CARNOT CAPITAL

CARNOT IMPACT INVESTING

OVERVIEW AND AKASOL IMPACT CASE STUDY

In cooperation with:

BlueOrchard Impact Investment Managers | Member of the Schroders Group

AKASOL High Performance Battery Systems

PRI Principles for Responsible Investment

IMPACT INVESTING IN NUMBERS

100%

of the companies in the portfolio support the goals of climate action (SDG 13) and clean energy (SDG 7)

5,7%

of the revenues of all portfolio companies is invested in innovation (R&D)

68%

of portfolio company revenues are achieved with impact products

THE CARNOT EFFICIENT ENERGY FUND SUPPORTS FIVE SDGS

IMPACT. BEYOND ESG.

«Suddenly environmental protection is important on Wall Street» – was a headline in the NZZ on August 5, 2020 [1]. So, Wall Street, of all places, is now supposed to promote sustainability? The article then lists the most important reasons for the change of heart: Firstly, record-low interest rates are making investments in longer-term future projects feel better, and secondly, as a result of the COVID 19 pandemic, there has been a growing awareness of sustainability issues.

Carnot Impact Investing since 2007

- integrates ESG sustainability as a bottom-up process into impact analysis
- sees the fight against climate change as a business model with attractive opportunities
- does not demand a renunciation of consumption
- initiates active engagement in personal dialogue with the companies
- finds the innovative and promising companies

Carnot Capital has been investing in energy and resource efficiency since its launch in 2007. By focusing on these two topics, impact and sustainability have become the DNA of the company. At the beginning of the current year, the product range was expanded by an investment certificate on the topic of 'circular economy'. This investment certificate also focuses on the sustainable use of natural resources, which is to a large extent a question of suitable technologies as well as processes and systems.

Two years ago, we presented our impact investment process to the general public in a research paper (Carnot Impact Investing). This investment process is based on two goals: an attractive financial return and a substantial positive impact in terms of the UN's sustainable development goals. The detailed impact reports illustrate and quantify the positive effects that Carnot Efficient Energy and Carnot Efficient Resources achieved in 2019.

With the present analysis, we want to focus on the effects of the Carnot Impact Investing process: Which sustainable development goals are affected? Where does the portfolio actually achieve improvements and reduce energy and resource consumption?

The case study in Chapter 3 is intended to help give concrete meaning to the very frequently used terms of impact and sustainability. Using the company Akasol as an example, we show how a manufacturer of battery systems for commercial vehicles passes the impact analysis. It also shows why small and young companies tend to perform poorly in the common sustainability ratings and what Carnot Capital does to make the assessment realistic and fair.

"More show than sustainability" - this was another NZZ headline (NZZ of 28 May 2020 [2]). We are aware that the topic is often misused for marketing purposes and that the contents of sustainable investment vehicles do not always match the packaging. It is very important to us to counter this trend and to convince with good, well-founded research.

Carnot Impact Investing isn't surfing the green wave, but actively shapes Impact Investing.

Rolf Helbling

Andres Gujan

1 NZZ Neue Zürcher Zeitung, Plötzlich ist der Umweltschutz an der Wall Street wichtig, Nr. 179, Wednesday, August 5, 2020, p. 21.

2 NZZ Neue Zürcher Zeitung, Mehr Schein als Nachhaltigkeit, Nr. 122, Thursday, May 5, 2020, p. 21

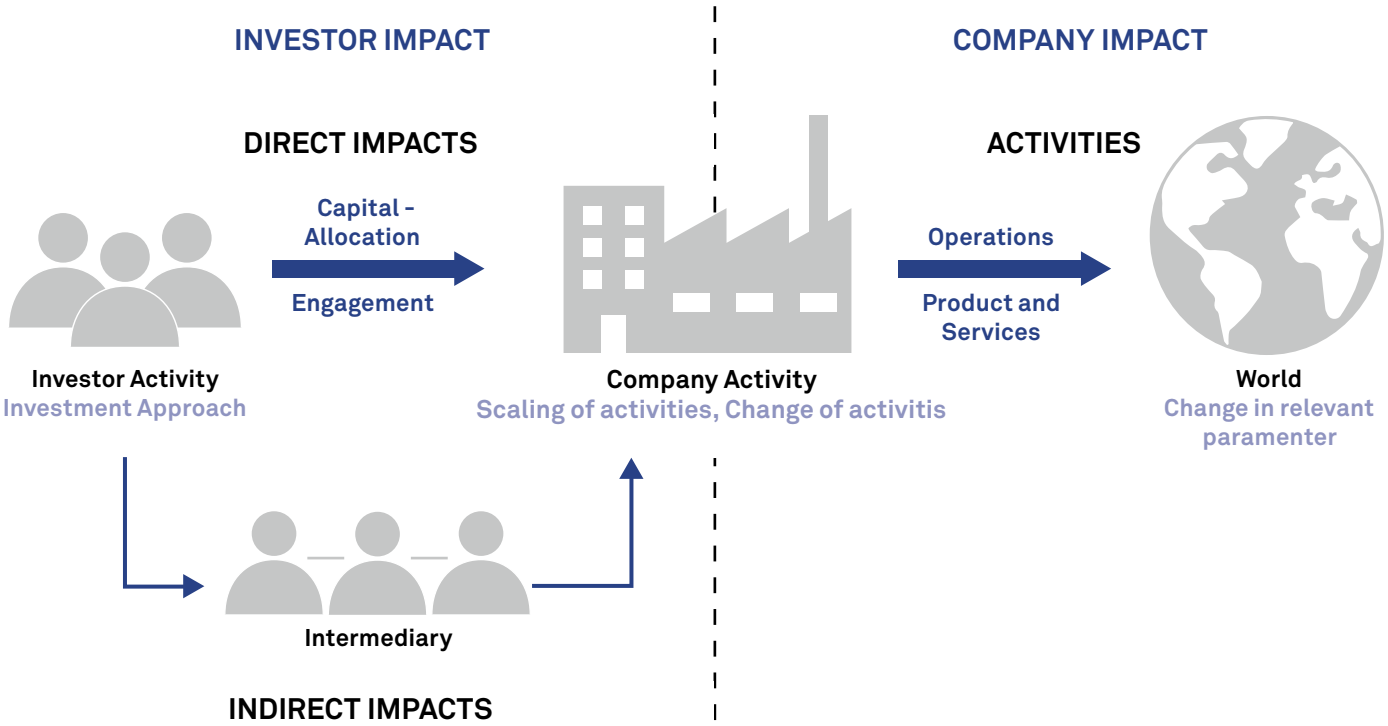
TABLE OF CONTENTS

1. OVERVIEW CARNOT IMPACT INVESTING

Impact Investing describes an investment behaviour with the goal of achieving an additional return in the form of ***social benefit in addition to the financial return.*** In Carnot Capital's approach, the reduction of resource and energy consumption is the central component for achieving the additional return. This approach is an ideal solution for two reasons: First, from an ecological perspective, unused resources provide maximum benefit. Secondly, investments in reducing consumption also pay off financially, as we have seen over the past thirteen years.

Carnot's approach addresses a growing need among investors not only to achieve a return on their financial investments but also to contribute to solving the most pressing problems of our time. An increasing number of publications shows that the topic has also been taken up by the scientific community. With the 'Center for Sustainable Finance and Private Wealth', the University of Zurich has a specialized institute that plays a leading role internationally. In a meta-study, the key findings on how investments can have a positive impact are summarized as follows:[3]

3 vgl. Julian F. Kölbel et al. (2020), Can sustainable investing save the world? Reviewing the mechanism of investor impact, p. 3 / ©Universität Zürich, Center for Sustainable Finance and Private Wealth (CSP)



The investor can create a positive impact through the allocation of capital and an active role as a shareholder. He has the greatest leverage through the impact of his company's products. Source: Prof. Julian Kölbel et al., Universität Zürich, 2020

- An investor achieves the greatest impact through active engagement.
- A verifiable impact is also achieved with the capital allocation, whereby the influence is significantly stronger for smaller companies.
- No significant impact can be achieved through indirect activities, e.g. through participation in relevant professional organizations.
- The effects of the company owned by the investor through its products and services are decisive.

The effects of a company on its surrounding environment (Company Impact) can be very large and are central from an investor's point of view, because investors are a co-owners and thus bear joint responsibility for the effects. Today, quantifying the impact is largely limited to ESG concepts and measurement systems. The carbon footprint, water consumption and the amount of waste produced are calculated for a large number of companies and receive a great deal of attention. But these values are limited to the operational activities of a company. Further effects such as the impact of products on the environment or research activities to solve the problems of civilisation can hardly be measured at present, neither conceptually nor quantitatively. Nevertheless, they are of eminent importance for investors with the need to know the effects of their investments in terms of a sustainable world.

The Carnot Impact Investing approach builds a ***bridge between investor, company and sustainability goals.*** Carnot uses a multi-stage assessment grid to determine the contribution of a financial investor to the UN's sustainable development goals. The present case study is intended to help make the individual steps for quantification transparent and comprehensible.

1.1 Reduce consumption by increasing efficiency

The Carnot approach focuses on ***reducing the consumption of natural resources.*** The focus is on products, technologies and services that conserve natural resources or use them more efficiently as factors of production..

An in-depth financial analysis is used to evaluate the return potential of an investment and to ensure that ***financial return is a priority.*** As a specialist in equities, Carnot relies on an active strategy. The portfolio managers combine a quality approach based on financial ratios with impact and sustainability analyses to create a ***"blended approach"***. In this way, financial added value is created in various ways:

a) Growth prospects: Companies that use their ***innovative strength*** and ***knowledge*** to preserve the climate or solve other ecological problems benefit from a structural increase in demand.

b) Risk reduction: Lower energy and resource consumption reduces the negative external effects and thus the risks.

1.2 Achieving Impact

We evaluate and document the impact of each portfolio position using a comprehensive test grid ***(impact questionnaire, part 1)***. We check, among other things, whether reducing the consumption of resources is part of the company strategy, what R&D expenditure the company is conducting, which products contribute to resource conservation, the share of sales, what benefits they bring in ecological and financial terms. We examine and record which sustainable development goals are influenced to what extent and map the results in aggregated form as a heat map[4].

1.3 Integral sustainability: More than ESG

The sustainability analysis is not only created by negative screening (exclusion lists, ***top-down)***, but is also qualitatively deepened several times over with positive screening (ESG rating, ***bottom-up)***. Since commercial databases only provide parts of the ESG data set, we contact the companies directly and collect the missing information with our ***ESG questionnaire (part 2).***

1.4 Engagement

If questions arise from the Carnot analysis, e.g. on corporate governance or suggestions for improvement, e.g. reporting on the company's impact, we use our contacts to the management level and address these ***engagement issues*** personally. As long-term shareholders with a good knowledge of the company, we find that we have an open ear. Our ***engagement questionnaire (part 3)*** illustrates this step of the process.

> ***"We invest in innovative companies with resource-saving technologies. We consider the financial return to be a prerequisite for sustainable positive impact. To determine the impact, we do not use databases, but expert knowledge and detailed work."***

1.5 Innovation

Abstaining from consumption (sufficiency) is the most obvious way to curb resource consumption. In practice, renunciation is not a realistic recipe and is not desirable, especially in less developed economies. A much more realistic approach is to use clever innovation to reduce resource consumption without sacrificing prosperity. The ***innovative ability of companies*** therefore plays a central role in our strategy. Technical progress focuses on the development of applications and customer-oriented solutions to reduce consumption and enables optimized use of energy and resources at economically low costs.

4 United Nations (2015), Sustainable Development Knowledge Platform, SDGs

The new technologies make it possible to conserve natural resources and use them more efficiently.

"The ability to innovate is a core element in our impact analysis of the companies."

1.5.1 How does Carnot find the technology leaders?

In the Carnot Impact investment process, the first step is to search the relevant industries for companies with efficient products and to subject them to an initial financial analysis. Return on capital employed (ROCE) has proven to be a good indicator of the company's technological leadership and the marketability of its products. Our broad industry network helps us get specific clarifications in a timely manner.

1.5.2 How can processes be improved?

A few examples will illustrate how significant efficiency improvements can be achieved with a manageable use of resources:

- Automation: Robot technology enables flexible, highly accurate manufacturing processes with less scrap and less infrastructure requirements thanks to maximum capacity utilization around the clock. The use of resources is reduced, and the production process has to be started up and shut down less frequently.

- Digitization (IoT): Internet-of-things technologies allow lower process costs through less manual intervention, less communication effort, shorter set-up times and easier information retrieval. Energy-consuming process steps are reduced to the required performance. Additional digitalized information improves product quality (compliance), provides transparency for process optimization and services, enables proof of origin and provides the basis for the development of new products.

- **Engineering:** In the planning phase, the parameters of buildings, products or projects are defined on the drawing board for the longer term. In the case of buildings, for example, a large proportion of future resource consumption is determined at the design stage.

1.5.3 What are innovation-friendly conditions?

Government regulations can promote entrepreneurial innovation and initiative if they are designed to be market-oriented and reliable.

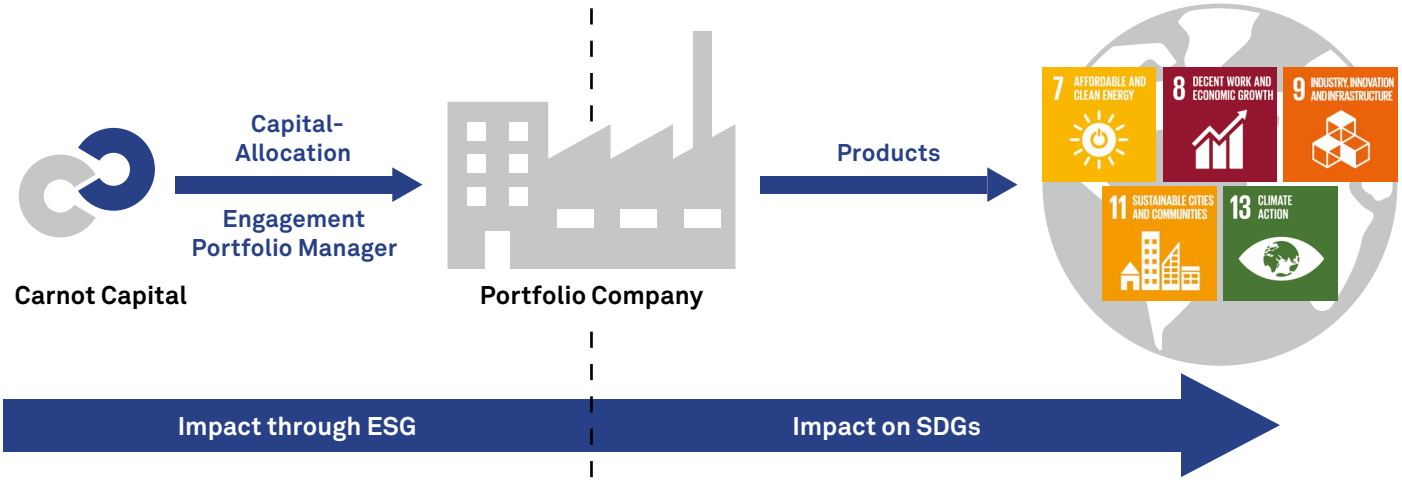
- **Regulation:** Government regulations and standards play an important role in the development of new products, services and projects because they influence the market and change costs and benefits. Innovation must pay off for the company within a defined period.

- **Taxes & Fees:** CO_2 tax and emission certificates mean an internalization of external effects and are accepted by companies if they are implemented across industries. As measures open to new technologies, they provide incentives for innovation and improve planning reliability.

- **Accountability:** corporations and the state itself are held accountable by their (young) citizens for compliance with environmental protection laws. In Canada, the Netherlands and other countries, corresponding legal proceedings have been successfully concluded.

"The increasingly ambitious climate targets mean great opportunities for innovative companies in the Carnot portfolio."

Impact beyond ESG



Carnot Impact Investing comprises a targeted allocation of capital to companies with positive effects as well as a commitment by the portfolio manager. Source: Carnot Capital

2. IMPACT AREAS

Since 2007, our investment process has been based on reducing the ***consumption of energy*** and resources. Our sustainability approach goes beyond selecting companies based on their sustainability profile. We seek out companies that use their ***innovative power*** to develop the products, technologies and services of tomorrow.

"Efficiency is defined as the effectiveness and profitability of a company. Technology leadership meets profitability!"

Efficiency basically generates a positive impact. Through our ESG analysis, we also make sure that no unacceptable negative effects arise in the value chain.

2.1 Climate Protection

Climate change is directly linked to the ***growth of energy production.*** On the one hand, this connection can be replaced by replacing fossil fuels with CO_2-neutral energy sources, and on the other hand, by using the available energy more efficiently.

More efficient use of energy is a very practical and profitable way to combat global warming. Carnot Impact Investing finds the most promising ways to

Starting Point to Emission Reduction in Switzerland

BUILDING TECHNOLOGY

The Swiss building park accounts for around 50% of energy consumption and 30% of CO_2 emissions.

TRANSPORT

Transport accounts for 36% of final energy consumption, 94% of which is covered by petroleum products.

INDUSTRIALS

The greatest potential lies in electric motors in industry and commerce, where almost 6 billion kWh are wasted.

Source: Swiss Federal Office of Energy, Carnot Capital

reduce consumption in the sub-themes of ***building services, transportation and industry:***

2.1.1 Better Building Quality

IBuildings in Switzerland consume around 50% of Switzerland's energy. 40% is accounted for by building operations, i.e. heating, hot water, ventilation, air conditioning, appliances, lighting, etc. The building sector is responsible for around 30% of Swiss CO_2 emissions:

a) Building exterior: The less heat escapes or penetrates into the building, the less energy is needed for heating or cooling. Therefore, ***good thermal insulation and a tight building envelope (windows)*** are the most effective energy-saving measures.

The preservation of our natural resources requires high investments in innovative technologies.

Electric, clean: Local train from Stadler Rail with fuel cell. Rail traffic is electrified with the help of overhead lines but also with batteries and fuel cells.

b) **Building technology:** In order to reduce the large energy losses of heating, ventilation and cooling, ***precise measurement of the indoor climate,*** minimum power consumption of the drives for all applications, prevention of circulation losses, intelligent use of drive and sensor technology, simplified installation and commissioning and the possibility of remote maintenance are required.

c) **Planning:** In general, the planning phase offers the ***opportunity*** to create the conditions for ***low energy consumption*** and simple ***building technology systems.***

2.1.2 Less Emissions in Traffic

Vehicles used for passenger and goods transport today use fossil fuel almost exclusively. A reduction of emissions can be achieved by:

a) **Fuel consumption reduction:** Emissions from combustion engines can be significantly reduced or avoided altogether. The focus is on reducing vehicle weight, higher engine efficiency, exhaust gas treatment and synthetic fuels such as ethanol, biodiesel or synthetic methane.

b) **Shift to rail and water:** With the expansion plans for the connections from the Asian region to Europe, rail transport is also becoming an alternative to air freight. The energy-efficient alternative to air freight in intercontinental traffic is sea transport.

c) **Electrification:** Vehicles with a battery or fuel cell can be operated emission-free if the electricity used for charging or hydrogen production is CO_2-neutral.

2.1.3 Energy Efficient Industry

Most industrial processes involve large energy flows for heating and cooling processes, electric motors, compressors, etc. Progress can be achieved through mechanics (e.g. heat exchangers), but the great potential is only realized through the possibilities of Industry 4.0.

a) **Process technology:** the coordination of the components among each other and the control of the entire system is effective. Therefore, automation and digitalization (including sensor technology and communication) are key technologies for improving energy efficiency in industry.

Exemplary buildings: Modern buildings control heating, ventilation and cooling in an intelligent way and integrate renewable energies, storage and the charging station for electric cars.

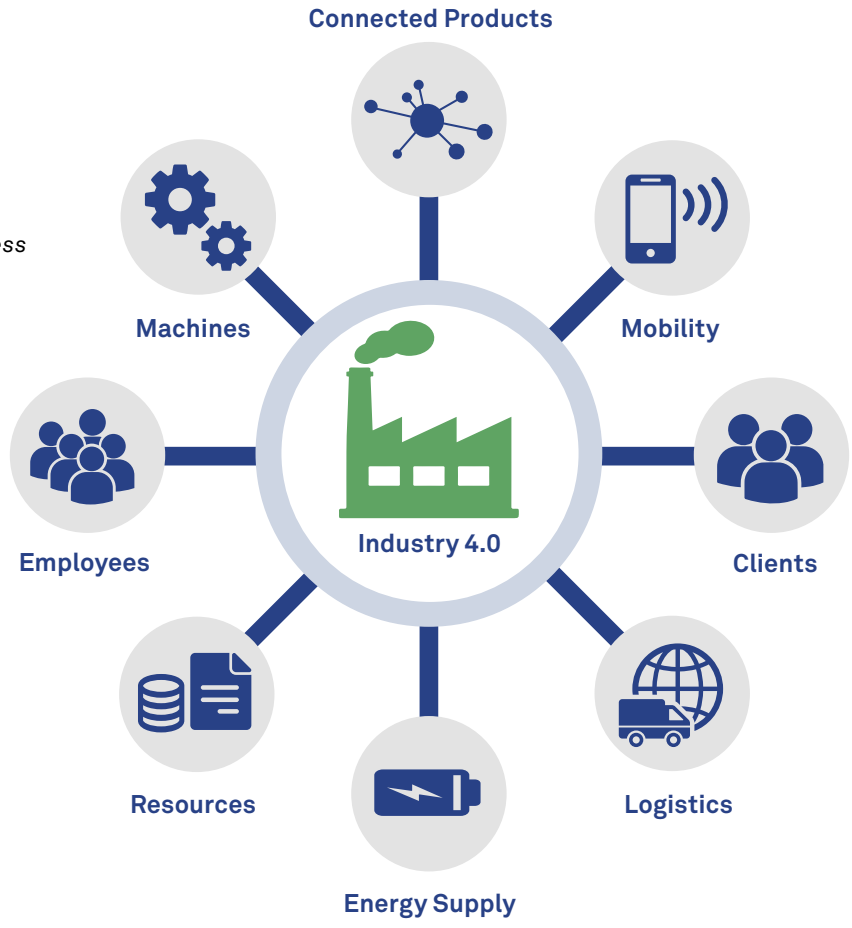
"Industry 4.0: It is not about capacity expansion, but about intelligent modernization."

b) Energy production: We also include technologies for the production of low-CO_2 energy in the industrial segment. Renewable energies belong to this segment just as much as energy generated from waste in combined heat and power plants.

c) Energy supply: *Supply and storage technologies* are an integral part of a low CO_2 energy supply. These include electricity transit and distribution technology including intelligent network management *(smart grid), smart metering, battery and charging technology.*

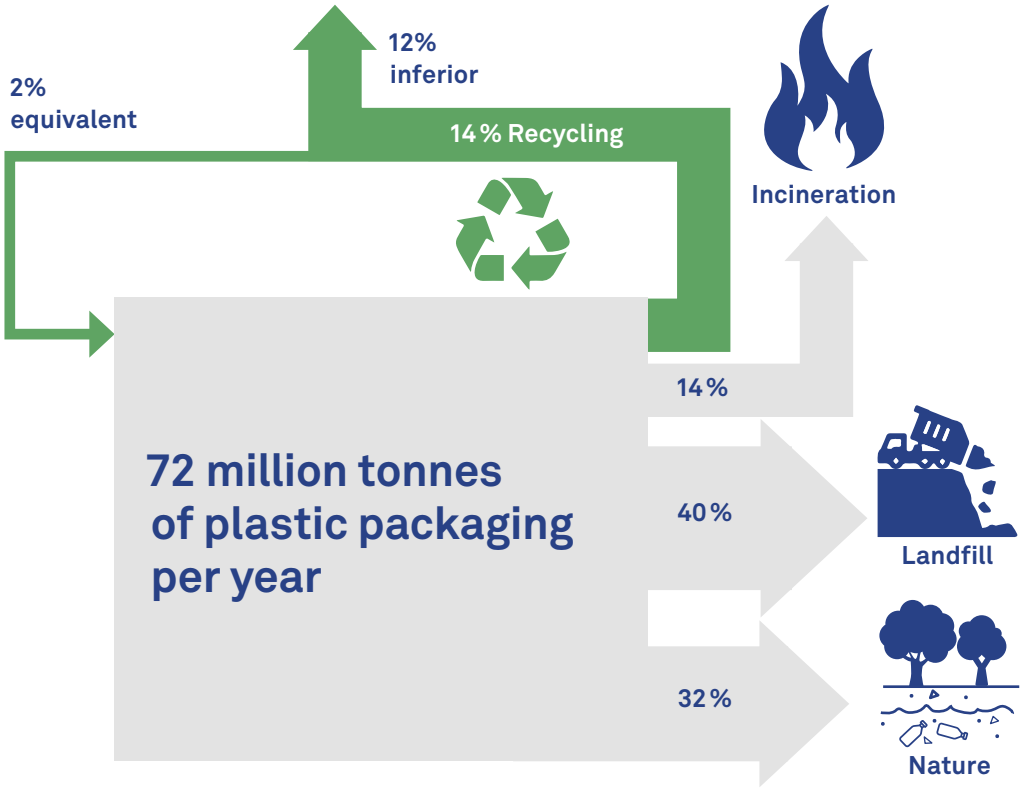
Industry 4.0

Sensor, communication and computer technology enable high efficiency gains in process technology.



Source www.serkem.de/industrie-4-0-produktion-vorteile-mehrwert/

Heading away from plastic packaging



The need for action and the potential for innovative solution providers are immense.

2.2 Circular Economy

The circular economy is the future of our children and grandchildren! "Disposable economy" relies on large quantities of cheap, easily accessible materials and energy. In contrast to this is the circular economy, in which raw materials and products are shared, leased, reused, repaired, reconditioned and recycled for as long as possible. The ***life cycle of materials is extended, and waste is reduced to a minimum.***

2.2.1 Structuring of Systems

a) Standardization of materials: The introduction of the refuse bag fee creates an economic incentive to avoid waste or to separate and recycle materials according to type. This applies to cellulose, glass, metals and last but not least plastics.

b) Involvement of the consumer goods industry: The commitment of the consumer goods industry is based on the ***polluter pays principle*** by internalizing external costs.

Investments in recycling are a huge opportunity to curb resource consumption.

Addressed Development Goals (SDGs), Ranked According to the Impact of the Carnot Efficient Energy Fund *

Climate Action

13.2 Include climate change measures in national policies, strategies and plans

Affordable and Clean Energy

7.2 Significantly increase the share of renewable energies in the energy mix.

7.3 By 2030, to double the worldwide rate of in-crease in energy efficiency

Industry, Innovation and Infrastructure

9.4 Modernize infrastructure, increase the use of clean and environmentally sound technologies and industrial processes.

Sustainable Cities and Communities

11.2 Enable access to safe, affordable, accessible and sustainable transport systems for all, through the development of public transport.

11.6 Reduce urban pollution, improve air quality, treat waste

Decent Work and Economic Growth

8.4 Move towards decoupling economic growth from environmental degradation

* Size of the symbols equal to the significance of the impact according to the heatmap

Source: Carnot Capital

2.3 Addressed Development Goals (SDGs)

Carnot Impact Mapping compares the reduction in consumption from the three Carnot areas, including sub-themes, with the substantive goals of the SDGs and links them if there is qualitative agreement. With the ***Carnot Impact Analysis questionnaires,*** the impact of the selected companies is assessed according to predefined criteria and recorded with a personal rating (0–3). In a ***Carnot Impact ranking list*** as well as Impact-Heatmap their quality and their contribution to the positive effects are disclosed.

"With efficiency you achieve impact!"

In the impact analysis, we examine the effect of the portfolio company and its products on the sustainable development goals, which are in the foreground due to the fund theme. The overview shows the 5 SDGs with the respective sub-goals, which are directly addressed by the energy efficiency fund Carnot Efficient Energy. ***Climate protection*** and ***clean energy*** (SDG 13 and 7) are in the foreground. Furthermore, there is a direct effect in favour of innovation, sustainable cities and environmentally sound economic growth.

2.2.2 Operation of Systems

a) **Collect and recycle plastic:** Despite all political efforts and regulations, the amount of plastic waste is expected to increase by up to 80% by 2030. But there is also good news: the recycling rate could simultaneously increase from the current 14% to up to 50%.

b) **Plastic packaging cycle:** Currently, only 14% of plastic packaging is recycled. The collection potential is immense and so is the chance to stop the senseless environmental pollution. Innovative companies like the Norwegian Tomra have excellent growth prospects in this area.

3.CASE STUDY: AKASOL

The eCitaro city bus from Mercedes is operated with battery systems from Akasol.

3.1 Electric Mobility for Commercial Vehicles

When people talk about electromobility, they usually mean electrified passenger cars, with or without hybrid drive. In the first half of 2020, sales of vehicles with electric drive systems increased, although car sales collapsed globally. In addition to regulatory measures, the variety of new models will further increase the market share of plug-in cars.

Rarely does the public discussion on mobility address the role of commercial vehicles. This is surprising, since the use of batteries in commercial vehicles is very promising. The spectrum ranges from

"The pace of electromobility is much faster than we have seen in the field of combustion engines. We must assume that there will be further technological leaps within two to three years."

Sven Schulz, CEO Akasol

trucks (especially for distribution transport) and buses to special vehicles and off-road applications such as agricultural and construction machinery.

Commercial vehicles are predestined ***for electrification in many cases.*** On the one hand, this is due to their use in cities, which react sensitively to exhaust and noise emissions. On the other hand, the usage patterns are more clearly defined. This makes it possible to calculate a clear energy and power requirement, which can be used to optimize energy storage and thus costs. The electrification of commercial vehicles is therefore ***already economical in many cases.***

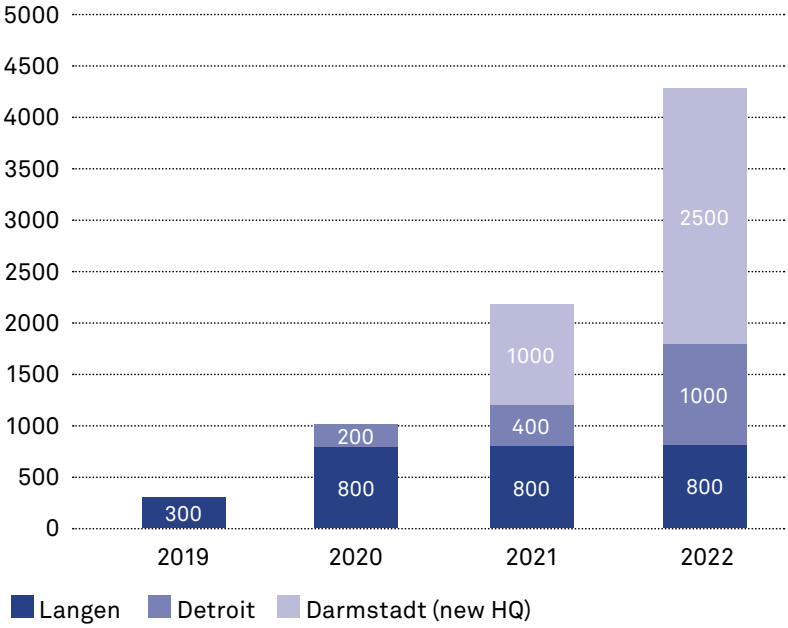
There are great opportunities in public transport. After the subway and streetcars, municipal bus companies are now preparing to electrify their fleets. Only a few cities have expanded overhead line networks, which is why the vast majority of bus networks are powered by fossil fuels.

The situation is more open today regarding trucks. The build-up of a charging infrastructure is more complex, the usage profiles are often less clearly defined. Different concepts are being tested. There are trials with overhead lines on the freeway, battery-powered delivery vans are being bought and the first transporters are acquiring vehicles with a fuel cell.

A large-scale trial in Switzerland is already well advanced: H2 Energy is currently commissioning the first badge of a total of 1000 Hyundai trucks powered by fuel cells. The necessary hydrogen will be produced in run-of-river power plants, which means 'green' hydrogen and an emission-free concept. The project is supported by the Swiss transport industry: It is financing a network of filling stations that is being built in Switzerland.

AKA battery systems from Akasol. A scalable battery solution for mobile and stationary applications. 39.5 kWh capacity, 365 kg weight.

Production Capacity 2019–2022 in MWh



Akasol is about to quadruple its battery production capacity within two years.

"Pinky" racing solar car, with which the Technical University of Darmstadt won the world championship title in 1990.

3.2 Key Technologies

3.2.1 Battery Cells

Progress in battery technology is crucial for the development of electromobility. Samsung, LG, Tesla and dozens of other companies and research institutes are investing large sums of money to improve battery performance. From an investor's point of view, we consider the cell manufacturing sector to be of little interest: capital intensity and risks are high, combined with innovation activity and new technologies, this creates an unfavourable environment for investors.

3.2.2 Battery Management Systems

Similar to the smartphone, charging and discharging the battery also plays a central role in vehicles. The challenges are on the one hand the development of heat and on the other hand the even stressing of all battery cells. Especially a quick charge of the battery endangers the life span considerably. ***Controlling the temperature and managing the charging*** and discharging process are therefore key technologies.

3.3 From solar mobile world champion to international technology leader

Akasol was created in the 1990s, when the first competitions with solar vehicles were held. The Technical University of Darmstadt - from which Akasol was later spun off – was able to assert itself against applicants such as Swatch and the ETH and won various titles.

In a subsequent phase, research efforts turned towards battery technology. Then it was decided not to enter into cell production but to concentrate on the battery system.

With the foundation of Akasol AG in 2008, the commercialization of the developed know-how began. The first battery modules were delivered in 2010, but it took Akasol until 2015 to receive the first serial order from a major bus manufacturer.

The IPO in 2018 introduced Akasol to the wider public. The company has invested the considerable inflow of funds from the IPO in the expansion of its production capacities. Currently (August 2020) Akasol has an annual battery production capacity of 800 MWh, which will be expanded to over 3,000 MWh by the end of 2022 – a 'Gigafactory' will be

Akasol: Impact Appraisal by Carnot

Climate Action	3 Significant
Affordable and Clean Energy	3 Significant
Industry, Innovation, Infrastructure	2 Substantial
Sustainable Cities and Communities	2 Substantial
Responsible Consumption and Production	1 Low Impact

built in both Europe (Darmstadt) and North America (Michigan)!

3.4 Impact Analysis

The idea of an efficient, environmentally friendly energy supply is part of the basic concept of Akasol's activities. We are pleased to note this, but we would like to see a more concise formulation in the strategy and are working towards an improvement.

Ever since its foundation, Akasol has invested heavily in the development of better and more efficient battery systems. In mid 2020, almost a ***third of the employees were working in research and development.*** The result of these major efforts is that the performance of the second generation of battery systems has been increased by 40%. The next generation, which is expected to be launched next year, will also bring improvements on a comparable scale.

The result of these efforts is that today a good 5,000 battery systems leave the production facilities every year and contribute directly to saving energy. According to the company, the ***estimated reduction in CO_2*** emissions compared to conventional drive systems is ***61%.***

The great leaps in innovation have already brought the total cost of electrically powered vehicles very close to the cost of vehicles with an internal combustion engine. Many cities and municipalities have begun to convert public transport to electric buses. By 2019, the share of electric local public transport buses already exceeded 10%. We expect this figure to rise to over 50% within 5 years.

The impact analysis shows that energy-efficient products account for 100% of sales. The products are used worldwide, therefore the positive impact reaches a significant amount of people. The ***R&D expenditure is very high at 7% of revenues.*** The applications of the new products have an estimated amortization period of five years. The sustainable development goals 7 (clean energy) and 13 (climate protection) are supported most strongly. Here we give the maximum mark 3, which means "very high impact". Although the electricity used to charge the batteries is undoubtedly associated with CO_2 emissions (Germany: still 40% coal and gas electricity). However, we appreciate Akasol's great development efforts and the continuous improvement of the electricity mix. We are fundamentally of the opinion that electric buses make a major contribution to resource-saving and clean mobility. We rate the impact on SDG number 9 (resilient, modern infrastructure) and SDG 11 (sustainable cities) as 2 "large". Akasol's products help to cope with urbanisation (subgoal 9.4), especially Akasol's stationary energy storage systems meet the goal of a modern, efficient and clean infrastructure (subgoal 9.2). In SDG 11, access to sustainable public transport is formulated in subgoal 11.2, which also justifies the attribution of a " impact. We rate the impact on SDG 8 (decent work and economic growth) as 1 "substantial" because the products – energy storage and supply - help to decouple economic growth and environmental destruction.

3.5 ESG Analysis

After the impact analysis, we take an in-depth look at the environmental and social aspects as well as corporate governance. We use a points system to ensure that there are no unacceptable risks in the portfolio in this respect. In this analysis, Akasol scores only mediocrely and reaches about 60% of the maximum points. What's the problem? Akasol is a young company which is in the middle of its expansion phase. In the coming years, the turnover is expected to multiply, which is a great challenge for a production company. The 'Corporate Center' has not been able to keep up with the rapid development and does not (yet) meet today's requirements.

There are no known incidents that indicate negative behavior with respect to ESG criteria. However, due to the scarcity of resources, a number of data necessary for a positive rating are missing, for example, there is no sustainability report. As a consequence, ***Akasol does not appear in any of the current sustainability lists.***

Following discussions with management, we believe there is a high likelihood that Akasol will report in more detail on ESG performance indicators in the foreseeable future. We expect this information to be positive in terms of sustainability. In comparable companies, improved transparency has had a positive effect on the share price performance in each case.

3.6 Engagement

Our investment philosophy includes an active exchange with the portfolio companies. In addition to financial and business management topics, these discussions include aspects of sustainability. We use a structured method (impact, ESG and engagement questionnaire) to identify possible starting points for improvement.

At Akasol we see ***considerable potential in the communication*** with investors. In the past, the company has oriented itself towards traditional financing concepts and has not yet emphasized aspects of sustainability enough. It is therefore not surprising that sustainability ratings do not correspond to the quality of the company, if a rating is available at all.

In the production of batteries, information on how the raw materials for the production of battery cells are produced is desirable. Proven efforts for a 'clean supply chain' would provide assurance that quality requirements are met at this level.

We are in an active exchange with the company to improve transparency in many ways. Simple and quick to implement are, for example, a more concise formulation of the strategy or the integration of important information in the annual report. Akasol's intention to provide precise information regarding the saving of fossil fuels and thus CO_2 is a positive sign for us. With the preparation of additional data, Akasol will attract new investors and we see good chances for a rising valuation.

3.7 Concrete potential for improvement – a practical example

Electric buses emit no local pollutants, unlike diesel buses. So out with the diesel, in with the electric bus? How big are the savings in practice?

A city bus covers an average of 220 km per day, which corresponds to 80,000 km per year. With a consumption of 50 litres of diesel per 100km and a CO_2 emission of 1000g/km (tank-to-wheel), this results in an annual diesel consumption of 40,000 litres and a CO_2 emissions of 80 tons per bus and year. In Europe alone there are more than a hundred thousand city buses in operation, which together emit several million tons of CO_2!

A comparable E-bus consumes 1.1 kWh/km, including heating and other 'additional services'. Extrapolated to the annual consumption, this results in an electricity consumption of 88'000 kWh (roughly equivalent to the electricity consumption of 20 households). In the German electricity mix (40% share of coal and gas), CO_2 emissions are 400g/kWh. With this value, the annual CO_2 emissions amount to 35 tons, corresponding to a ***saving of over 50%*** compared to a diesel bus. In Switzerland, with a high proportion of CO_2-free electricity production, the savings are significantly higher.

At the moment the range is still an obstacle to the widespread introduction of electric buses. 220km driving performance is possible with today's battery systems, longer deployments make intermediate charging necessary. In addition, the acquisition costs for an electric bus are even higher today. Technological developments mean that the performance and range of electric buses are rapidly increasing, and costs are falling. Especially in terms of maintenance and service life, electric buses are likely to be far ahead of diesel models in the future. Soon, electric buses will also take the leading position economically.

Based on Germany's electricity mix, electric buses reduce emissions by over 40%.

Battery Man shows that everyone, who takes batteries in for recycling, is a hero..

3.8 What happens with old batteries?

3.8.1 Negative Impact?

The question is justified since it is not guaranteed that the procurement of the necessary materials and the disposal of the products at the end of the life cycle do not cause substantial negative effects. These would have to be included in the impact analysis. We judge the negative impact as small, because the Akasol batteries are durable and will be completely recyclable at the end of their life cycle.

3.8.2 Reduce, Reuse, Recycle

The battery industry minimizes the negative effects according to the principles of the circular economy: Reduce, Reuse, Recycle. Reduce means continuously reducing the need for metals or increasing the energy density, i.e. storing more energy with the same amount of material. There are even batteries under development that do not require cobalt, which will significantly improve the environmental friendliness of the battery.

The Reuse principle is just as crucial: Firstly, the number of possible charging cycles until the charging capacity becomes insufficient. Akasol designs the batteries so that this point is only reached after 8 years. For a bus, this results in over 20,000 charge cycles, which is a multiple compared to passenger vehicle batteries. Secondly, discarded batteries are given a "second life": they are used as a buffer storage for solar energy. The demand for this is huge and a slightly reduced energy density is not relevant for stationary storage.

3.8.3 Battery Recycling

In 10 to 15 years recycling the Akasol batteries produced today will be a pressing issue. In today's standard process, the batteries are ground and melted. Lithium, graphite, aluminum and the electrolyte burn up in the process. The first plants are in operation which also recover these components. They shred the batteries under nitrogen confinement to prevent oxidation or crush them with electro-hydraulic shock waves in a water bath. In our opinion, it can be said that the batteries produced today are recyclable.

3.9 Akasol's Investment Case

The investment case is the second central pillar in the Carnot investment process. It is not the focus of this study, but we would like to address it nevertheless.

Akasol develops, produces and distributes high-performance batteries for a wide range of applications. Typical applications include local buses, commercial and rail vehicles, construction machinery and stationary energy storage systems. Akasol's technical know-how is based on close cooperation with the Technical University of Darmstadt. Since its separation from the university, the company has concentrated on developing customer-specific battery systems.

Akasol is already showing numerous successes on the road to commercialization. Comprehensive ***supply agreements with the leading bus manufacturers Daimler and Volvo*** or contracts with Hyundai for commercial vehicles and Alstom for rail vehicles have increased the order book to over EUR 2 billion.

Akasol is now faced with the task of building up the production capacity to fulfill the extensive contracts and to complete them without major mishaps. At present, three lines with a maximum annual capacity of 800 MWh are already in operation in Germany. This is enough to equip around 2000 buses with battery systems. These lines were set up without major problems, which is positive for

further expansion: In the next two years, capacity is expected to increase to over 3,000 MWh per year.

We expect Akasol to achieve a turnover of EUR 65 million in the current year and thus an operating profit in the second half of the year. In the next two years, the turnover is expected to ***double in each case.*** With a margin approaching the double-digit range and stable investments for further expansion, we expect a balanced cash flow towards the end of 2022.

Akasol is not a typical Carnot investment because it will take some time for the company to generate a positive cash flow. In the end, three factors convinced us to invest despite this "flaw":

1. **Akasol has the technical expertise and development capacity to become the leading supplier of battery systems for electromobility.**

2. **The electrification of commercial vehicles represents an attractive, rapidly growing market.**

3. **Sven Schulz has contributed significantly to the development of the company since its foundation and has been managing the company since 2018. At the same time, he is the major (minority) shareholder together with the Schulz Group.**

With the investment in Akasol we have the opportunity to participate in a strongly growing market with the leading company.

POUCH CELL / POC

- Format options
- Chemistry options

PRISMATIC CELL / PRC

- VDA format options
- BEV, PHEV chemistry

CYLINDRICAL CELL / CYC

- 18650, 21700 format
- Chemistry options

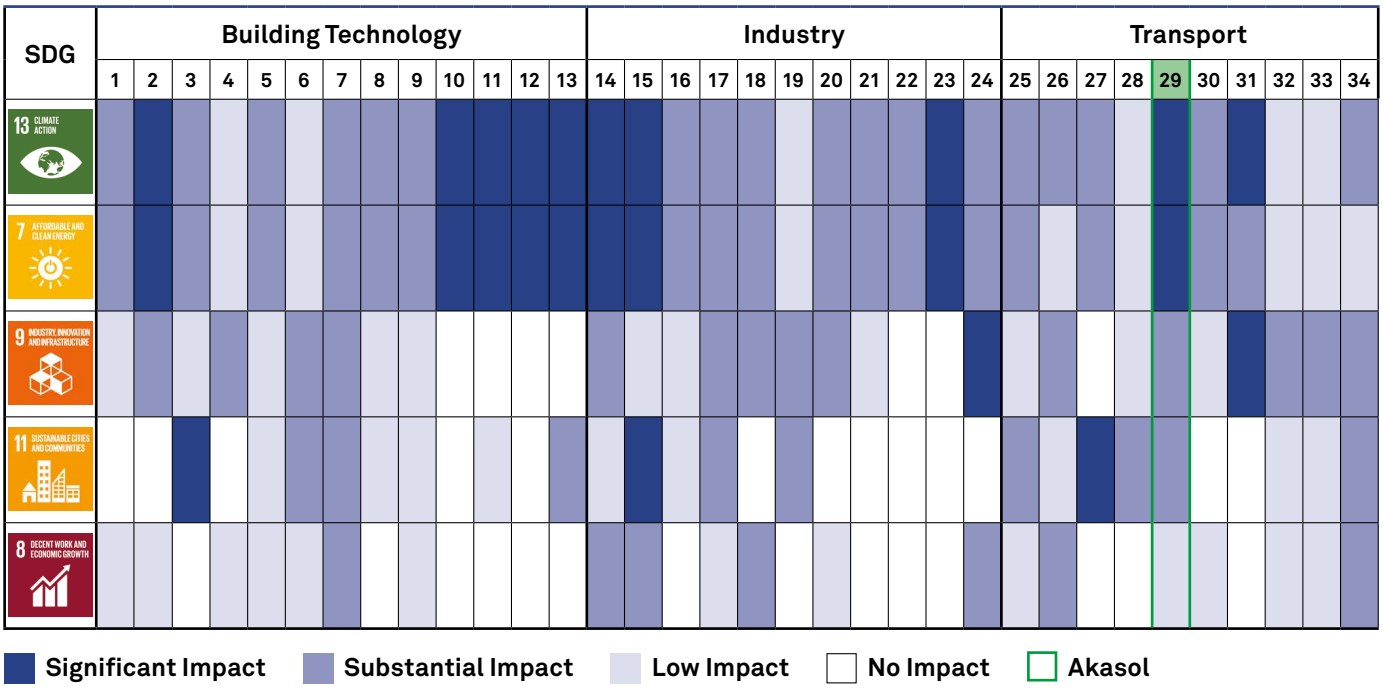
Just as important as the battery cell is the design of the battery and the battery management system, which is crucial for charging time, temperature management and battery life.

4. CONCLUSION

4.1 Overview of the Impact

Akasol fits perfectly into the portfolio of the Carnot Efficient Energy Fund. Like many other companies, the company achieves a very large impact with its products in terms of the sustainable development goals “climate action” (No. 13) and “affordable and clean energy” (No. 7). The following diagram (“heat map”) shows the impact of the 34 portfolio companies at a glance, broken down by SDG. The extent of the impact ranges from dark blue (very large) to white, where we could not determine a significant impact.

Portfolio Companies of the Carnot Efficient Energy Fund at a Glance



Akasol is nr. 29 in the heatmap. Further examples from the industrial and transport sectors include Rotork (UK) in column 24 and Ems Chemie in column 25.

4.2 “Double Bottom Line”: Financial Return and Impact

✓ Impact Investing is not a matter of pure philanthropy, which prioritizes impact at the expense of return. A social-ecological self-image can be combined without contradiction with a profit-oriented investment policy. Sustainable investing is an instrument of risk management and is used specifically to increase performance. Meanwhile it can be statistically proven that investing sustainably does not mean having to forego returns (see Carnot Efficient Energy Fund).

a) Profitability

✓ The development of more efficient products, services, processes and activities leads to a reduction in consumption that makes the use of resources sustainable (= efficiency increase). The demand for these products and services increases and helps companies to increase their sales and profits.

Revenues with Impact Products	31/12/2019	31/12/2018
Impact products* revenue per CHF 1 million investment amount	CHF 515,000	CHF 451,000
As % of total sales revenue of the portfolio companies	68 %	58 %

*pure environmental Impact

✓ The internal application of the consumption reduction measures improves the performance parameters of the company itself, which also has a positive effect on the financial return.

b) Positive social & environmental effects

By supporting sustainable enterprises an additional income can be expected:

✓ Companies that operate sustainably can deal with risks better, because what is measured is also managed. More ecological processes reduce environmental risks, and social criteria and governance standards minimize reputational risks.

✓ There are positive social and ecological effects in both the short and long term. For example, reducing energy consumption improves air quality in the short term. In the long term, it makes economic growth environmentally compatible and helps to counteract climate change.

c) Portfolio share of impactful companies

The focus on energy efficiency means that all positions have a positive ecological impact (excluding the cash component).

d) Share of revenue with Impact products

In our impact questionnaire we determine the impact-relevant revenue. On average, portfolio companies generate around half of their sales with products, services and projects with a positive impact (see table for details). A fund investment of CHF 1 million accounts for approximately CHF 0.5 million of sales with a positive environmental impact. Part of this turnover also has a social impact, as shown above (SDGs 9.4 and 11.2); however, we do not determine the exact turnover figure.

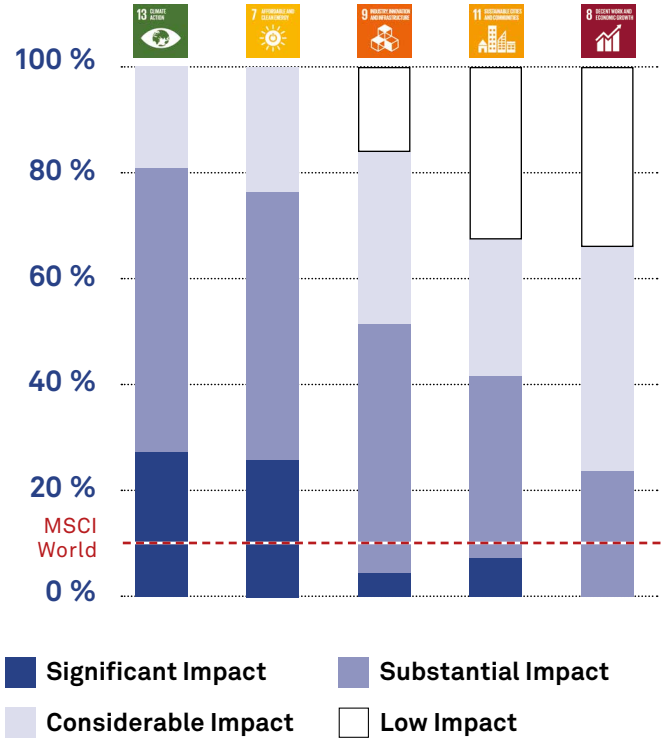
Energy and Resource Efficiency: Double Bottom Line

* See Edward Freeman: Strategic Management, A Stakeholder Approach (1984)

Portfolio Share with Impact, as of 31/12/2019

Carnot Efficient Energy	**100 %**
Benchmark MSCI World*	< 10 %
Portfolio share with environmental impact	**100 %**

Climate Action	**100 %**
Affordable and Clean Energy	**100 %**
Industry, Innovation, Infrastructure	**86,7 %**
Sustainable Cities and Communities	**67,5 %**
Responsible Consumption and Production	**67,3 %**



* Quelle: yourSRI/MSCI

4.3 Outlook

The integration of Impact into the investment process is highly dynamic. Today, the discussion revolves more and more around the question of how the investment result can be improved by taking impact into account rather than whether these aspects should be considered at all. Here, the financial markets are at the beginning of a development that will go through a process of maturity - in the spirit of "A start has been made, but there is still a long way to go".

Everyone is affected by the changed environment. Many investors are focusing their analysis on the risks and are trying to reduce them by using exclusion criteria. More and more frequently and quite rightly, however, the opportunities that arise are coming to the foreground. Changing conditions lead to new products and services with huge potential - Impact as a business model!

In our daily work, we can see that these opportunities are also increasingly being evaluated by the capital market. Ten years ago, sustainable companies were still traded at a discount due to supposedly reduced profit prospects. Today, a premium seems to be forming for companies that can curb climate change and resource consumption.

We hope that this study has given you an exciting and valuable insight. We look forward to your feedback and further discussions!

Contact and Feedback:
Dominique Sekyra
dominique.sekyra@carnotcapital.com
+41 43 299 62 30

5. WHO IS CARNOT CAPITAL?

Carnot Capital is an investment management company, specialized in energy and resource efficiency. The company was founded in Zurich in 2007 and received the permission as an asset manager for collective investments by the Swiss Financial Markets Supervisory Authority FINMA in 2013. Carnot Capital manages the equity impact funds Carnot Efficient Energy and Carnot Efficient Resources investing in listed companies with products and technologies that lower the consumption of energy and natural resources. Due to rising scarcity and increasing environmental problems these companies benefit from structural growth. Investments comply with sustainability standards (ESG). Stocks are selected based on a value approach which sets the quality of the company into the centre, particularly profitability and the stregth of the balance sheet.

Carnot Impact Investing is a blended approach which differentiates itself through the combination of financial as well as social-ecological performance criteria and the documentation of the positive effects of the companies (impact from ESG & SDG mapping).

The name Carnot Capital refers to the French physicist Nicolas Léonard Sadi Carnot (1796–1834) who was able to define the maximum physical efficiency of a steam engine. Improving energy efficiency is nothing more than increasing the level of efficiency when converting primary energy to useful energy. To a certain extent, we relate maximizing the degree of efficiency to our investment activities, applying strict risk-return criteria. And that's why our creed is: Investments featuring a maximum degree of efficiency.

www.carnotcapital.com

Research Paper

Investments into Energy and Resource Efficiency with a Measurable Impact
By Dr. Andreas Walther, Chief Impact Officer

> https://www.carnotcapital.com/_pdf/dokumente/Carnot_Capital_Research_Paper_Impact_Investing_in_Public_Equities_EN.pdf

CARNOT CAPITAL

Carnot Capital AG
Schaffhauserstrasse 418 · 8050 Zürich · Switzerland · T +41 43 299 62 30
info@carnotcapital.com · www.carnotcapital.com