» Climate Partnerships with the Private Sector

A programme carried out on behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) | Report on phase 1 (2010-2015)

Supported by:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

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KFW DEG

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1 | About the programme

The programme Climate Partnerships with the Private Sector (CPPS) is implemented by DEG – Deutsche Investitions- und Entwicklungsgesellschaft mbH, which finances investments of private companies in developing and emerging economies, on behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). The first programme phase ran from 2010-2015.

The programme has two main aims: (1) Afford the German private sector the opportunity to contribute to climate protection efforts in developing countries and emerging markets. (2) Leverage private sector investment flows as an engine for growth, with the goal of fostering an ecologically sustainable development process in the target countries – and thus contribute to the establishment of a global clean energy economy.

The programme focuses on strengthening technology and knowledge transfer for climate-friendly technologies. Financial support is extended to private sector companies in various development related funding areas. In order to be funded, a given project has to either demonstrate climate-friendly technologies, promote the introduction and dissemination of innovative climate protection technologies or adapt proven carbon emissions reduction technologies to the specific conditions in the target countries and in doing so help establish structures that will promote the use of ecologically sustainable energy.

The Climate Partnerships with the Private Sector programme is funded as part of the BMUB's International Climate Initiative (IKI) – which, since its inception in 2008, has been funding climate protection and biodiversity projects in developing countries, emerging markets and transition countries. Having been initially funded by auctioning emission allowances, the IKI is now funded from the BMUB budget.

As one of the largest European development finance institutions, DEG, a subsidiary of KfW promotes entrepreneurial initiatives in developing and emerging economies, with the aim of fostering ecologically sustainable growth and improved living conditions for local populations.

To this end, DEG has been structuring and financing private sector investments for more than 50 years. Within the framework of the BMUB-funded CPPS program, DEG has supported 15 Climate Partnerships on four continents since the programme's inception in 2010.

This report discusses all 15 of these partnerships and their outcomes.

German and European companies are eligible to participate in the programme, either on their own or in co-operation with local companies. Participating businesses need to possess the financial wherewithal to ensure the economic viability and sustainability of the envisaged project – and thus need to meet the following criteria in order to be funded:

- Annual turnover of at least €1 million
- A staff numbering at least ten
- In operation for at least the three years

The following additional funding criteria apply as well:

- In order for a project to be funded it cannot be an undertaking that is prescribed by law; nor can the project already have gotten underway.
- Funding can only be provided if the company in question would not implement the project without this public support.

Although all countries on the OECD-DAC list are possible project countries, preference is given to projects in emerging markets. The programme provides funding of up to € 200,000. The partner company, which is required to fund at least 50% of total project costs, is responsible for the project in terms of finance, content and personnel. Project proposals may be submitted to DEG at any time.

2 | Outcomes

2.1 | Introduction

The 15 projects described here spanned various funding areas and varied in terms of target groups, and the focus/scope of their measures. Some projects were particularly innovative, whereas the approach adopted by others lends itself to replication or to engendering a far reaching multiplier effect. The outcome of virtually all of the projects was a needs-oriented, economically efficient climate protection effect – one that is compatible with the goal of helping the target countries to leverage their energy saving potential more effectively, in the face of rising greenhouse gas emissions.

One focus area was energy efficiency, mainly in India's manufacturing sector. Six pilot projects addressed this issue through the use of climate friendly technologies that are virtually unknown in India. Demonstrating these solutions at local companies helped to identify major energy saving potential. The broad range of approaches adopted here included the following: implementing heat recovery systems and designing a ecologically sustainable model factory for the Indian textile industry; implementing energy-efficient drive solutions such as synchronous motors, regenerative frequency inverters and electronic drive control units; combustion plant renovation; and using modern technology to improve power grid quality.

The climate protection initiative CPI2 was founded by a consortium of eight large German retailers and created an assessment instrument for both trading and manufacturing companies. This instrument allows for the measurement of climate protection performance of local footwear and textile manufacturers, and the results pinpoint alternative ways to cut energy consumption. The CPI2 online tool, launched in four target countries as part of the programme, is being used today by more than 500 manufacturers in 18 countries, and could potentially become an internationally recognised standard for measuring and curbing carbon emissions.

Another focus area was renewable energy and resource protection mainly in South Africa. For instance the energy consumption of a pilot winery was reduced by 70% through the use of highly efficient process controlled irrigation pumps, which were adapted to the local context. Further approaches included the implementation of an innovative wastewater treatment system using solar water collectors, for optimised resource management, the launch of a resource and climate protection network and the establishment of a training centre by Sunfarming GmbH, known today beyond the country's borders for sustainable, broad-scale know-how transfer in the solar power sector.

A project realised by a German-Brazilian consortium (headed by MVV Decon GmbH) aimed to demonstrate that renewable energies are both ecologically sustainable and economically efficient. Following an extensive feasibility study, a pilot biogas power plant was built in which animal dung is being used as a substrate. Commissioned in February 2014, the facility became the first Brazilian biogas project to be implemented using German technology.

In Bosnia and Herzegovina, Fella Maschinenbau GmbH identified potential for small hydropower projects and raised awareness among the local population of the benefits of this ecologically sustainable technology.

In Kazakhstan, Petroline GmbH built a model home to illustrate the benefits of efficient energy and resource use. The company also established an external training centre in collaboration with a local university, for the purpose of strengthening expertise and local capacities in the construction sector.

All 15 Climate Partnerships serve as models in their particular contexts in that they either conserve resources or generate ecologically sustainable energy – and thus have the potential to reduce carbon emissions in the target countries, through dissemination and implementation of the technologies in question.

The pilot projects alone have already saved several thousand tonnes of carbon emissions annually; and if the technologies in question are successfully commercialised, the carbon reduction potential estimated by the companies far exceeds an annual total of 18 million tonnes of CO_2.

2.2 | Experiences of partner companies

The results of a brief survey that was conducted by DEG shed light on the following: (a) problems that frequently arose in implementing innovative technology in the target countries; (b) key factors for successful implementation of a climate partnership; and (c) the economic potential that can be derived from such partnerships. These findings formed the basis for providing recommendations, mainly concerning optimisation of the program.

Challenges "Time plays a different role in India"[1]

Certain challenges arise in connection with private sector technology transfer for the introduction and dissemination of innovative climate protection technologies in developing countries and emerging economies. The survey revealed reservations and scepticism in a number of target countries in regard to previously unknown climate protection technologies. The survey showed that people in the target countries tend to be sceptical about novel technological approaches until the technology provider demonstrated the economic efficiency at the local level.

"The local people had all kinds of preconceived ideas about the project. So we had to supply them with a great deal of information about it."[2]

It is often also necessary to convince local authorities about the need for climate protection technologies, which are regarded as unproven, and to overcome bureaucratic hurdles. The bureaucracy at government agencies and training institutions turns out to be cumbersome in practice – and this, combined with intercultural barriers, often leads to unexpected delays and at times requires staying power.

In addition to the lack of experience with new technologies, some local training institutions lack hands-on experience. As a result, many partner companies were forced to deal with a lack of training and skills at academic institutions, and among the employees of local implementing agencies and pilot companies.

Some partner companies faced a reluctance to invest at the local level. Owing to an absence of, or poorly defined, environmental standards and emission limits, many local companies are under no obligation to subject themselves to what appear at first glance to be unappealing, and initially high-cost modernisation measures.

Also, many developing countries and emerging economies lack government incentive systems aimed at promoting climate protection. Final decisions concerning the purchase of innovative technologies tended not to be made until economic efficiency had been demonstrated: "Business potential increased notably after feasibility had been proven. Potential customers observed what we were doing during the entire construction phase; and after successfully completing it we received a number of inquiries."[3]

Success factors "The project paved the way for heading in the right direction"[4]

A success factor, which initially seems obvious, but is frequently underestimated is careful project planning. One key element entails thorough investigation of local conditions which may pose unfamiliar challenges for successful project implementation.

Requirements specific to a given location may be ascribable to geographical conditions, bureaucratic hurdles, legal provisions or cultural differences in terms of business practices. Hence the pivotal success factors are as follows:

- Setting clearly defined aims and strategies in terms of market orientation.
- Selecting a project location wisely.
- Realistically calculating the amount of time needed for the project.

Taking local conditions into account is particularly important as regards the introduction and dissemination of ecologically sustainable technologies. Technologies based on German standards need to be tailored to local weather conditions, as well as the outdated technology often found at local pilot companies, so as to ensure existing potential is tapped to the full. "The various standards that come into play and the necessary adjustments to technology arising from this definitely pose a problem."[5]

How often and for how long partner companies and project leaders remain on site proved to be a further key factor for project success. A local organisation with the necessary capacities (assured by a subsidiary or the regular presence of project managers), and thus direct support on the ground, is vital when it comes to the capacity to expeditiously respond and make any necessary changes or adjustments in critical situations. Contact persons endowed with the necessary skill sets within the local organisation, as well as continuous exchange with local staff, have also proven to be indispensable – particularly when it comes to creating networks that will form the basis for long term engagement in the target country.

"The number one success factor is motivated local staff. Without their groundwork, our project wouldn't have worked. Contact with state institutions, universities and potential customers can only be realised through colleagues on the ground."[6]

In light of the lack of qualified staff in developing countries and emerging markets, selection, ongoing involvement and extensive training of local implementing partners and pilot companies have proven to be a key success factor.

"Catering to an ongoing need for both information and training lays the groundwork for the deployment of modern technologies."[7] Creating reliable platforms that allow for a qualified transfer of knowledge, especially in projects that focus primarily on training, such as the Petroline and Sunfarming project, is of

key importance for the projects' success: "If you simply want to sell technology in the target countries – that doesn't go down well. Efforts made on the ground are expected and appreciated."[8]

Further success factors in this context are carrying out large scale public information events and having the relevant project materials translated into the local language. Such measures help to foster the required acceptance and wide-ranging impact and open people's minds to new and unfamiliar technologies – and thus pave the way for successful penetration of the target market.

Business potential and leveraging effects

"The climate partnership was an ideal programme for our company to tap the huge market potential."[9]

The tremendous potential for efficient energy use in developing countries and emerging markets, and the ever louder call from the international community to implement climate protection measures are factors that translate into significant business potential when it comes to using innovative and ecologically sustainable technologies. The Climate Partnership programme aims at supporting companies, who whish to exploit theses potential. The programme's promotional measures provide companies with support to minimise risks, and both facilitate and expedite access to new markets.

"The advantages for small and medium-sized enterprises are obvious. Access to high-potential markets albeit with at times, inadequately trained staff, can be successfully achieved through a Climate Partnership."[10]

The programme helps companies to implement sustainable measures that facilitate market entry and at the same time generate positive environmental impact beyond the companies' core business.

Project visibility has been enhanced by involving local multipliers, strengthening local capacities, and setting up high-profile technology transfers. This in turn enables such transfers to engender leveraging effects and promotes the commercialisation of climate friendly technologies in the target countries.

"In India the co-operation enabled us to make numerous contacts with state organisations and potential industrial customers. In doing so, we promoted our brand much more extensively and managed to improve the technical know-how of our local staff. This in turn helped us to gain a number of new customers – including during the project phase itself. Modernisation of a reference facility can be particularly helpful when it comes to laying the groundwork for generating new business."[11]

Two-thirds of the partner companies plan to extend their activities to other neighbouring and emerging market countries, in addition to continuing their commitment in their current target country. Over 70% of the partner companies indicated in the survey that carrying out their project enhanced the business potential of their technology in the target country.

"The business trend is very positive. The value of the orders we have received thanks to the project now runs into the millions, and additional orders are in the pipeline. [...] Without the project it would have been a fraction of that."[12]

Lessons learned

Each of the 15 partner companies that were surveyed indicated that the Climate Partnerships with the Private Sector programme is extremely helpful when it comes to durably opening up new markets for innovative technical solutions and that they would gladly enter into such a partnership again.

The main factors for successfully implementing ecologically sustainable technology identified in the survey of partner companies are consistent with the programme's defined indicators. Existing business potential is sustainably exploited and supported via large scale capacity building, technology transfers, and know-how tailored to local requirements.

Both of the aforesaid challenges faced by the partner companies, and the key factors identified for successful project implementation, have engendered recommendations for realisation and possible optimisation of the CPPS programme. In view of the project implementation delays, which in many cases were attributable to unforeseeable political, technical or organisational conditions in the target countries, partners need to carefully assess local conditions and factor ample "buffer" time into their project implementation schedules. Partners need support in this regard, and need to be informed concerning local conditions prior to project implementation.

It is also advisable to identify instruments that promote the establishment of networks and thus help create synergy. Within this context it would be conceivable to establish a network of partner companies from the programme's current and new projects to enable a topic-related or locally specific exchange of experience, as well as a network of partner companies with other current development cooperation projects and initiatives.

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[1] Climate Partnerships with the Private Sector Attendee, November 2014
[2] Fella Maschinenbau GmbH, Survey November 2014
[3] Petroline GmbH, Survey November 2014
[4] Climate Partnerships with the Private Sector Attendee, November 2014
[5] Sunfarming GmbH, Survey November 2014
[6] Saacke GmbH, Survey November 2014
[7] Brückner Trockentechnik GmbH & Co. KG, Survey November 2014
[8] Petroline GmbH, Survey November 2014
[9] Climate Partnerships with the Private Sector Attendee, November 2014
[10] Sunfarming GmbH, Survey November 2014
[11] Saacke GmbH, Survey November 2014
[12] Petroline GmbH, Survey November 2014

3 | The projects


otto group


BRÜCKNER


TEXTILMASCHINEN
Thies


HANNING
ELEKTRO-WERKE


KIMO®
Antriebstechnik


SAACKE


modl
Intelligente System-Lösungen


WIKA


ÖKO THERM®
Biomasse-Heizanlagen


wilo


mic
The Venture Platform


SUNFARMING
GmbH


MVV
decon


FELLA
MASCHINENBAU
DIVE Turbinen


PETROLINE GmbH
Berliner Allee 3 • 30855 Langenhagen

3.1 | CPI2: Carbon Performance Improvement Initiative, supra-regional (Bangladesh, China, India and Turkey) – Otto GmbH & Co. KG

Nowadays, the vast majority of consumer goods such as clothing and footwear are manufactured in developing countries and emerging economies. Inefficient production processes, combined with a lack of awareness of the carbon footprints entailed by the various manufacturing phases directly result in high carbon emissions.

There is vast untapped potential for the realisation of major greenhouse gas emission reductions, with relatively little effort. Retailers that purchase goods from sourcing markets can provide impetus and act as multipliers for a clean energy economy, by having their manufacturers and suppliers implement ecologically sustainable practices – and ensuring that these measures are enforced.

To this end, a consortium of eight major German retailers headed by the Otto Group has launched what is known as the Carbon Performance Improvement Initiative (CPI2). It aims to develop and establish an instrument for determining and assessing the climate protection performance of suppliers in developing countries and emerging markets – and using this as a basis, demonstrating ways to cut energy consumption.

This will allow potential for greenhouse gas reductions in the supply chain to be exploited, and will at the same time set in motion a process of continuous optimisation.

The user friendly and practical CPI2 online tool for clothing and footwear manufacturers was established during the project. After compiling information concerning the existing situation, the tool makes recommendations for targeted energy saving measures. Supplemented by instructions, investment cost and amortisation information, calculation tools, and various motivating case studies, the tool encompasses some 256 energy saving measures. It is available in English, Bengali, Chinese, Turkish and Tamil and underwent trials in the target countries during the project at 20 suppliers in the clothing and footwear sectors. Workshops were also held where users could familiarize themselves with the tool, and case studies were compiled on the climate performance of selected suppliers.

"The Tool is easy to use and showed us how to operate more efficiently. We have already achieved significant savings on our energy bill."[13]

The online tool was showcased at various trade fairs and sector events to boost visibility – and has thus helped to establish the CPI2 tool as a recognised industry standard for climate protection efforts.

A reliable assessment tool has been created for clothing and footwear manufacturers. This tool can play an important role in formulating purchasing criteria, promoting competition in the buying markets for ecologically sustainable manufacturing processes. In the meantime (as at December 2014) 19 major retailers have joined the initiative and over 500 manufacturers in 18 countries use the tool.

"CPI2 sends a clear signal from retailers about significantly lowering greenhouse gas emissions in the global supply chain. It offers a framework for joint realisation of the resources necessary to fight climate change and ways to address the need to catch up."[14]

[13] Managing director of a textile factory in Bangladesh
[14] Jochen Flasbarth, State Secretary BMUB (Translated from German)

otto group

Private sector partner:	Otto GmbH & Co. KG
Total project cost:	€ 494,000
BMUB funding:	€ 198,000
Duration:	12/2011–03/2013
Website:	www.cpi2.org
Pilot project:	Developing an online tool for assessing climate performance in nine energy-related areas such as process management, compressed air, processing heat, electricity supply, drying and engines. The tool was piloted at 20 textile and footwear manufacturers in China and Bangladesh.
Local/international implementing partner:	• Systain Consulting GmbH • Additional founding members of the CPI2 Initiative: Reno, Tchibo, Tom Tailor, HSE24, KiK, s. Oliver, QVC
Training and capacity building:	• Three workshops for 75 producers/suppliers with a total of 141 attendees
Awareness raising measures:	• Project presented at the DTB (Dialogue Textile Clothing) trade fair • Project presented at various industry events such as the 12th German retail convention, the German retail association convention etc.
Co-operation with local multipliers:	None
Publications and informational material:	• Online tool encompassing 256 energy saving measures for determining and assessing manufacturer performance (with a bronze, silver and gold rating) as regards their carbon footprint, including recommendations for action, information on investment costs and amortisation, and calculation tools • Marketing flyers • Press releases
Energy efficiency and carbon emission reduction measures at pilot companies:	Potential for saving an annual average of 50–100 tonnes of carbon emissions per manufacturer, via simple, cost-effective improvements
Potential for saving energy and reducing carbon emissions following market penetration:	Potential carbon emission reductions amounting to 10 million tonnes
Partner performance during project and outlook for the future:	• The Carbon Performance Improvement Initiative (CPI2) was registered as a trade association and as a limited liability company during the project implementation phase in 2013 • Addition of the water and chemicals domain to the online CPI2 tool • Approximately 500 producers/suppliers were using the online tool, as at Dec. 2014

3.2 | InMoWin: Innovative, mobile heat recovery system for the textile industry, India – Brückner Trockentechnik GmbH & Co. KG

The Indian textile industry, which is largely based on manufacturing and export, accounts for some 14% of world-wide industrial textile production and around 3% of India's GDP. India will be able to increase its share in global trade by another 3.5% by 2020. In textile finishing, air temperatures ranging from 120 °C to 210 °C are needed for thermal processes such as drying and thermofixing, in order to draw off process moisture and contaminants. The use of heat recovery systems would greatly

improve the efficiency of energy inputs and would allow for the recovery of some 20% of them – thus greatly reducing the use of primary energy. Unfortunately, Indian textile manufacturers still know little or nothing about this carbon emissions reduction solution.

The project aimed to raise awareness of this technology on the part of political leaders, manufacturers and grid operators. The project set out to identify untapped potential for more efficient usage of electricity, via a pilot heat recovery system that was tailored to local requirements. To this end, a two stage mobile heat recovery system was designed and implemented for periods of four to six weeks at nine previously identified local pilot companies in the textile sector. The following additional measures were realised concurrently: training courses were provided, mainly for the facility managers at the participating companies; energy data was collected; case studies were drawn up; and conferences were held with textile industry representatives.

The project successfully identified potential savings – and thus has helped to improve acceptance of an ecologically sustainable technology in a new and important market.

"Conferences were held at India's most important textile centres on how the facilities operate and the results from the pilot companies. The events were well attended by captive audiences."[15]

[15] Brückner Trockentechnik GmbH & Co. KG, Final Report, February 2014 (Translated from German)

Private sector partner:	Brückner Trockentechnik GmbH & Co. KG
Total project cost:	€ 328,000
BMUB funding:	€ 158,000
Duration:	11/2010–02/2014
Pilot facility:	Two-stage (air/air, air/water) mobile heat recovery system for installation at nine local pilot companies in the textile industry for four to six weeks at a time
Local implementing partner:	• Co-operation with India based Voltas Limited
Training and capacity building:	• Five day training course for two employees from Voltas Limited, so as to enable them to supervise the mobile heat recovery system periodically at the nine identified pilot companies
Awareness raising measures:	• Project presentation at five conferences during Eco-Tour India, for around 70 customers • Project presentation at two trade fairs
Co-operation with local multipliers:	None
Publications and informational material:	• Heat recovery system manual (facility documentation, instructions) • Publications in connection with Eco-Tour India • Press release from the final project report titled “Brückner brings climate-friendly technologies to India”, published in eleven international industry publications in 2014
Reduced energy consumption and greenhouse emissions:	No information available
Potential reduced energy consumption and greenhouse gas emissions following market penetration:	Annual saving potential, via heat recovery systems, of 230,000 tonnes of carbon at an energy saving rate of 10% on the basis of annual consumption of 66 billion kWh of thermal energy in the Indian textile finishing industry (equivalent to using 1.1 million tonnes of coal)
Partner performance during project and outlook for the future:	• Setting up networks for future use; but no notable sales increase during the project

3.3 | Energy efficient model factory for the textile industry, India – Thies GmbH & Co. KG and Brückner Trockentechnik GmbH & Co. KG

Process energy production and use in India's textile-finishing sector tend to be inefficient, and cause serious environmental problems. The outdated technology of the machines used in the sector, combined with a lack of expertise, often results in inefficient operation of them.

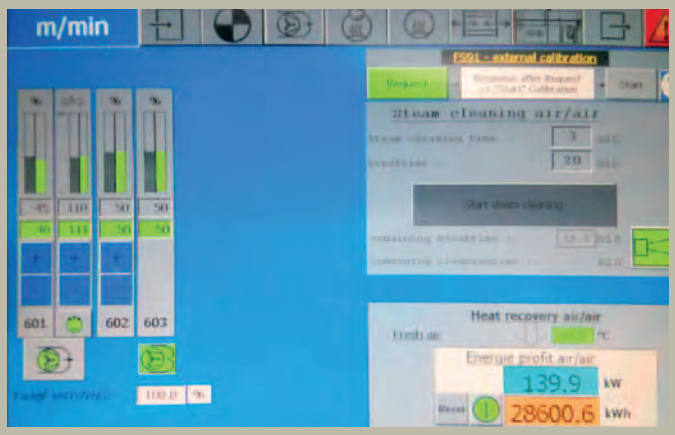
The aim of the project was to design and implement a model factory that would demonstrate the cost effectiveness of resource and energy efficiency in the Indian textile-finishing sector.

Following an analysis of representative local textile businesses and existing energy structures, the product portfolio, process stages and process management for the model factory were then defined, along with the resources needed to provide process energy. At the same time, training was conducted to raise machine operator awareness of how energy consumption could be reduced by running the machines in an energy-optimised manner.

The next envisaged phase involving identification of a suitable pilot company or investor for the pilot project was not realised during the project period. As a result, the envisaged measures based on the analysis concerning operation of the machines in an energy-optimised way and a process overarching energy management were not implemented in a model factory. These measures were ultimately carried out as individual steps at the existing company, Rohini Textiles Industry (P) Ltd., and at other textile finishing companies.

At Rohini, an existing heat recovery system was optimised from a management and control standpoint and was fitted with an energy monitoring device. Energy savings for the process were realised through self-optimised regulation. Two additional textile finishing plants that had been analysed were equipped with heat recovery systems.

Thies GmbH & Co. KG is planning to implement facilities to serve as reference projects in the future with two local textile finishing companies.



According to insights gained from the analysis, energy savings of 30% can already be achieved by running machines more efficiently in the Indian textile finishing industry. A further 10% of energy savings is achievable via across the board process energy management.

"Documenting the values of Rohini's process analysis allowed for recording the status quo, and pinpointing savings potential. It amounts to 30%."[16]

[16] Thies GmbH & Co. KG, Final Report, December 2014 (Translated from German)

Private sector partners:	Thies GmbH & Co. KG in co-operation with Brückner Trockentechnik GmbH & Co. KG
Total project cost:	€ 783,000
BMUB funding:	€ 352,000
Duration:	12/2011–12/2014
Pilot facility:	Analysis of six local textile finishing companies; and based on this, designing an optimised, energy-efficient model factory, taking the local context into consideration
Local/international implementing partners:	• Co-operation with India based Voltas Limited • Co-operation with DLR (Germany's national aeronautics and space research centre)
Training and capacity building:	• Training for employees from six textile finishing companies during the analysis phase of the project
Awareness raising measures:	• Two press releases • Project presentation at two VDMA events (in Mumbai and Coimbatore) with around 250 attendees
Co-operation with local multipliers:	None
Publications and informational material:	• Feasibility study on the use of solar processing heat, conducted by the DLR
Reduction of energy consumption and carbon emissions at pilot companies:	No information available
Potential for energy savings and carbon emission reductions following market penetration:	Annual saving potential, via heat recovery systems, of 230,000 tonnes of carbon at an energy saving rate of 10% on the basis of annual consumption of 66 billion kWh of thermal energy in the Indian textile finishing industry (equivalent to using 1.1 million tonnes of coal)
Partner performance during project and outlook for the future:	• Setting up networks for future use; but no notable increase in sales during the project

3.4 | Synchronous technology for industrial applications, India – Hanning Elektro-Werke GmbH & Co. KG

There is considerable scope for improving energy efficiency in India, particularly in the industrial manufacturing and drive technology sectors. Every year in India around two million electrical drive systems in the 50 watts to 4 kilowatts class are sold, most of them asynchronous motors. Of these systems, 20% to 25% could be switched to more energy efficient electronically controlled synchronous motors. However, in India synchronous technology is not regarded as having been sufficiently tested, and its profitability is considered to be unproven.

Hence the project set out to demonstrate the potential for saving energy and cutting carbon emissions by implementing synchronous technology in the Indian market. Using the specifications for demonstrating the diverse range of possible applications of synchronous motors, three pilot companies were identified in various sectors where the individually designed synchronous solutions were installed. Data was compiled both before and after the changeover so that profitability, including potential energy savings, could be calculated for each company.

Total potential annual savings of around 3.5 million kilowatt hours were calculated, along with a reduction of 3,040 tonnes in annual carbon emissions.

The new technology was installed at two pilot companies. The process was supported by training courses at the University of Baroda (the local partner university), along with various workshops and visits to trade fairs – the goal being to raise awareness on the part of decision makers and potential customers of the many and varied applications of synchronous motors.

The sustainable large scale impact of the project is being ensured by providing inputs to the European Energy Manager course series and by co-operation with the Indo-German Chamber of Commerce (IGCC) continuing beyond the project period.

By introducing modern climate-friendly technology, the project is helping to increase energy efficiency in India, especially in energy intensive sectors such as the textile industry.

"The JC pilot operation is a specific customer project currently being launched to develop a synchronous motor that is perfectly tailored to the application. JC Tex has been persuaded that using energy-efficient synchronous motors makes sense in India and offers competitive advantages."[17]

[17] Hanning Elektro-Werke GmbH & Co. KG, Final Report, June 2014 (Translated from German)

Private sector partner:	Hanning Elektro-Werke GmbH & Co. KG
Total project cost:	€ 318,000
BMUB funding:	€ 141,000
Duration:	11/2010–06/2014
Pilot project:	Customised synchronous motor solutions at three pilot companies: JC Tex-Mach Marketing (textile industry), JP Extrusion (plastic processing) and Kompress (logistics systems)
Local implementing partner:	• Hanning Motors India Pvt. Ltd.
Training and capacity building:	• One-day training course for students and faculty at the University of Baroda, with a total of 71 attendees • Two-day training course for an employee from Hanning Motors India Pvt. Ltd.
Awareness raising measures:	• Project presentation at three trade fairs in India • Project presentation as part of an AHK workshop for around 30 experts • Contributions to the European Energy Manager (EUREM) energy series, organised by the IGCC; to be continued in 2015
Co-operation with local multipliers:	• Co-operation with the Department of Electrical Engineering at the University of Baroda at Vadodara • Co-operation with the IGCC (Indo-German Chamber of Commerce)
Publications and informational material:	• Presentation entitled Synchronous Training • Business plans, including the depreciation periods for the three pilot companies
Reduction of energy consumption and carbon emissions at pilot companies:	Potential annual savings of around 3.5 million kWh and an annual reduction of 3,040 tonnes in carbon emissions
Potential for energy savings and reducing carbon emissions following market penetration:	Potential annual carbon emissions savings of 130,000 to 160,000 tonnes with concomitant energy savings of 20%, by switching 20% to 25% of the electric motors sold to electronically controlled synchronous models
Partner performance during project and outlook for the future:	• Hanning Motors India Pvt. Ltd. expanded its workforce from around 15 to 30 following an increase in orders for synchronous technology in the textile machinery sector within the project period • Moving into a new building with more space for production and administration

3.5 | Energy-efficient drive solutions, India – Kimo Industrie-Elektronik GmbH

In view of rising energy demand and the untapped potential for energy savings in India's industrial manufacturing sector, the large scale use of energy efficient electric drive technology could reduce energy demand and thus counteract the prevailing shortfall in supply. However, in India the necessary awareness and willingness to invest are somewhat limited.

This is where the project came in. The idea was that industrial companies in India would learn to improve their energy efficiency by using regenerative frequency inverters and electronic drive control units. In many cases, using such units allows for energy consumption reduction of more than 50%. The project set out to strengthen technical expertise, technical planning and service capacities via the following measures: creating a network of marketing partners; awareness-raising measures; technology transfers; co-operative projects with local educational partners.

Educational materials and online training modules were developed to offer attendees new qualifications, and the six identified local marketing partners received training in applications, technical specifications and potential energy savings from regenerative frequency inverters and electronic drive control units.

In addition, various pilot applications of energy efficient drive technology were launched, and were demonstrated during the project period to a broad audience, via site visits and trade fairs.

The project promoted the introduction of innovative electric drive technology in the Indian market – which local businesses can apply to bring down their costs and reduce carbon emissions.

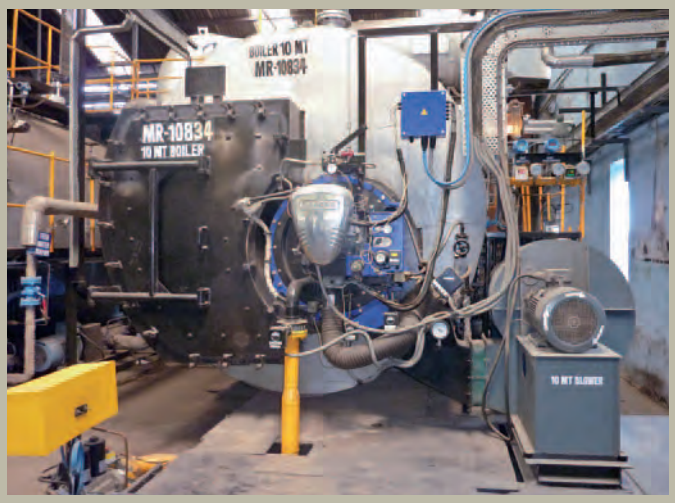
"The project achieved its objective of making industrial companies in India aware of the concept of using regenerative frequency inverters and electronic drive control units to increase energy efficiency. We conducted documented discussions and negotiations with over 1,200 firms. We also persuaded 21 firms to adopt electronic drive control units instead of non-controlled or mechanical solutions."[18]

[18] Kimo Industrie-Elektronik GmbH, Final Report, January 2014 (Translated from German)

Private sector partner:	Kimo Industrie-Elektronik GmbH
Total project cost:	€ 364,000
BMUB funding:	€ 171,000
Duration:	11/2010–01/2014
Pilot project:	Three pilot applications of energy efficient drive solutions at Century Fab-Tech, Bengaluru (girder crane, 7.5 kW lifting tackle), CMTI, Bengaluru (girder crane, 15 kW lifting tackle), and Alpha Power Controls, Coimbatore (7.5 kW wind power system), plus a mobile demonstration system
Local implementing partner:	• Creation of a network with six local marketing partners in Bengaluru, Coimbatore and Pune (Gayathri Engineering, Enviro Serve Pvt. Ltd., S2B Power Controls, Three V Controls, QrioTek and Synergy Tech Instruments)
Training and capacity building:	• Training courses for 19 marketing partner employees and Kimo employees • Series of presentations at CMTI (Central Manufacturing Technology Institute)
Awareness raising measures:	• Project presentation at four trade fairs
Co-operation with local multipliers:	• Co-operation with CMTI, Bengaluru
Publications and informational material:	• Training presentation entitled “Intelligent Drive Solutions” • Two articles published in 2012 in the trade magazine “Automation and Controls Today”
Reduction of energy and carbon emissions at pilot companies:	• Demo system with parallel motoring and braking using frequency inverters/braking choppers and regenerative frequency inverters (4 kW); 50% reduction in energy consumption • Demonstration of a soft starter in lieu of direct start-up in a process technology application (55 kW); 3% to 5% reduction in energy consumption • Demo system at CMTI with crane operation, 8% reduction in energy consumption compared with frequency inverter operation alone
Potential for saving energy and reducing carbon emissions following market penetration:	No information available
Partner performance during project and outlook for the future:	• Steady acquisition of new customers (four new customers in 2011, 22 in 2012, 26 in 2013 and 35 in 2014) during the project period

3.6 | Modern combustion technology, India – Saacke GmbH

In India, as in many industrialised countries, heat and steam for industrial applications are generated using conventional fuels such as oil and natural gas. The use of outdated technology results in extremely high secondary energy consumption by blowers and pumps in the combustion plants; plus the quantity of combustion air is not optimally controlled, nor is residual heat in exhaust air sufficiently exploited from a thermal standpoint. Measures to modernise industrial combustion plants could reduce both energy and raw materials consumption.



The project demonstrated the advantages of optimised combustion technology at the lubricant manufacturer Lubrizol Ltd. in Mumbai, which was selected from a shortlist of five companies. Converting the pilot company's heavy-oil combustion plants to more ecologically sustainable natural gas combustion and installing additional efficiency-optimising speed controllers and oxygen control units yielded considerable savings. The efficiency monitoring system that was installed allowed for data compiling, and the results revealed an efficiency increase of 5% to 10%, along with a 20% reduction in carbon emissions.

Training courses were also held for boiler house personnel.

Another focus was on raising awareness in the relevant industrial sectors, organised tours of the pilot plant, courses for industry representatives in co-operation with the Indian education partner PCRA; and lectures by guest speakers at local universities.

The results of the evaluations and the savings potential were summarised in case studies and made available to a wide Indian and international audience via a publication titled "A better use of energy – a practical handbook for combustion", which has been translated into a number of languages.

"With the aid of the manual, it was possible to forge contacts with education providers and state organisations in Morocco, Turkey and elsewhere. Information campaigns and the identification of technical solutions are the first step towards modernisation. However, it must be absolutely clear that the comprehensive introduction of efficiency-boosting measures and modernisation will be possible only when based on minimum standards set by the state."[19]

By introducing and disseminating innovative combustion technology in India, the project helped reduce fossil fuel use and carbon emissions. There is a large potential for conversion to energy efficient combustion technologies, which is thought to amount to several thousand plants in India over the next decade.

[19] Saacke GmbH, Final report, August 2013 (Translated from German)

Private sector partner:	Saacke GmbH
Total project cost:	€ 415,000
BMUB funding:	€ 199,000
Duration:	11/2010–08/2013
Website:	http://www.Saacke.com/de/aktuelles-referenzen/aktuelles/neues-handbuch-zur-energie-effizienz/
Pilot project:	Based on analyses conducted at five local companies, conversion of combustion plants to systems incorporating modern natural gas combustion solutions at the selected pilot company Lubrizol Ltd., Mumbai
Local implementing partner:	• Saacke India, Navi Mumbai
Training and capacity building:	• One day training course for 23 Lubrizol employees on combustion efficiency and operation monitoring • Guest lectures for students at two technical universities in Bangalore and Mumbai • Eight seminars with a total of 546 attendees from various industrial sectors in co-operation with PCRA
Awareness raising measures:	• Project presentation at three trade fairs in India • Tour of pilot plant with 35 attendees from industry and politics • Project presentation at the Indo-German Energy Forum 2013
Co-operation with local multipliers:	• Co-operation with the state run organisation PCRA (Petroleum Conservation Research Association)
Publications and informational material:	• A 160 page publication titled “A better use of energy – a practical handbook for combustion” in German, English, Spanish and Chinese
Reduction of energy consumption and carbon emissions at pilot companies:	A 5% to 10% increase in plant efficiency at the pilot company Lubrizol India Ltd. and a 20% reduction in carbon emissions (around 4,000 tonnes per year)
Potential for saving energy and reducing carbon emissions following market penetration:	Potential savings of 5% to 10% at plants burning heavy oil, potential savings of over 10% at plants burning solid fuels (coal, agricultural waste, etc.)
Partner performance during project and outlook for the future:	• Better market position and greater public awareness of the company • Acquisition of new customers following the establishment of a network comprising numerous contacts with state organisations and potential industrial customers, during the project period

3.7 | Improved network quality for more efficient energy transmission, India – Modl GmbH

The strong increase in India's energy consumption calls for the expansion of power generation and power transmission capacity. Grid capacities are stretched to the limit, and grid quality is deteriorating. Electricity quality hinges on a number of factors, two major ones being the proportion of reactive power and the amount of harmonic oscillations. In addition to actual active energy, reactive power also oscillates between the producer and the electricity consumer and puts a strain on already overburdened power grids. Harmonics superimpose additional currents on the network's fundamental oscillation and represent an additional burden. As a result, power stations need to supply more primary energy than would otherwise be the case. The universal use of reactive power compensation systems, or special active or passive filter solutions designed to improve network quality, could permanently take the strain off transmission equipment, reduce transmission losses and make energy transmission far more efficient.

Against this backdrop, the objective of the climate partnership was to use reactive power compensation systems in pilot schemes to optimise grid quality and with it energy efficiency in industrial companies.

Over the course of the project, it emerged that power grid quality in India is already heavily influenced by harmonics and other interference factors. In view of this situation, the project – originally restricted to reactive power – was extended to include overall optimisation of grid quality. To this end, appropriate components from selected local suppliers were built into a pilot system, which then underwent a stress test in Germany. The personnel of the production partner and some local suppliers were trained in guaranteeing an internationally recognised quality standard. The production partner's trained specialists from the areas of production, engineering and quality assurance and two MODL marketing employees now serve jointly as multipliers to secure the necessary expertise for using and producing reactive power compensation systems in India.

Visits were also organised to trade shows and conferences, the goal being to raise awareness of the target technology on the part of manufacturing company managers, and to demonstrate both the energy related and economic advantages of systems that correct for reactive power and reduce harmonics.

The project introduced modern technology aimed at optimising power grid quality – which in turn has helped to improve grid stability and avoid power outages and voltage fluctuations in India.

"After four years of experience in one of the world's most challenging markets, the undeniable fact remains that my team and I have achieved great success – not to mention that it has now been proven that our approach was strategically correct and that it will enable us to break into other markets as well."[20]

[20] Modl GmbH, Survey November 2014 (Translated from German)

Private sector partner:	Modl GmbH
Total project cost:	€ 456,000
BMUB funding:	€ 185,000
Duration:	11/2010–12/2014
Pilot project:	Production and endurance testing of components from local suppliers in the field of power grid quality optimisation
Local implementing partner:	• Co-operation with the local production partner Global Power Systems Engineering, Pune
Training and capacity building:	• Intensive training for four employees of the production partner Global Power Systems Engineering in Germany and India • Three workshops for trade professionals • Training courses on ISO 9001 for local suppliers
Awareness raising measures:	• Project presentation at a specialist event held by the Indo-German Chamber of Commerce (IGCC) • Project presentation at the Power Quality Competence conferences in Mumbai and Pune
Co-operation with local multipliers:	None
Publications and informational material:	• Manual containing 400 process steps for local partners
Reduction of energy consumption and carbon emissions at pilot companies:	No information available
Potential for saving energy and reducing carbon emissions following market penetration:	No information available
Partner performance during project and outlook for the future:	• Founding of Modl Power Quality Solutions Pvt. Ltd. in 2014 • Relocating to a new production facility and hiring two new employees during the project period

3.8 | Resource and climate protection network, South Africa – Wika Alexander Wiegand SE & Co. KG

South African energy consumption and carbon emissions are above the world-wide average. Despite the energy crisis that the country is now facing, alternative sources of energy account for only a fraction of its energy mix. The bulk of South Africa's energy comes from coal fired power plants, which cause severe air pollution. The combustion of coal for producing electrical energy generates around 912 grams of carbon per kWh. The priority now is to reduce South Africa's heavy dependency on coal and make greater use of renewables.

The objective of the project was to establish a resource and climate protection network as a basis for durably optimising South Africa's industrial resource use and climate protection. The aim was to demonstrate that employing modern and energy efficient environmental technology also pays off for the companies in the network from a commercial point of view.

In the wake of difficulties in recruiting companies to join the network, and a resulting market analysis to evaluate possible synergies, three companies (apart from WIKA South Africa) from various sectors were identified as potential members. Each of these companies has a production site in South Africa. Economically sound measures for optimising energy and resource efficiency tailored to each company were identified and evaluated after initial consultation with and analyses of the potential at the three companies. The companies chose to implement the measures themselves, rather than to enter into co-operation agreements to receive complete technical support for implementing the measures as had been envisaged in the beginning.

At WIKA South Africa considerable saving potential was identified thanks to the in-depth analysis and on-site testing carried out by the implementing partner, Arqum Gesellschaft für Arbeitssicherheits-, Qualitäts- und Umweltmanagement mbH. Several improvement measures were then implemented with Arqum's support. These steps created a solid foundation for implementing an environmental management system, which was also transferred to other WIKA sites. Measures aimed at heightening the visibility of the envisaged expansion of the network were also carried out, e.g. workshops with local organisations and institutions and informational events.

The companies have adopted a wait-and-see attitude toward participation in the network, as the market for resource and climate protection advisory services and effective incentive systems and legal frameworks are still in their infancy. This occurred despite numerous efforts to increase visibility, the fundamental need for investments in energy efficiency and the existence of approaches that incentivise investments.

"The companies involved in the project need advice in the area of resource conservation and climate protection, but gaining access to them is difficult. It can be assumed that climate protection and energy efficiency will become significantly more relevant in South Africa, as the result of rising energy prices and the optimisation and fleshing out of existing approaches such as a carbon tax."[21]

[21] Wika Alexander Wiegand SE & Co. KG, Survey November 2014 (Translated from German)

Private-sector partner:	Wika Alexander Wiegand SE & Co. KG
Total project cost:	€ 210,000
BMUB funding:	€ 100,000
Duration:	12/2012–12/2014
Pilot facility:	Within the framework of a resource and climate protection network, identifying three potential companies from the network, in addition to Wika South Africa, as well as determining savings potential for optimising energy and resource efficiency in four companies
Local/international implementing partner:	• Arqum Gesellschaft für Arbeitssicherheit-, Qualitäts- und Umweltmanagement mbH
Training and capacity building:	• Analysing untapped potential and elaborating lists of measures during visits to Boehringer Ingelheim South Africa, Sediberg Heineken Brewery and TRW Occupant Restraints South Africa Inc. • Analysing untapped potential and elaborating list of measures at WIKA South Africa
Awareness raising measures:	• Informational events to attract companies • Project presentation at numerous local companies • Project presentation for profile-raising purposes, at local organisations such as GIZ, Sanedi (South African National Energy Development Institute), GGDA (Gauteng Growth and Development Agency) • Project presentation at the SAEEC (South African Energy Efficiency Convention) and an information event with AHK South Africa
Co-operation with local multipliers:	• AHK South Africa
Publications and informational material:	• Various promotional materials
Reduction of energy consumption and carbon emissions at three pilot companies, after analyses were performed:	• Potential identified at Boehringer Ingelheim South Africa: energy savings of 15% by raising server room temperature • Potential identified at Sedibeng Heineken Brewery: annual energy savings of 197,600 kWh by replacing 100 electronic drive units and using biogas to generate 4.2 million kWh of thermal energy annually and 2.8 million kWh of electrical energy • Potential identified at TRW Occupant Restraints South Africa Inc.: annual energy savings of 4,509 kWh by replacing electronic drive units; annual total of 59,400 kWh through heat recovery using compressors; and an annual total of 73,000 kWh by replacing existing lighting
Reduction of energy consumption and carbon emissions at pilot companies after implementation:	• Annual carbon emissions savings of 47 tonnes by replacing the compressors at WIKA South Africa
Partner performance during project and outlook for the future:	No information available

3.9 | Modern biomass boiler for the wine industry, South Africa – A. P. Bioenergietechnik GmbH (Ökotherm)

Wine and fruit are South Africa's most important agricultural exports. In the South African wine industry, the water used to sterilise wine bottles and barrels is heated to 90 °C in wood burning boilers. The limited availability of wood and charcoal, the significant impact on the environment and soil quality of burning wood and charcoal, and the cost inefficiency of wood burning boilers, are prompting a sea change the country's energy sector. Retrofitting agribusinesses and industrial plants for the use of waste material to generate energy could pave the way to ecologically sustainable and resource friendly practices.

Against this backdrop, the aim of the project was to replace wood and charcoal with biomass, and at the same time recycle agricultural and industrial waste. After local conditions and biomass availability were analysed and the technological approach was tweaked to bring it into line with conditions on the ground, a specially designed biomass boiler was installed and commissioned at the target vineyard, Backsberg winery. The winery produces around 250 tonnes of grape pulp and 350 tonnes of vine wood annually, at its 100 hectare facility. The modern biomass boiler that was installed allows the vineyard to use this waste material as fuel to generate heat, and provides an alternative way to recycle the agricultural waste.

System commissioning was supported by the winery staff, who had undergone special training, along with students and faculty from Stellenbosch University. The local implementing partners helped to evaluate the commissioning process. Workshops were held to ensure durable technology transfer, as were tours of the pilot plant for interested wineries and agribusinesses.

Long term co-operation on the use of alternative fuels with Stellenbosch University will guarantee a global transfer of knowledge and corresponding training in an extremely promising area for the future.

Thanks to the unwavering commitment of the implementing partners the project was completed during the project period, synergies were leveraged and a functioning local network was established.

"The contacts made should enable at least three further facilities to be implemented in South Africa and marketed in collaboration with the School of Public Leadership at Stellenbosch University over the next three years."[22]

[22] A. P. Bioenergietechnik GmbH (Ökotherm), Final Report, November 2013 (Translated from German)

Private-sector partner:	A. P. Bioenergietechnik GmbH (Ökotherm)
Total project cost:	€ 278,000
BMUB funding:	€ 119,000
Duration:	02/2012–11/2013
Pilot facility:	Fabrication and installation of a biomass boiler at Backsberg vineyard in South Africa. The boiler generates thermal energy using grape pulp and root stock
Local/international implementing partner:	• A.P. Bioenergietechnik GmbH (ÖKOTHERM) • X-Tern International GmbH • RLP AgroScience GmbH • Dr. Wolfgang Jockel • Sofar (Straube Organisation for African Research)
Training and capacity building:	• Ten-day system operation and maintenance course for Backsberg vineyard staff
Awareness raising measures:	• Local tour of the pilot site • Kick-off workshop and closing workshop
Co-operation with local multipliers:	• Long-term co-operation with Stellenbosch University's Sustainability Institute
Publications and informational material:	• Guidelines on alternative fuels for wineries and growers • Implementation plan • A dissertation written at Stellenbosch University analysed the pilot facility
Reduction of energy and carbon emissions at pilot companies:	No information available
Potential for saving energy and reducing carbon emissions following market penetration:	No information available
Partner performance during project and outlook for the future:	No information available

3.10 | Process controlled high efficiency pumps for the wine industry, South African – Wilo SE

Much of the energy consumed in South African wineries is drawn off by pumps that operate wells for vineyard cooling and irrigation purposes. The power consumption of these frequently outdated pump systems is usually four to eight times higher than that of modern high efficiency pumps. Switching to modern pump technology can cut carbon emission by an average of 50% and thus contribute to reducing greenhouse gas emissions. Alongside lower energy consumption, optimised energy usage can optimise production efficiency and significantly cut costs at wineries.

The main aim of the project was to demonstrate how energy efficiency can be increased by replacing outdated pump systems at the pilot winery, Morgenster Wine & Olive Estate. The existing processes, technologies and pump performance were evaluated and an energy optimisation plan was elaborated. A new materials-flow model was devised, the winery's processes were re-engineered, and high efficiency pumps were installed so as to ensure optimal pump utilisation at the facility.

Winery staff underwent extensive training to ensure trouble-free operation of the process-controlled high efficiency pumps. This training also ensured that the steadily increasing savings in water and electricity consumption resulting from use of the new pumps will be sustained going forward. To guarantee expertise and technology transfer, the winery retrofit was accompanied by a number of informational events for interested parties from the agricultural, political and academic communities. Apart from tours of the pilot facility and setting up a showroom at Morgenster Wine & Olive Estate, a plan was drawn up for implementing energy optimisation in the vineyards.

After the project had been showcased at other wineries in Western Cape province, a WILO high efficiency pump was installed at Backsberg vineyard (the pilot winery of the partnership with LST GmbH), which has since been certified as climate-neutral.

An energy consumption study of South African wineries (based on seven of the country's vineyards) that extended beyond the study period was realised via the German partners' co-operation

with Stellenbosch University's Sustainability Institute. The Sustainability Institute is evaluating and monitoring the WILO SE pilot facility in collaboration with Morgenster Wine & Olive Estate. Significant electricity savings amounting to 70% have been measured at the winery.

"Pumping the large amount of water that the vines and olive trees need during the summer represent a major share of the annual electricity bill. The use of process controlled Wilo pumps has reduced power consumption by around 70%."[23]

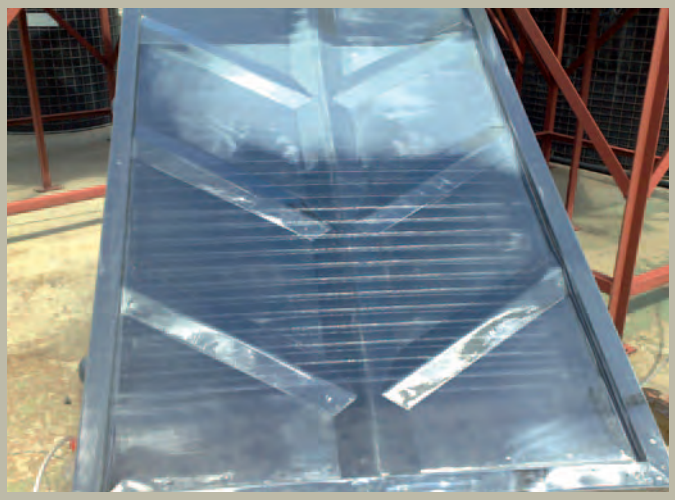
[23] Wilo SE, Survey November 2014 (Translated from German)

Private sector partner:	Wilo SE
Total project cost:	€ 451,000
BMUB funding:	€ 194,000
Duration:	01/2012–12/2013
Pilot facility:	Installation of a modern and highly efficient pump system at Morgenster Wine & Olive Estate in South Africa, for water and energy consumption optimisation
Local/international implementing partner:	• X-Tern International GmbH • RLP AgroScience GmbH • Tüv Rheinland Energie und Umwelt GmbH • Sofar (Straube Organisation for African Research)
Training and capacity building:	• Five day system operation and maintenance training course for two staff members • Wrap-up workshop open to the public (16 attendees)
Awareness raising measures:	• Tour of the pilot facility for students from Stellenbosch University and interested growers and wineries • A separate showroom for display purposes was set up on the grounds of Morgenster Wine & Olive Estate • Project presentation at ten additional wineries
Co-operation with local multipliers:	• Co-operation with Stellenbosch University's Sustainability Institute, to ensure long term co-operation
Publications and informational material:	• Assessment of the technical situation and infrastructure • Various training and marketing presentations • Implementation plan for vineyard energy optimisation • Study of energy consumption at seven South African vineyards, realised by Stellenbosch University's Sustainability Institute • Media publications
Reduction of energy consumption and carbon emissions at the pilot companies, as follows:	Power consumption reduced by 70% (116,000 to 34,000 kWh) over a ten month irrigation period – which translates into annual carbon emission reduction of around 80 tonnes, based on the emission factors for the South African electricity mix
Potential for reducing energy consumption and carbon emissions following market penetration:	Annual carbon emission savings potential of around 180,000 tonnes for 110,000 hectare vineyard in South Africa's Western Cape province
Partner performance during project and outlook for the future:	No information available

3.11 | Innovative wastewater treatment solution, South Africa – Mic AG, Flores Solar Water GmbH and Gondwana Water (Pty.) Ltd.

South Africa has much of the world's platinum, manganese, chromium, vanadium and gold deposits. But unfortunately, extracting these resources causes severe environmental pollution and contaminates drinking water – thus putting additional strain on what is already a scarce commodity in South Africa.

The mines in the Johannesburg area alone produce around 12 million litres of wastewater a day. The water treatment technology used at local water treatment plants is by and large outdated. Also, commonly used procedures such as reverse osmosis and microfiltration are often technically very complex, as well as relatively resource intensive and costly, and in many cases the quality of the treated water does not meet drinking water standards.



The aim of this project was to demonstrate an innovative wastewater treatment system for the mining industry using solar water collectors. The system's ecologically sustainable process was initially implemented at the University of Witwatersrand as a small demonstration facility for research and training purposes.

The treated water circulates in solar water collectors and condenses. Impurities (potassium, sodium, sulphate, etc.) are deposited and separated out. Extensive testing of filtration quality revealed that aquatic toxins can also be filtered out as part of the procedure. As a result, a larger pilot facility comprising 100 modules was installed and commissioned at a coal mine.

Use of this facility revealed, however, that the technology in question did not allow for generation of the originally anticipated ten litres of drinking water per module. After the pilot facility was relocated to the local implementing partner Hydrex (Pty) Ltd., and following further analyses and trial runs, the technology was optimised to the point where four litres of drinking water per module were being generated.

But as around ten litres is the commercialisation threshold for this technology, possible adjustments have been elaborated in collaboration with the University of Witwatersrand, and their implementation is in the pipeline.

Carbon neutral water treatment of unfiltered toxic wastewater has the potential to improve overall water resource management, as well as the water supply and its quality in South Africa. This could potentially make a lasting contribution to securing and improving access to clean drinking water for the South African population.

"The solar water collectors constitute a unique, extremely attractive concept for South Africa, where water resources are subject to increasing pollution and local districts battle against poor drinking water quality. But it needs to be borne in mind above all that the solution has not yet proven to be commercially viable."[24]

[24] Mic AG, Interim Report February 2014 (Translated from German)

Private-sector partner:	Mic AG, Flores Solar Water GmbH, Gondwana Water (Pty) Ltd.
Total project cost:	€ 438,000
BMUB funding:	€ 182,000
Duration:	12/2011–12/2014
Pilot facility:	Installation of a single-module demonstration facility at the University of Witwatersrand in Johannesburg, and of a 100 module pilot facility at Black Wattle coal mine which was relocated to Hydrex (Pty) Ltd.
Local/international implementing partner:	• Tüv Rheinland Energie und Umwelt GmbH • Co-operation with the local implementing partner Hydrex (Pty) Ltd.
Training and capacity building:	• Train the trainer courses for four Gondwana Water (Pty) Ltd. staff, to facilitate know-how transfer • Training for three staff members at the local implementing partner Hydrex (Pty) Ltd. • Four workshops for students and faculty at the University of Witwatersrand
Awareness raising measures:	• Presentation of the project at several informational events (African Power Conference, Victor Khanye Municipality Conference, WITS University) • Presentation of the project at local companies, organisations and institutions including Guateng Central Government, Department of Water Affairs (Mpumulanga), Deloittes Corporate Social Investment Department, etc.
Co-operation with local multipliers:	• Co-operation with the University of Witwatersrand in Johannesburg
Publications and informational material:	• Project brochure • Three bachelor's theses and three research projects on the solar water collectors were realised by six students at the University of Witwatersrand in 2012, 2013 and 2014 (partly published in the media)
Reduction of energy and carbon emissions at pilot companies:	No information available
Potential for reducing energy consumption and carbon emissions following market penetration:	No information available
Partner performance during project and outlook for the future:	• Technology to be developed in consultation with a Mic AG portfolio company that specialises in product development and optimisation, in co-operation with the local partners

3.12 | Training centre for photovoltaics, South Africa – Sunfarming GmbH

According to official solar atlases for South Africa the country has an extremely high overall level of annual solar radiation, amounting to 2,300 kilowatt hours per square metre – compared to Germany, where the figure is 1,000 kilowatt hours.

Yet this vast potential for photovoltaics in South Africa is barely used, for a number of reasons: (a) a shortage of skilled personnel; (b) the fact that grid access regulations and payment and accounting systems have yet to be adopted; (c) a policy and business environment that is not yet conducive to the widespread use of photovoltaics.

In view of the fact that it will not be possible to commercialise photovoltaics in South Africa until these hurdles have been overcome, the aim of the project was to address these issues by building and strengthening human resource capacity in companies and institutions in South Africa. Based on an assessment of the current situation, Sunfarming and NWU University in Potchefstroom jointly planned and implemented a training centre for the dissemination of photovoltaics know-how.

Multiplier effects and long-term knowledge transfer beyond the confines of the training centre are fostered by integrated train the trainer components and high profile PR work. The courses target NWU students and faculty, electricians and technicians from local companies, and decision-makers from politics and the private sector. The course attendees receive professional advice on matters such as grid integration and photovoltaic project financing. Tailored and continually developed training documents provide guidance on topics such planning, installation, storage technology, network integration, the regulatory environment, approval procedures, economic viability and photovoltaic system management.

By successfully setting up a local pool of experts, the necessary business and policy environment for commercial usage is being promoted, and local companies are put in a position to design, install, operate and maintain their photovoltaic systems independently via technology and know-how transfers. Thus the groundwork is being laid for use and long-term dissemination of photovoltaics in South Africa.

"The prevalence of coal fired power plants in South Africa means that almost 1 kg of CO_2 is produced per kWh of electricity generated. Since the training centre was set up, Sunfarming has been successful in supplying qualified personnel, so as to enable facilities to be operated that save 900 tonnes of CO_2 annually. Potential savings of several million tonnes of CO_2 are to be expected in the coming five years in South Africa."[25]

[25] Sunfarming GmbH, Survey November 2014 (Translated from German)

Private sector partner:	Sunfarming GmbH
Total project cost:	€ 438,000
BMUB funding:	€ 190,000
Duration:	4/2013–11/2014
Pilot facility:	Planning, supplying training equipment (five photovoltaic plants with 3 kW each including a monitoring station for optimised yields) and commissioning a photovoltaics training facility called the Solar Training Centre at NWU (North West University) in Potchefstroom
Local implementing partner:	• Co-operation agreement over the entire four years of the project, with the local implementing partner NWU
Training and capacity building:	• Five train-the-trainer intensive courses for six master trainers/multipliers plus subsequent certifying • Five one-day training sessions for over 200 attendees from 100 companies and organisations (banks, industrial companies, electrician and technician businesses, project developers, energy producers) with subsequent certification • Permanent incorporation of officially certified courses into the NWU curriculum
Awareness raising measures:	• Identifying and contacting around 150 stakeholders • Opening event with around 100 attendees
Co-operation with local multipliers:	None
Publications and informational material:	• www.solar-training-center.com • Flyer and press releases to publicise various training measures • Media publications • Handbook for training equipment • Training modules based on the training concepts developed • Electromobility concept based on solar power for the NWU campus (e-bikes)
Reduction of energy and carbon emissions at pilot companies:	Annual savings of 25 tonnes of carbon emissions at the training centre; implementation of facilities capable of saving around 900 tonnes of carbon emissions annually
Potential for reducing energy consumption and carbon emissions following market penetration:	Potential for saving several million tonnes of carbon emissions in the next five years, thanks to the use photovoltaics
Partner performance during project and outlook for the future:	• Solid performance, increasing demand and implementation of several facilities during the project period

3.13 | Feasibility study and implementation of a biogas plant on a pig farm, Brazil – MVV Decon GmbH

Millions of pigs are kept on fattening farms in the Santa Catarina region of Brazil. There, the massive quantities of pig slurry are produced causing serious environmental problems attributable to storage, evaporation, and unregulated discharge into soil and bodies of water. Climatically harmful high levels of methane emissions are also generated.

However, biomass from these pig farms could in fact be used to produce energy, which would also help to meet Brazil's rising demand for energy and reduce greenhouse emissions. According to the Brazilian Electricity Regulatory Agency Aneel, only 0.06% of the country's electricity currently comes from biogas. The biogas potential from wastewater and organic waste in Brazil is estimated to be around 50 million cubic meters of methane per day, or about 3,400 MW of untapped capacity.

Hence the goal of the consortium consisting of MVV Decon GmbH, Wirtschafts- und Wissenschaftszentrum Brasilien-Deutschland e.V. (WWZ) and Brazilian Eco Conceitos S.A. Group was to demonstrate that a biogas plant can be used to generate electricity that is both ecologically sustainable and eco-nomically viable, by using dung as a substrate.

In the first project phase, a comprehensive concept study was developed based on determination (in consultation with pig farmers) of the relevant parameters for biogas production, and discussions on technical feasibility with German plant designers. This study included aspects pertinent to the project's viability such as procedure, locations, investment and operating costs, and a minimum charge was investigated for feeding current into the grid.

After an initially identified investor in Ipuacao withdrew, an alternative location (Pomerode) containing a pig farm was chosen for implementation of the concept – which is in fact suitable for just about any location.

A composting facility was set up after the biogas plant began test operations, thus ensuring that pig slurry, which had previously been discharged into a river, could be avoided and environmental standards met. Selling the organic fertiliser gained from composting also contributes to improving the economic efficiency of a biogas plant.

After receiving its operating and environmental permits, the biogas plant began operation in February 2014 – the first of its kind in Brazil using German technology – and is currently producing around 360 cubic metres of biogas per day using pig slurry substrate. Banana peels, chicken manure and food waste from restaurants can also be used in the plant.

Plans call for the production of 1,000 cubic metres of biogas per day, which is equivalent to approximately 500 cubic metres of natural gas. Electricity will be generated beginning in 2015, and a local utility company has already agreed to purchase it.

Extensive measures for raising awareness among decision-makers in local government agencies, the scientific community and the private sector were part of the project, as was setting up a robust local network. These project attributes show that German biogas technology can be employed in Brazil sustainably and can be operated cost-effectively.

The potential to expand the concept using various modules means that it has a high degree of replicability.

The project is thus setting the stage for the use of thus creates the preconditions for using biogas plants in southern Brazil, where around 17 tonnes of slurry are produced annually and for achieving a long-term beneficial effect for the climate and environment:

"This facility will set an example that will reach far beyond Santa Catarina. Even though there are already hundreds of simple biogas plants that use the tunnel model in Brazil, very few of them function in a stable fashion for a long period of time. This differently designed unit demonstrates that this is possible. We are using natural resources as the basis for the production of gas, electricity and organic fertiliser. In other words, cutting edge technology is helping us to find our way back to nature."[26]

[26] Hans Prayon, Chairman of the Supervisory Board of the German-Brazilian Eco Conceitos Group; WZZ press release, September 2014 (Translated from German)

Private sector partner:	MVV Decon GmbH
Total project cost:	€ 473,000
BMUB funding:	€ 200,000
Duration:	12/2010–12/2014
Pilot facility:	Designing a concept, installation and six-month test operation of a 100 kW biogas plant comprising the following elements: preliminary tank, substrate feeding, fermenting, creating fertiliser, gas recovery and technology container in Pomerode, Santa Catarina (change in location due to withdrawal of investor in Ipuacao)
Local/international implementing partner:	• Wirtschafts- und Wissenschaftszentrum Brasilien-Deutschland e.V. (WWZ) • Eco Conceitos S.A. Group
Training and capacity building:	• Two-month intensive training course in Germany for a local technician in the field of biogas technology • Two guest lectures at the SENAI Institute in Florianopolis, for around 80 students
Awareness raising measures:	• Kick-off workshop with 23 attendees from the fields of agriculture, industry and politics • Workshop with 38 attendees from agriculture, industry and politics to wrap up the first phase of the project • Biogas course with 100 attendees from 30 identified multipliers • Project presentation at the EcoGerma Kongress • Biogas lectures, at the AHK, parliament, industrial association, and gas supplier • Open house at the Pomerode site • Tour of the demonstration plant during the official opening for around 200 experts and selected multipliers • Presentation of results to high ranking local representatives from the political and business communities
Co-operation with local multipliers:	• FIESC (Federacao das Industrias do Estado de Santa Catarina; industrial association) • Private investors
Publications and informational material:	• Concept study for financing and implementation: “Implementation of biogas facilities for pig farming in the district of Ipuacao in Brazil”, including drafting a sample contract for substrate supplying • Media publications • Training documents on process engineering and process biology for universities and environmental authorities
Reduction of energy and carbon emissions at pilot companies:	Annual carbon emission savings of 160,000 tonnes and production of around 360 cubic metres of biogas per day (equivalent to around 880 MWh annually)
Potential for reducing energy consumption and carbon emissions following market penetration:	Potential carbon emission savings of 2.8 million tonnes a year for Santa Catarina province
Partner performance during project and outlook for the future:	• The project has engendered a flagship effect and is a valuable building block for future development of the consulting sector in the field of supplying sustainable energy in Latin America

3.14 | Sustainable hydraulic energy production using small hydropower plants, Bosnia and Herzegovina – Fella Maschinenbau GmbH

Hydropower is one of the key sources of energy in Bosnia and Herzegovina, in that under normal weather conditions, up to 50% of the country's electricity demand can be met via this source. The fact that large centralised power stations dominate the market has caused serious damage to flora and fauna. However, small hydropower plants could generate decentralised energy without harming the environment or the climate.

However, designing, authorising, building and operating small decentralised, low-head hydropower plants (with a drop of less than ten metres) requires expertise that does not yet exist in Bosnia and Herzegovina – and thus the potential for small hydropower often remains unexploited.

The project aimed to implement a small pilot hydropower plant in order to demonstrate ecologically sustainable use of a newly developed turbine. Originally, the project was to be carried out with a long-term Bosnian partner company, so that it could become a competent project planner and supplier of power plant components.

In order to keep the investment costs low and ensure the economic viability of hydropower plant operation, key plant components were originally to be manufactured in Bosnia and Herzegovina, with the exception of the turbine. Various installation, commissioning and maintenance training programs were also planned that would have involved other German engineering companies, as well as Munich and Stuttgart Universities. Experience gained from implementing the demonstration project was to be folded into the relevant academic programs at a local university.

Elaborate local authorisation procedures and changing responsibilities forced planned sites to be shifted. However, after overcoming these challenges a technical and economic concept for implementation was drawn up with a local implementation partner.

The concept was based on a new location for the planned small hydropower plant (Centov most in Jajce) and was submitted to the relevant local authorities. After the citizens of Jajce gave positive feedback on the project presentation, which was held as part of an approval process that was open to the public, the authorities finally decided against granting the concession to the Centov most site.

As a result, it was unfortunately not possible to realise many of the planned project elements. But it did prove possible to overcome initial scepticism on the part of local citizens, and convince them of the benefits of this ecologically sustainable technology for generating energy through hydropower.

"It was necessary to communicate to the local people that the small plants, particularly the dive turbine, can be built and operated sustainably, and without damaging fauna and flora. Informational events were used to emphasise the positive aspects of small hydropower plants and break down prejudices. With the PPP promotional project we were able to convince the residents of Jajce to take an active role in shaping their environment."[27]

Within the framework of this project, Fella was successful in setting up a local network in south-eastern Europe and, in doing so, in promoting future implementation of small hydropower plants in the region in a targeted fashion.

The target technology is now well known in Bosnia and Herzegovina and is regarded as being of high quality. Inquiries concerning this technology have now been received from Bosnia and Herzegovina. Thus Fella expects to implement five small hydropower plants with an installed capacity of 500 kW each over the next five years.

[27] Fella Maschinenbau GmbH, Survey November 2014 (Translated from German)

Private sector partner:	Fella Maschinenbau GmbH
Total project cost:	€ 296,000
BMUB funding:	€ 148,000
Duration:	12/2010–02/2014
Pilot facility:	Planned: Small hydropower plant with a dive turbine at a low head location, yet to be identified
Local implementing partner:	• Co-operation with a local supplier of steel components, A&F d.o.o.
Training and capacity building:	• None, as the pilot facility was not implemented
Awareness raising measures:	• Kick-off workshop with the project partners • Project presentation at a public meeting with local authorities and residents of Jajce as part of a democratic approval process for the building of the demonstration facility • Project presentation at the local university, Zenica
Co-operation with local multipliers:	None
Publications and informational material:	• Presentation of dive turbines • Technical and economic concept for implementing the planned Centov most power plant at the Jajce site • Training documents for implementing small hydropower plants via dive turbines
Reduction of energy and carbon emissions at pilot companies:	No information available
Potential for reducing energy consumption and carbon emissions following market penetration:	Annual carbon savings potential of around 7,906 tonnes via five planned small hydropower plants with 500 kW each
Partner performance during project and outlook for the future:	• Spin-off of the turbine business into the Dive Turbinen GmbH & Co. KG • Solid sales performance and positive outlook due to good positioning in the Balkans

3.15 | Model home that demonstrates energy efficient construction, Kazakhstan – Petroline GmbH

Kazakhstan has the largest and strongest economy in Central Asia. However, energy consumption in buildings is around 50% to 60% higher than in Western countries due to a lack of environmental awareness and expertise in the field of energy efficiency.

Vast amounts of energy are lost due to poor insulation and outdated heating systems powered by coal-fired plants working at full capacity. This loss is attributable to both the new buildings, as well as the prefabricated constructions, that dominate the urban landscape. Recently launched government building and refurbishment programmes have provided good opportunities to have a positive impact on the country's climate performance, while at the same time opening up sales prospects for German companies with manufacturing and sales operations in the fields of building insulation, heating and air conditioning, refurbishment, and energy consumption metering.

Against this backdrop, the aim of the climate partnership with Petroline was to improve energy efficiency in buildings over the long term. To demonstrate the advantages of energy and resource efficient construction methods, the project involved construction of a 190 square metre model home, equipped with a solar system based on German energy saving regulations and sensors for effective monitoring.

As a concrete step toward building local capacities, Petroline implemented an external training centre for basic and advanced courses for local skilled workers on heat pumps, heating technology, sealing and insulation technology, and solar technology. Course fees are ploughed back into hiring external training staff so that the project can self-finance after the necessary infrastructure has been created.

A faculty-training co-operation agreement has been signed with a local university, and efforts are being made to obtain official accreditation for the courses. In addition to the training courses, informational events for architects, building owners and the relevant government agencies have been held, along with tours of the model home.

The intensive efforts made to transfer knowledge proved to be the right approach and a factor for success in this partnership. Six local construction companies have signed up their staff for training at the training centre, due to the current lack of specialists and next year's courses are already fully booked. Petroline estimates that 90% of their follow-on contracts are ascribable to the climate partnership.

"The project has entirely fulfilled its function as a door opener. Even if we are currently only at the beginning, we assume that with our current order books and continuing positive business, we can save a considerable amount of conventional heating energy over a period of three to five years – and thus reduce carbon emissions."[28]

[28] Petroline GmbH, Final Report, October 2014 (Translated from German)

PETROLINE GmbH
Berliner Allee 3 • 30855 Langenhagen

Private-sector partner:	Petroline GmbH
Total project cost:	€ 500,000
BMUB funding:	€ 199,000
Duration:	12/2012–10/2014
Pilot facility:	Individually manufactured 190 square meter model home with a solar system, a 17 kW compact heating pump system, stations for fresh water, and a solar energy system, including sensors for analysing data for continuous monitoring
Local implementing partner:	• Contract concluded and implemented by a subsidiary, Petroline Bau T.O.O.
Training and capacity building:	• Eight elementary courses for five to ten attendees, on heating technology, including certification • Eight elementary courses for five to ten attendees on sealing and insulation technology, including certification • Eight advanced courses for five to ten attendees on heating technology, including certification • Eight advanced courses for five to ten attendees on sealing and insulation technology, including certification • Introductory course on energy-efficient construction at a local university, with 17 attendees • Theoretical and practical training of Kazakh trainers in various German specialist firms, to ensure the success of training going forward
Awareness raising measures:	• Ten informational events with a total of 114 attendees from the relevant sectors
Co-operation with local multipliers:	• Co-operation agreement with a local university on faculty training
Publications and information material:	• Detailed training documents on heating technology and sealing and insulation technology for elementary and advanced courses
Reduction of energy and carbon emissions at pilot companies:	Annual carbon emissions savings of 10 tonnes in the model home
Potential for reducing energy consumption and carbon emissions following market penetration:	Annual carbon emissions savings potential of 5,400 tonnes for an estimated heated area of around 100,000 square meters, using carbon neutral geothermal energy
Partner performance during project and outlook for the future:	• Contracts running into the millions concluded during the project period, attributable to project implementation

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DEG – Deutsche Investitions- und
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Kämmergasse 22
50676 Cologne, Germany
Box 10 09 61, 50449 Cologne, Germany
Phone +49 221 4986-0
Fax +49 221 4986-1290

info@deginvest.de
www.deginvest.de

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KFW DEG

DEG – Deutsche Investitions- und
Entwicklungsgesellschaft mbH
Kämmergasse 22
50676 Cologne, Germany
Phone +49 221 4986-0
Fax +49 221 4986-1290
info@deginvest.de
www.deginvest.de