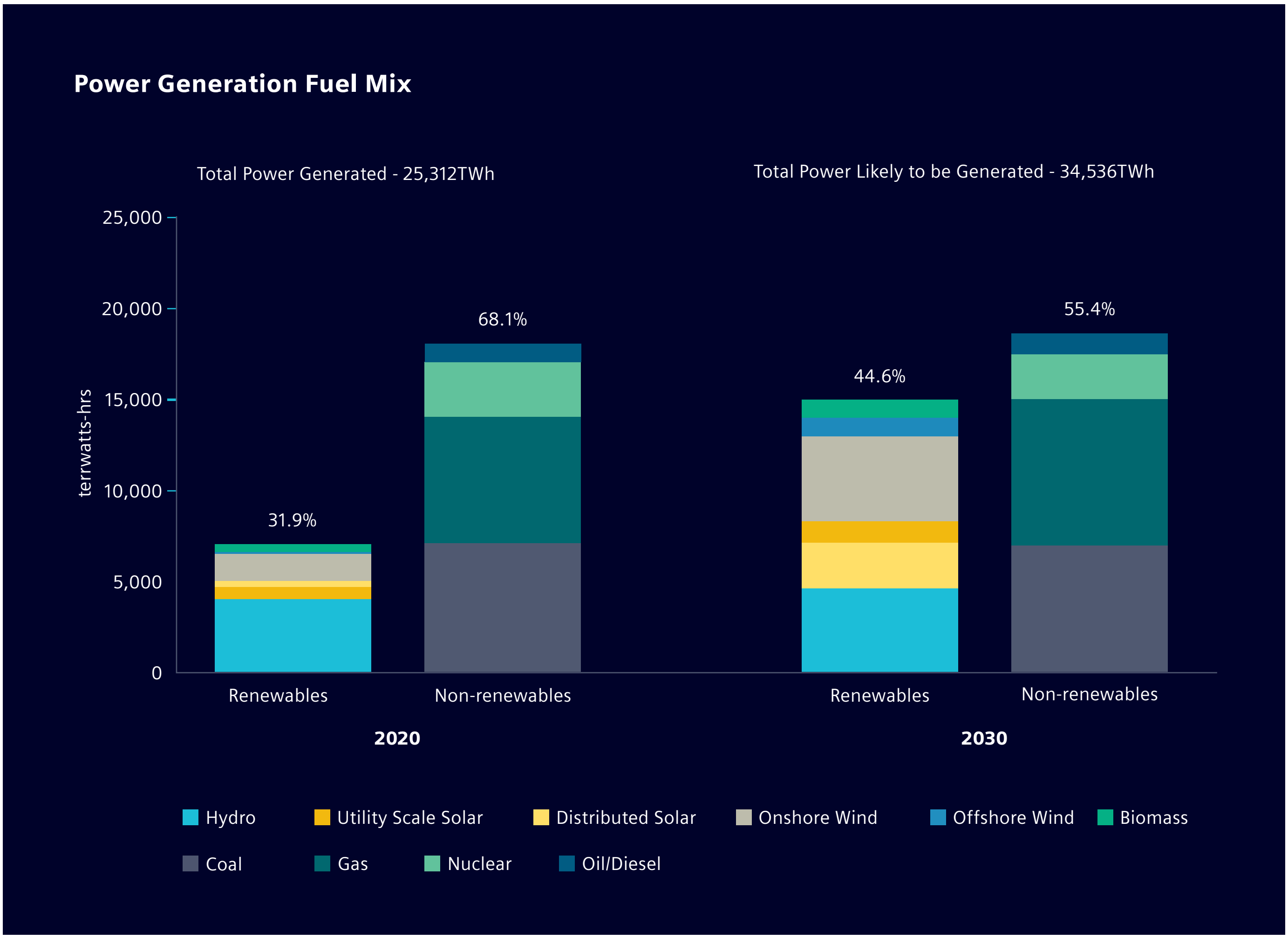


Figure 3: The growth in renewable power generation

Innovations in technology and business models

Innovations in energy efficiency solutions

Improving energy efficiency is a key objective to reducing Scope 1 carbon emissions. Outcomes can be realized by investing in solutions that improve the overall performance of existing assets and infrastructure, or in more efficient assets to reduce energy consumption (e.g. heat pumps for space and water heating). In the chemicals industry, for example, companies are exploring ways of recycling "waste" heat created during chemical processes in heat pumps.

Data analytics is playing an increasingly vital role in improving the efficiency of existing infrastructure without the need to buy new assets. The implementation of Energy Management Systems in buildings (where energy costs are one-third of the operating expenses) is increasing and Frost & Sullivan expects the market to grow with a CAGR of 12% between 2018 and 2025[12]. This is being driven by:

- High peak electricity demand charges
- Customer commitment to reduce energy consumption
- Energy efficiency legislation
- State incentives
- The increasing use of energy performance contracts
- Growing customer awareness
- The penetration of building Internet of Things.

Similarly, investments in the Asset Performance Management (APM) market, especially in industries that have high energy requirements, is expected to grow with a Compound Annual Growth Rate (CAGR) of 10.2% from 2019 to 2024[13]. Growth in the market is being driven by the mounting focus on enhancing asset health and reducing operational costs through artificial intelligence or machine learning (better performing assets consume less energy and emit less CO_2). In this instance, companies which invest in energy efficiency measures benefit by reducing their CO_2 footprint and their operational costs as well.

In the automotive industry, material transformation activities such as stamping, casting, and forging are the most energy intensive steps of vehicle manufacturing, closely followed by painting and facility related HVAC, lighting and heating. Industrial Internet of Things technologies will enable manufacturers to significantly enhance and optimize their operations, thereby reducing energy losses and downtime.

For example, the implementation of a Siemens Energy Efficiency analytics solution for Gestamp, an automotive component manufacturer, has led to a decrease of 15% energy consumption through the use of artificial intelligence alone.

Digitization and increasing connectivity is a panacea for new business models

Increasing digitization and connectivity across industries has been a key enabler for the energy transition. Smart infrastructure provides more responsive energy management systems and access to a wider selection of cleaner energy generation sources, for example through virtual power plants (VPPs). A case in point in the automotive industry is vehicle producer General Motors who has signed multiple PPAs for virtual plants since 1995.

Digitization has also unlocked the possibilities of optimizing existing legacy systems, merging incompatible assets, and providing new possibilities for services and business models from which decarbonization outcomes and gains are realized. Digital models also help build infrastructure resilience and decrease operational risks for customers which further supports the business case for decarbonization.

The deployment of outcome-based 'As-A-Service' business models

The development of innovative 'As-A-Service' models helps companies to invest in decarbonization initiatives that would otherwise be cost prohibitive under a normal 'pay and purchase' approach. For example, energy efficiency models allow the customer to reduce energy demand through energy savings or efficiency contracts with no upfront costs and with the service provider taking ownership of delivery and performance risks. In addition, 'Energy-As-A-Service' contracts can help customers decarbonize by having access to efficient on-site energy generation or by procuring energy from renewable sources via PPA contracts.

Example models that reduce energy consumption by increasing energy efficiency

Energy Savings Performance Contracting (ESPC) model

- Turn-key contractor providing infrastructure optimization services with performance guarantee and lifecycle service agreement
- No upfront costs - financing agreement with external bank or contractor
- Cash flow neutral or positive
- No off-balance treatment of assets
- Performance shortfalls paid by contractor to customer and surpluses shared between contractor and customer

Energy Efficiency As A Service (EEAAS) model

- Outcome-based true-service model
- Usually cash-flow positive for client
- No upfront costs - long-term performance service agreement for customers without CAPEX budget
- Asset ownership with contractor of SPV; Outsourcing of assets and services as additional benefit
- Construction and performance risk with contractor (or SPV backed by contractor)

Example models that provide clean energy sources by increasing energy efficiency

Energy As A Service ("On-site EAAS")

- Energy supply (electricity, heat) via on-site or near-site assets
- Project SPV as asset Hold Co
- Can be transferred into other output-based compensation models

Green Energy Supply Via PPA

- Long-term virtual or physical Power Purchase Agreement
- Origination from renewable energy project portfolio of contractor partners - guarantees of origin
- Long term price security
- Payment based on energy consumed
- Risk management via contractor partners

3. Partnering with a decarbonization expert - a key success factor

Organizations often do not have the know-how, time or resources to develop comprehensive carbon reduction plans, and partnering with industry experts is the most sensible route to achieving their decarbonization objectives. Engaging with energy specialists who have deep decarbonization expertise pays dividends. The contractor provides advisory services to assess the customer's activities and implements solutions to deliver optimal results at an affordable fee through a financing partner.

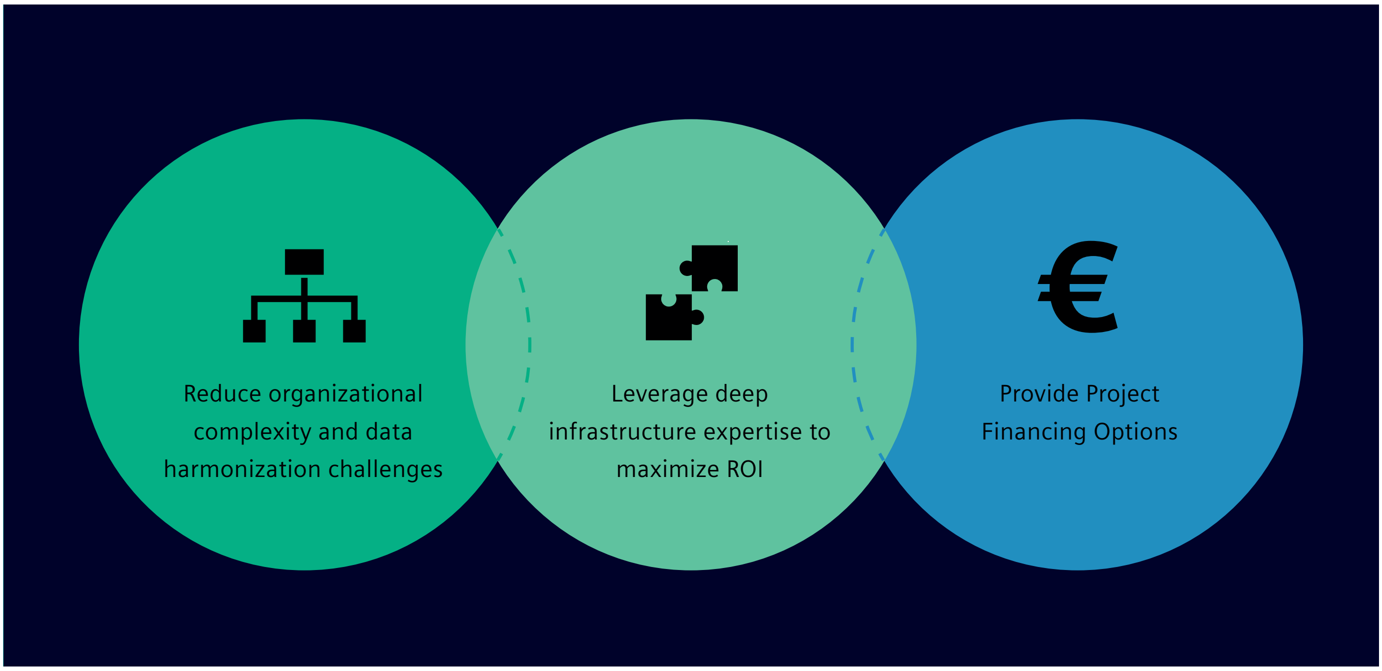


Figure 6: The benefits of partnering with a decarbonization expert

Leveraging deep infrastructure expertise required to maximize ROI for decarbonization

The choice of measures that can be leveraged for optimal carbon mitigation outcomes is highly customized based on local conditions and requires deep equipment expertise. Very few organizations have the internal capabilities to understand the breadth and depth of decarbonization solutions, which can cause decision making inertia, or worse, bad strategic choices leading to:

A. Unrealized value gains from not achieving an optimal mix of measures – low CO_2 abatement per $ investment

B. Costs associated by unnecessarily complicating operating asset reporting procedures

C. More expensive financing costs and lower project ROIs

D. Delays in timelines and implementation of key carbon mitigation measures

Energy experts adopt a holistic approach to decarbonization, targeting a number of levers that can be optimized to achieve the maximum impact per $ invested and where synergies are captured from the component parts. An ideal decarbonization program involves reducing operational carbon emissions as much as possible and then making up the balance through carbon capture, offsetting or purchasing carbon credits through:

A. Improving energy efficiency and reducing energy consumption - Investments vary in scale and solutions are highly customized; these can range from upgrading lighting systems with energy efficient LEDs to comprehensive asset performance management systems

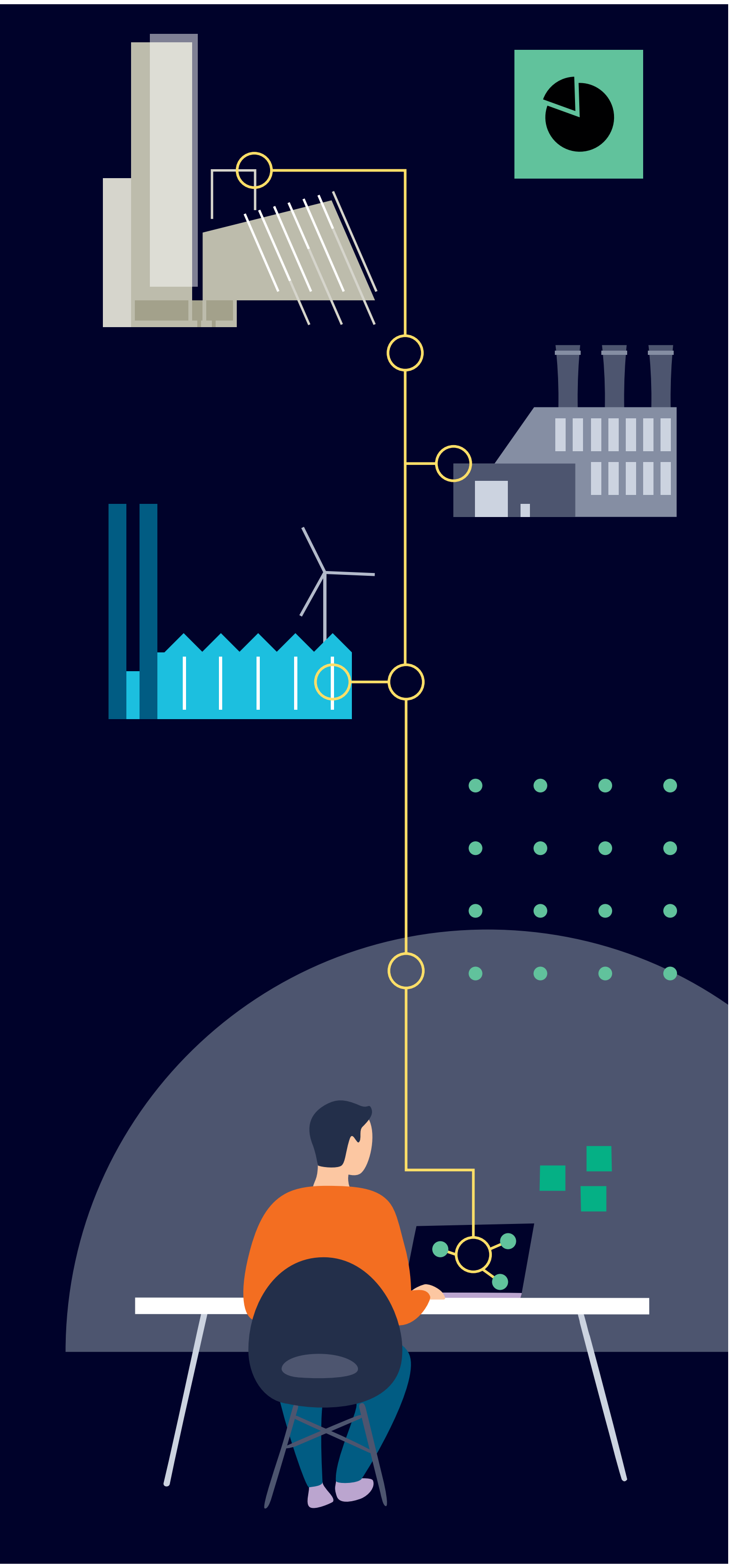
B. Producing energy onsite through DERs - This provides a pathway for customers to build resilience and reduce their reliance on the electricity grid where the primary sources of energy are still derived from fossil fuels. Solutions include a variety of hybrid distributed power generation technologies with energy storage. These include renewable solar photovoltaic sources and wind turbines, but also employ highly energy efficient combined heat and power (CHP) systems using heat pumps.

C. Shifting to electrification - Provides many opportunities to reduce a company’s carbon footprint. Examples include using heat pumps to alleviate peak demand, adding energy storage (including electric vehicles to grid) to store and use excess renewable energy, and using hydrogen produced from renewables as an energy carrier.

D. Procuring clean electricity from grid generation sources or through PPAs - Energy sources are typically derived from large scale, centralized plants such as utility scale solar or wind farms and hydro plants but, as the energy grid becomes increasingly connected, virtual power plants (VPPs) will also feature, creating an aggregation of cleaner DERs.

E. Offsetting the balance - Offsetting and ‘cap and trade’ schemes of carbon emissions can be used to reduce the total emissions associated with a company’s operations through trading carbon credits or carbon avoidance. This is where money is paid into projects to stop emissions (e.g. renewable energy projects), or projects where carbon is removed from the atmosphere (e.g. afforestation or carbon capture and storage).

Early adopters of decarbonization programs are enacting a number of these levers to achieve CO_2 savings. For example, Coca-Cola European Partners is investing in 100% renewable electricity with the support of RE100 whilst reducing the energy intensity of its cold drink equipment fleet by 60% since 2010[14]. Apple introduced energy efficiency measures at its facilities and supply chain which prevented more than 500K tons of CO_2e being emitted, and concurrently uses 100% renewable energy for the electricity it uses in its offices, retail stores and data centers in 43 countries[15].



Overcoming operational complexity and difficulties in data harmonization

Differing operating and reporting structures, site locations, plant configurations, and types of equipment present considerable challenges for many companies in accurately measuring carbon footprints and assessing the optimal solutions to implement. As a first step in developing a decarbonization plan, companies have to harmonize information gathering and transfer processes to ensure a consistent approach to collecting operational data; this can be a significant challenge for multi-national corporations with sites across countries.

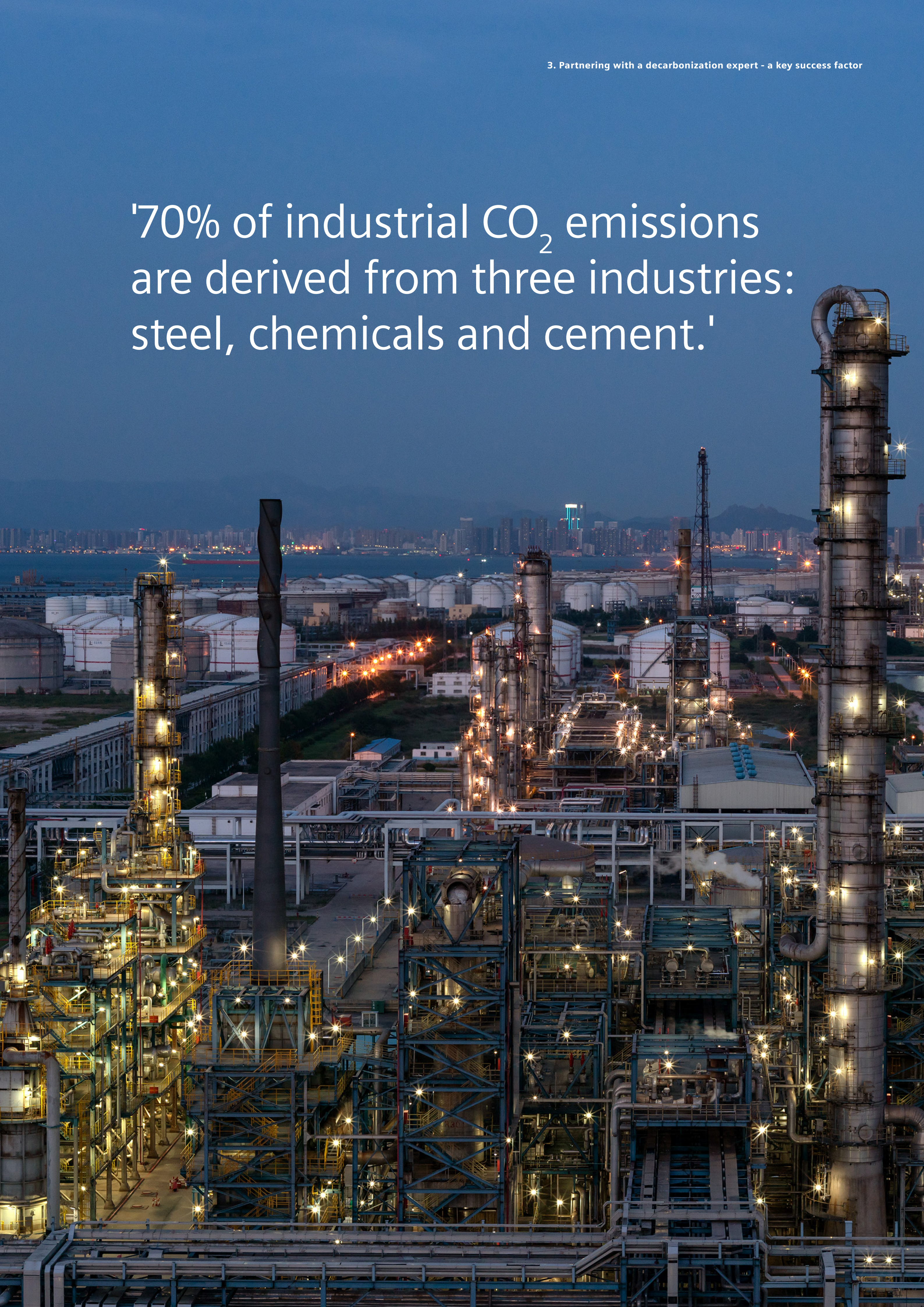
Decarbonization solutions providers have the tools and methodologies to help organizations navigate these potential roadblocks and prevent delays in implementation.

Providing project financing solutions

The costs to decarbonize in the industrial sector can be high given it is very capital intensive and large, expensive equipment (for example furnaces) need to be replaced. According to the EIA, 70% of industrial CO_2 emissions are derived from three industries (steel, chemicals and cement) and production is highly concentrated in emerging countries which account for 70-90% of their combined outputs[16] – these industries are extremely competitive and operate on very lean margins.

Investing in decarbonization initiatives, which are often associated with low (or even negative) ROIs can therefore be very challenging. Further, the investment cycle, particularly in heavy industry, is long (equipment lifespans are typically 40 years[17]) and this means that some companies may have a limited window of opportunity to invest in the best available decarbonization technology to achieve net zero by 2050. The enormity of the decision can lead to analysis paralysis and delays in decision making.

The 'As-A-Service' models offered by experts increasingly comprise financing options, which reduces the financial burden on customers by substituting large upfront costs with regular affordable payments and frees capital to be used in other critical areas. This allows companies to initiate projects that would otherwise not meet internal investment criteria, such as payback period.



'70% of industrial CO_2 emissions are derived from three industries: steel, chemicals and cement.'

4. The case for Decarbonization-As-A-Service

A ‘Decarbonization-As-A-Service’ model comprises a combination of variants of the ‘As-A-Service’ models. For example, the contractor may provide a hybrid of ‘Energy-As-A-Service’ with an on-site ‘Energy-As-A-Service’ offering. The core objective of the value proposition is to give organizations an optimal mix of outcome-based services that will maximize decarbonization gains relative to their objectives.

There are also many benefits for organizations to engage in such contracts and this allows them to embark on a carbon reduction program with performance guarantees.

Single point of contact through one principal contractor minimizes risks, customer transactional costs and project lead times.

Projects are delivered on a turnkey basis with operation and maintenance factored in across the lifetime of the contract leading to operational synergies and minimized operational disruptions.

No upfront cost - financing cost is built into a long term service contract through a monthly fee that is affordable for customers improving project economic.

The fee is treated as an operating cost because it is based on energy used and is not included on the balance sheet, freeing up capital for other critical investments.

Figure 7: Key benefits of implementing ‘As-A-Service’ models

The key steps to a 'Decarbonization-As-A-Service' approach

Advisory and conception

The first and most crucial step to developing an impactful decarbonization roadmap is to establish an accurate baseline from which the various pathways can be assessed in line with the specific operational characteristics of the customer site. Therefore, a holistic review of the company's activities needs to take place.

This is where the provider leverages its significant infrastructure know-how to conduct an audit of the client's operations. It is rigorously done through multiple dimensions including energy consumption, procurement and supply, and energy efficiency and building performance optimization.

Planning and Implementation

The contractor uses flexible 'As-A-Service' models that target an array of decarbonization levers to implement an efficient CO_2 reduction program.

For example, the delivery models can address demand management and infrastructure enhancement solutions that improve energy efficiency metrics, and energy supply management solutions where cleaner energy sources are provided either through on-site generation or through PPAs. Critically, financing schemes are offered as part of the contract to avoid challenging upfront costs and to enable project viability through favorable returns on investment over the project lifecycle.

Operations and Services

Post implementation support services are provided to ensure optimized operations of assets and systems through an extensive array of services. Energy analytics and data management, asset performance services, participation in the energy and flexibility market, and digital twins are some examples of services included in the contract. Maintaining the operational integrity of the infrastructure is a vital element of the offer because the models are outcome based and compliance to performance guarantees is critical.

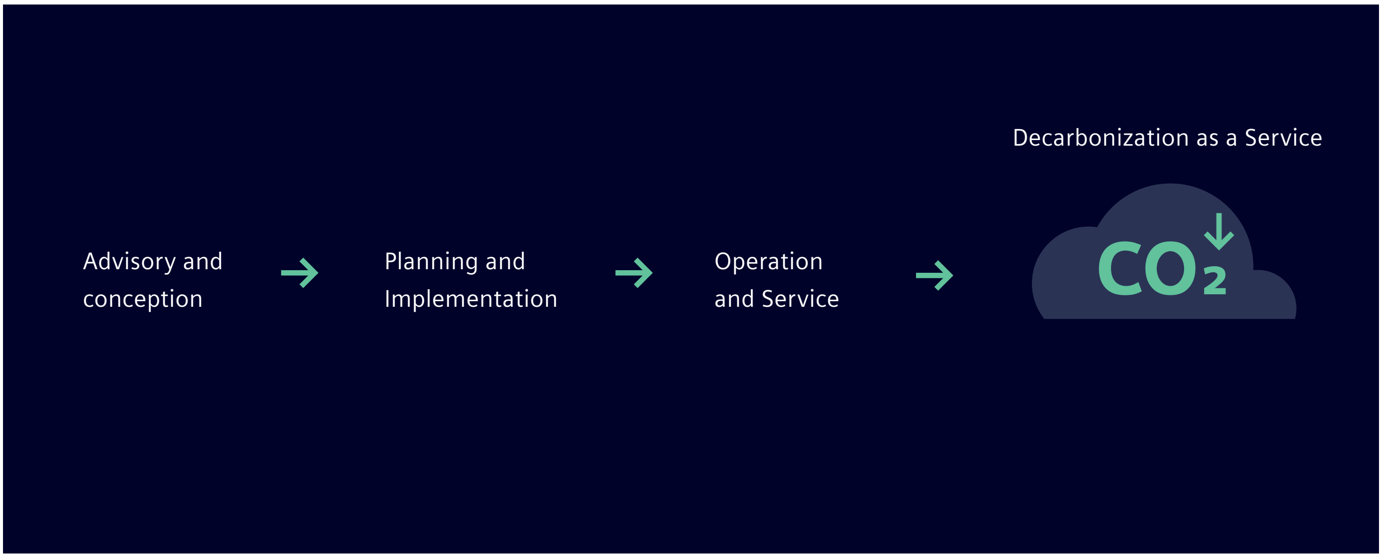


Figure 8: Key benefits of implementing 'As-A-Service' models

Case study: Supporting an ice-cream factory in France to become climate positive

The challenge:
The customer set an ambitious target to become carbon positive by 2030; 24 of its sites out of 22l are already carbon neutral. Globally, it procures 100% of its electricity from renewable energy - this was achieved in January 2020. However, electrification of heat is a major challenge for the customer and they wanted to implement an X-as-a-Service contract model to better manage their energy needs.

Site description and objectives:
The site comprises an ice cream factory with intense energy consumption where 100% renewable electricity is used. Total emissions amount to 1,719 Tons of CO_2 per year due to the use of natural gas. The customer's core objective was to electrify the heat produced at the facility and become Climate Positive by injecting Biogas (from waste) to the grid.

Siemens solution and value to the customer:
Siemens implemented demand side measures including: improvement of the pasteurization unit, energy efficient (LED) and advanced lighting, pumping systems optimization, etc. Siemens also addressed clean energy supply gaps by installing an ammonia heat pump (electrification of the heat) and adding methanizer and biogas injection equipment. The total investment amounted to 7.6M€ with a payback period of 6.6 years. More importantly, the factory will become climate positive (negative CO_2 emissions) by injecting waste-biogas into the grid.

Case study: Achieving double the energy efficiency target of a pectin factory in Italy

The challenge:
The customer is committed to reducing absolute scope I and 2 green gas emissions by 10% by 2025 from a 2017 base-year. The customer is also committed to reducing scope 3 greenhouse gas emissions by 30% per ton of product sold by 2030 from a 2017 base-year. Due to internal rules, projects with payback longer than 3 years are not approved and some plants are losing productivity due to the funding scheme.

Site description and objectives:
The Pectin factory is an aging facility with micro-outages due to the poor grid connection in the South of Italy. It has a total of 25,530 tCO_2 per year of scope I & 2 emissions. The customer wanted to achieve the following objectives:

- carbon reduction and increase resiliency; and
- modernization of the site including digitization and electrification of existing infrastructure.

Siemens solution and value to the customer:
Siemens implemented both demand side and supply side solutions to maximize gains for the customer.

Demand side measures to improve energy efficiency and reduce consumption included installing: mechanical vapour recompression, heat recovery units in pectin dryers, variable frequency drives on peel dryer fans, and chiller plant and cooling plant optimization. From an energy supply side, Siemens installed a gas turbine combined heat and power system to provide cleaner energy.

The total investment comprised 6M€ with a 5 year payback including subsidies. This investment will yield a 19% CO_2 reduction in Scope I and 2 greenhouse gas emissions, which is nearly twice the targeted outcome.

5. A call to action for the Commercial & Industrial industry – the next steps

Companies across the C&I sector will be increasingly exposed to compliance penalties if they do not meet carbon reduction targets set by government policy. Given the decarbonization challenges, they will also incur significant costs if they do not implement effective measures to reduce their carbon footprints. Key principles that should be followed by organizations to ensure success include:

Drive decarbonization initiatives from the top.

Decarbonization targets need to be driven from top management to encourage collaboration and introduce standardized approaches to data gathering and reporting. Accountability should run throughout the organization; HeidelbergCement, for example, became one of the first companies to link the achievement of its climate protection goals to the bonus scheme for employees and management[18].

Engage with decarbonization experts who provide outcome-based 'As-A-Service' models.

An effective decarbonization program is one that encompasses a holistic approach across the organization - this requires comprehensive infrastructural knowledge which takes considerable time and money to scale up. Partnering with an expert solutions provider not only allows immediate access to valuable industry knowledge but also brings numerous additional benefits including access to affordable financing schemes, reduced delivery risks, and performance guarantees.

Exploit and monetize sustainability credentials.

Failing to comply with decarbonization targets will not only result in costly penalties, but can also harm an organization's ability to raise equity in financial markets. This could restrict future growth potential as investors become increasingly focused on sustainability credentials. Further, the brand image of these companies may also suffer as consumers shift to more sustainable goods for which they are willing to pay more – there is a strategic imperative for companies to develop unique value propositions that can offset the costs of carbon mitigation.

References:

1. Greenhouse Gas Protocol (ghgprotocol.org)
2. Dow Jones Sustainability World Index | S&P Dow Jones Indices (spglobal.com)
3. Climate Action 100+
4. Simon-Kucher: Global Sustainability Study 2021 (www.simon-kucher.com)
5. The Paris Agreement | UNFCCC
6. A European Green Deal | European Commission (europa.eu)
7. Energy efficiency directive | Energy (europa.eu)
8. Energy performance of buildings directive | Energy (europa.eu)
9. Carbon Pricing Dashboard | Up-to-date overview of carbon pricing initiatives (worldbank.org)
10. Frost & Sullivan Report: Growth Opportunities in Distributed Energy, Forecast to 2030 (frost.com)
11. Frost & Sullivan Power Generation Forecasts
12. Frost & Sullivan Report: Global Home Energy Management Systems (HEMS) and Building Energy Management Systems (BEMS) Market
13. Frost & Sullivan Report: Service-based business models increase asset performance management (frost.com)
14. Action on climate (cocacolaep.com)
15. Apple commits to be 100 percent carbon neutral for its supply chain and products by 2030 - Apple
16. Net Zero by 2050 – Analysis - IEA
17. Net Zero by 2050 – Analysis - IEA
18. HeidelbergCement virtual Annual General Meeting 2021: Climate protection as central theme

Smart Infrastructure
Global Headquarters
Theilerstrasse 1a
6300 Zug
Switzerland
Tel +41 58 724 24 24

For the U.S. published by
Siemens Industry Inc.

800 North Point Parkway
Suite 450
Alpharetta, GA 30005
United States

siemens.com/energy-sustainability