SOLARUS

Impact Report October 2015

PREPARED BY TRUCOST

SOLARUS

TRUCOST

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ABOUT TRUCOST

Trucost helps investors to understand the economic consequences of natural capital dependency in order to identify risk and opportunity from growing natural resource pressures and environmental costs.

Natural capital liabilities such as carbon, water, resource use, pollution and waste are threatening the ability of our natural ecosystems to deliver economic growth. The impact is already being felt through volatile commodity prices linked to extreme weather events, pollution impacts and natural resource constraints.

We provide the world's most comprehensive natural capital data representing 93% of global markets by market capitalisation to support the investment community in evaluating the environmental efficiency of companies and their supply chains, analysing portfolios against benchmarks, and creating new products.
Key to our approach is that we not only measure natural capital risk in physical quantities, we also apply a financial value to provide an overarching metric for risk and opportunity analysis.

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1. CEO OVERVIEW

Solarus Sunpower BV is an innovative renewable energy company that develops and markets hybrid concentrated solar photovoltaic and solar thermal (C-PVT) panels that supply clean and low cost heat and electrical energy for residential and industrial customers. By combining photovoltaic and solar thermal technology, Solarus' PowerCollectors™ are capable of harnessing up to four times more of the available solar irradiation compared to conventional photovoltaic products on the market. This increased efficiency allows Solarus to displace more fossil fuel based energy, whilst reducing the cost of energy generation and making the technology attractive in both developed and developing country markets.

Solarus' customers range from residential homeowners through to large industrial companies. Wherever electricity and heat are needed, Solarus has potential customers. Thanks to accelerating advances in storage technologies for both heat and electricity, the benefits to Solarus' clients will only improve with time. To date, Solarus' main markets have included Sweden, the Netherlands and South Africa, and the company plans to expand its sales into South East Asia, India and Southern Europe in 2016. Solarus works with local technology, marketing, logistics and installation partners in each target market to create local employment opportunities.

Solarus' vision is: to create the most compelling solar organization of the world by driving the transition toward access to sun power for the people. Solarus' corporate strategy and business model have been developed to deliver on this commitment. Solarus seeks to join the Social Stock Exchange (SSX) to gain access to socially responsible investment that will enable it to expand its capacity and operations, and further its goals to create social and environmental value for the communities it serves.

Solarus is a certified B Corp member and embodies the commitment to social and environmental performance, accountability, and transparency that this certification represents. Solarus believes that these ideals are closely aligned with that of the SSX, and that membership of the SSX will aid Solarus in further strengthening its commitment to social and environmental value.

Organisational Summary

The history of the Solarus PowerCollector begins in 1998 when the Research and Development (R&D) wing of Vattenfall, an energy utility operating primarily in the Nordics, Germany and the Netherlands, began research into solar heat collection technologies. In 2006, this activity spun off as Solarus, which now seeks to take this innovative technology to market. However, it was not until early 2014 that Solarus effectively emerged from the R&D phase to realign its focus squarely on active market engagement.

Solarus Sunpower BV is now a private company based in Venlo, the Netherlands. Solarus develops, produces and markets hybrid solar PowerCollectors in international markets. Solarus has established large-scale production capacity for its PowerCollector products and is focused on accelerating international distribution over the next three years.

Solarus now employs 22 staff: five at the R&D center in Sweden, ten at the primary production, sales and marketing facility in Venlo, and seven staff operating as local sales, project management and support teams in South Africa, India and South-east Asia. Manufacturing in Venlo is outsourced to a local investment partner, Janssen Distribution Services. Solarus also works with an ever expanding network of local distributors and installers across Western Europe, South Africa, Namibia, India, Turkey, South-east Asia, Abu Dhabi and Brazil. Solarus' customers include private persons, businesses, communities and governments.

In many respects, Solarus resembles a start-up company in a rapid expansion phase of development. This requires management systems that evolve strategically in response to emerging challenges and opportunities, combined with structured processes for reporting, stakeholder engagement, and quality control that ensure that the business expands in accordance with our social and environmental values.

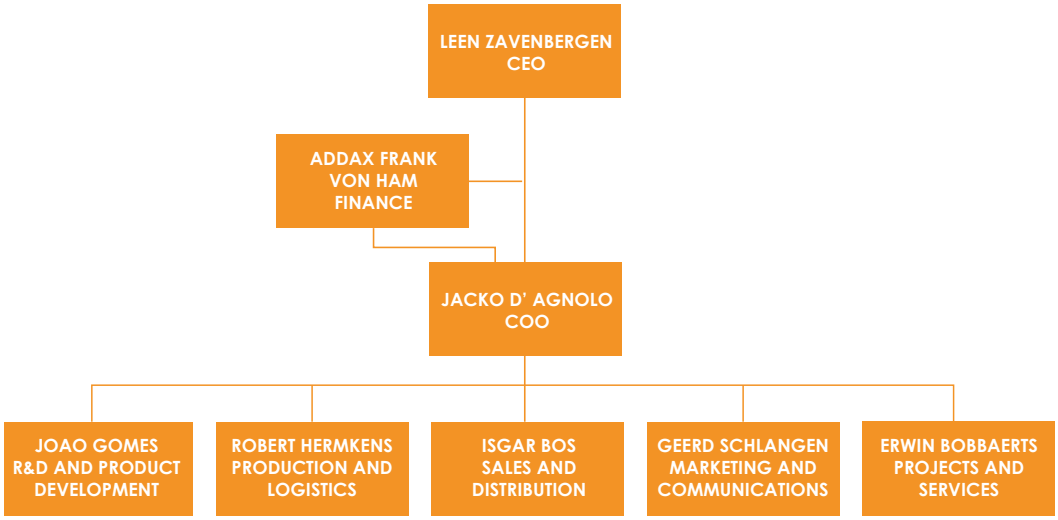
Key members of the Solarus management team include:

- **Leen Zevenbergen**, CEO. Leen has 30 years' experience as an entrepreneur working in 20 international start-up advanced technology companies, and for several multinational businesses.
- **Jacko D'Agnolo**, COO. Jacko has 25 years' experience in entrepreneurship, specialising in technology and technology start-ups and as a general senior manager mainly in telecommunication and professional service firms.
- **Geerd Schlangen**, CMO. Geerd has 30 years' experience in international marketing and brand building.
- **Joao Gomes**, Research Director. Joao has extensive experience in solar research having worked for Swedish universities as well as the European Organisation for Nuclear Research (CERN).

Our supervisory board consists of:

- **Göran Lundgren**, Chairman, has extensive international energy experience with both Vattenfall and ABB.
- **Catharina Ringborg**, member of the Board, is a senior consultant to the International Energy Agency (IEA) in Paris and international experience with ABB.
- **Anders Wijkman**, member of the Board, is a member of the Swedish Royal Academy of Sciences and has held previous positions within Red Cross, United Nations and European Community.
- **Gerrit-Jan Baars**, member of the Board, is CEO of Thermaflex and has 30 years' experience in thermal energy and is actively involved in building the development of Solarus.
- **Dick Hak**, member of the Board, is CEO of Rabobank South of Limburg and has over 30 years' experience in banking and financing

The chart below provides an overview of how Solarus business is structured.



Commitment to Social Value

Solarus believes that it can help improve the quality of life for communities across the globe by embracing innovative business models that provide local solutions to local needs. In addition to directly addressing energy poverty, a key focus of the UN-Energy group and an issue highlighted by the International Energy Agency (IEA), Solarus will address unemployment in its primary international markets by partnering with local licensees and installation and distribution partners.

Specifically, Solarus seeks to deliver on the following social and environmental objectives:

- Reducing energy poverty by providing access to low cost and environmentally sustainable electric and thermal energy.
- Addressing climate change by reducing global dependency on fossil fuel based energy technologies and increasing the use of low-carbon C-PVT technology.
- Reducing exposure to local air pollution in developing countries by displacing common water heating practices that rely on the burning of coal and biomass.
- Creating local employment opportunities in developing countries in sales, distribution and installation.

Solarus energy has an organization-wide commitment to each of these objectives, which are fully aligned with its core business and product offering. Solarus is committed to measuring and regularly disclosing information on its social and environmental performance through the company's annual Impact Report and direct engagement with its partners, stakeholders and customers. Solarus is certified as a B Corp (Benefit Corporation) and is a member of the international B Corp organization of companies

Solarus is also committed to transparent and robust reporting on the social and environmental impacts of the company. This will be achieved through Solarus' annual impact reports to the SSX, annual reports to its shareholders and stakeholders, active engagement with its partners and stakeholders, and via communication on Solarus' website. As the company grows, Solarus will develop new channels and strategies to better communicate and transparently report on progress against the company's social and environmental objectives.

2. SOCIAL PURPOSE & CONTEXT

The Challenge

Greenhouse gas (CO_2e) emissions from energy generation and heating represent a major driver of global climate change. Presently, 47% of total global energy consumption is directed to heating and cooling demands (Andrea Maurano, 2015). Of this energy, 70% percent is currently generated using greenhouse gas emitting fossil fuel technologies (IEA, 2014). Climate change is already impacting upon human and natural systems on all continents of the earth (IPCC, 2014), and these impacts are expected to intensify over the coming century if significant action is not taken to reduce emissions of greenhouse gases. In 2010, parties to the United Nations Framework Convention on Climate Change (UNFCC) agreed to reduce greenhouse gas emissions such that climate change is limited to no more than two degrees Celsius (UNFCC, 2014). However the path to achieving this goal is unclear. Scenario analysis by the International Energy Agency (IEA) suggests that if the world is to have an 80% chance of achieving this goal, the share of renewable energy in world electricity generation must grow to 57% by 2050 (IEA, 2013)

The need to transition to a low carbon, and largely renewable, energy system comes at a time when 1.3 billion people, or 18% of the global population, live without access to electricity and 40% of the world's population rely on solid biomass fuels for cooking (IEA, 2015). The potential for energy poverty to increase as a result of strong action on reducing greenhouse gas emissions represents a key trade-off in the fight to address climate change (Urge-Vorsatz, 2012). This trade-off can be avoided through the use of innovative renewable energy technologies that reduce greenhouse gas emissions and energy costs simultaneously. Solarus has developed an integrated solar heat and electricity generation system that delivers clean and low-cost energy for household or industrial use. Solarus' PowerCollector C-PVT panels are highly adaptable and can be implemented in a range of contexts to supply energy for building heating and cooling, electricity supply, energy storage or the purification and desalination of water. The flexibility with which Solarus' technology can be employed enables Solarus to empower local communities to create local energy solutions that address local problems.

A key objective for Solarus is to reduce energy poverty and improve quality of life in developing countries, many of which (such as South Africa and India) are located in regions with significant untapped solar energy resources, which further enhance the efficiency of C-PVT technology. For Solarus, this offers a "win-win", as the company can both grow its business while simultaneously delivering access to clean, affordable solar energy. Furthermore, by helping to reduce household expenditure on energy, Solarus' products can help release additional disposable income for households to spend on healthcare, education or to invest in future income-generating activities. The benefits of Solarus' technology also extend to customers in developed countries by providing a cost-effective solution to deliver secure and reliable off-grid energy whilst insulating against future increases in energy prices. This holds great potential to help address energy poverty in Europe

Solarus did not choose India and South Africa as the primary initial markets based on an arbitrary sense of opportunity. These target markets were chosen on the basis of the significant scope to deliver social and environmental benefits through the rapid adoption of C-PVT technology.

Mission Statement

Solarus' mission is to: **"offer the most efficient means of collecting solar power to empower communities and individuals to improve their socioeconomic circumstances while minimizing their environmental impact"**.

Solarus' mission and objectives are closely aligned with the United Nations' Sustainable Development Goals, and the company's activities directly or indirectly contribute to achieving a number of these goals, as described in Table 1.

TABLE 1: ALIGNMENT OF SOLARUS' MISSION WITH THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

UN GLOBAL SUSTAINABLE DEVELOPMENT GOAL	ALIGNMENT WITH SOLARUS' MISSION
Goal one: end poverty in all its forms everywhere	Fundamental to Solarus' market approach is the objective of ensuring local employment through a network of licensed manufacturing and distribution partners.
Goal seven: ensure access to affordable, reliable, sustainable and modern energy for all	With a conversion efficiency of approximately 70 percent (combined heat and electricity), Solarus stands out as the clear industry leader on the road to achieving this goal.
Goal eight: promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all	Unskilled and unemployed youth in developing nations can be employed as assembly line staff, after little training. With the increase in local demand for Solarus' solutions, the skill development will continue to uplift the staff.
Goal nine: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation	The products developed are a result of robust research and development, upholding innovation in its truest sense. It believes that industrial requirements, such as hot water, can be provided for in a sustainable manner.
Goal ten: reduce inequality within and among countries	Convenient access to energy remains a contentious element of unequal societies. Moreover, the "psychological" divide between the wealthy and the poor is reinforced by the utilities they have access to. By providing a technology to both ends of the wealth (inequality) spectrum, Solarus will contribute to narrowing the divide.
Goal thirteen: take urgent action to combat climate change and its impacts	The trend to transition from rural to urban lifestyles in emerging economies is accompanied by a massive increase in energy consumption. Solarus provides a renewable alternative to fossil fuels for both electricity and heating that contributes significantly to climate change and is thus an active combatant against climate change.

Organisational Strategy and Alignment with Our Social and Environmental Purpose

Solarus was established with the express purpose of driving the adoption of highly efficient renewable energy technology in the developed and developing world, providing access to clean and low-cost energy whilst displacing energy from fossil fuels. As the social and environmental benefits that Solarus delivers derive largely from the performance of the PowerCollector technology, further expansion of our manufacturing and sales operations to new markets will further enhance Solarus' capacity to create social and environmental value. Solarus' commitment to delivering on its values is evident in the company's decision to expand into developing markets in Africa and Asia where the PowerCollector technology has the greatest potential to create a positive impact.

As a certified B Corp, Solarus has adopted robust organizational values and high standards of social and environmental performance, transparency and accountability. As a relatively newly established business, B Corp principles have formed the foundation of Solarus' social and environmental strategy. However, the company is committed to developing and strengthening its capacity to measure, monitor and deliver on the social and environmental value that the company seeks to create. Solarus is confident that the company's commitment to its social and environmental objectives will ensure that the business stays true to its mission through this current period of rapid expansion and into the future.

3. WHO BENEFITS?

Solarus aspires to be an equitable and sustainable business that shares its success with all those actively participating in the value chain, as well as society and the environment. For developed nations, reducing greenhouse gas and other polluting emissions remains an important challenge, while many developing nations have an opportunity to leapfrog the "dirty energy" phase of development and transition directly and cost effectively to a clean energy system. In fact, the market is rapidly approaching the "tipping point" for renewable energy where established renewable technologies are becoming cost competitive with conventional energy sources. Solarus is positioned to provide the aforementioned countries with the best technology to implement smart solutions. The following section describes the key beneficiaries of Solarus' activities and the way in which they benefit:

The Customers

Solarus' customers represent the company's primary direct beneficiaries and comprise a diverse group of stakeholders ranging from households, public authorities, through to commercial operations. Key benefits afforded to each of Solarus' major customer groups are described below.

Households: Solarus' PowerCollector technology can be implemented at a small scale for the benefit of individuals and households across a broad range of applications in the developed and developing world. Fuel poverty is extensive in the developing world with over 18% of the global population living without access to electricity, and with 40% without access to clean energy for cooking (IEA, 2015). Fuel poverty is also increasing in developed countries where access to energy networks is extensive, yet the rising cost of energy prevents access to adequate energy supplies for many low-income households. For example, in South Africa electricity prices have risen at 8% per annum in recent years – well above the rate of consumer price inflation – and prices are expected to increase in the future (Eskom tariff hike: '8% still too much', 2015). Research by Groves (2011) highlights the benefits of solar water heating roll-out schemes, such as the Kuyasa project in South Africa, in which low-income households benefit from 50-60% cost savings through the replacement of paraffin and electric heating systems.

Solarus' products offer households a simple, cost-effective hybrid renewable energy solution, which can supply up to 50% of the energy needs of a typical household. The PowerCollector technology can be adapted for use in diverse applications depending on the needs of the community. For example, PowerCollectors can be implemented in developing countries such as South Africa or India to provide access to electricity for general use (or to supplement grid electricity) whilst also supplying hot water for cooking and bathing, displacing the common practice of heating water using coal or biomass burning. In developed countries, PowerCollectors may be used to provide a low cost and low carbon means of heating swimming pools or providing hot water supplies for households. Other potential applications include using PowerCollectors to power small-scale desalination plants to supply clean drinking water.

Currently, poor communities in South Africa spend up to 25 percent of household income on electricity, the majority of which is for heating in one form or another. Due to the low cost of energy produced by the PowerCollector system, the savings accrued can be spent on educating children, buying more nourishing food, and accessing medical checks and treatment, leading improvements in quality of life for low income households.

Solarus has developed simplified installation processes for small-scale PowerCollector applications to ensure that even very small-scale installations deliver real cost benefits for customers.

Table 2 demonstrates the energy cost savings realised by Solarus customers by comparing the cost per kWh generated by the PowerCollector system to the average cost of energy in selected developed and developing country markets.

TABLE 2: AVERAGE COST PER KILOWATT HOUR FOR SOLARUS POWERCOLLECTORS AND COMMON ALTERNATIVE TECHNOLOGIES IN DEVELOPED AND DEVELOPING COUNTRY MARKETS ($US, 2015)

	CONVENTIONAL ENERGY COST (€ 2014 per kWh)	SOLARUS ENERGY COST (€ 2014 per kWh)	REDUCTION IN ENERGY COST PER kWh (%)	SOURCES
Cost per kWh in Developing Country Market	0.076	0.048	37%	Solarus Data (Average electricity prices around the world: $/kWh, 2015)
Cost per kWh in Developed Country Market	0.173	0.125	28%	Solarus Data (EUROSTAT, 2015)

Key Assumptions

- Typical cost per kilowatt-hour of heat and electricity produced by Solarus PowerCollectors in each market was supplied by Solarus.
- Typical cost per kilowatt-hour supplied by the most common alternative technology in each market was estimated based on data from Eurostat (2015) and; (Wilson, 2015)
- The developed and developing country scenarios represent India and the Netherlands respectively.

Rural/Isolated Communities: Energy insecurity is common in developing countries where many people face volatile energy prices and unreliable (or non-existent) energy supplies from centralised energy networks. These challenges are most significant for the millions of South African families that do not have access to low-income housing – estimated at over 1 million in Cape Town alone – and are forced to live in illegal shanty towns. Solarus' PowerCollector technology can offer a low-cost solution to deliver electricity, heating and potentially purified water, to even the most disadvantaged members of the community. Solarus offers customers a low cost and secure option for generating decentralised heat and electricity in the homes or at business sites. In South Africa, rebates are currently offered by the government for the installation of solar water heaters. Rebates range from USD 273 to USD 747 depending on the size of the system purchased and its associated electricity saving potential. The Department of Energy has set an ambitious target of installing 1.3 million high-pressure solar hot water units in South Africa. Solarus is setting up a manufacturing facility in South Africa to meet growing demand resulting from the rebate, along with cost saving that can be achieved (Global Solar Thermal Energy Council , 2014).

Lack of electricity infrastructure is one of the main hurdles in the development of rural India. India's grid system is considerably under-developed, with major sections of its populace still surviving off-grid. As of 2004, there were about 80,000 villages without access to electricity in the country. Of these villages, 18,000 could not be electrified through extending the conventional grid. Distributed generation in rural areas and support for latent urban demand has the potential to reach 4 GW by 2020 and increase rapidly to more than 10 GW over the next three to four years after 2020 (S.P. Srivastava, 2013). The capacity to capture and store energy anywhere in the world, without the need for investment in network infrastructure, creates a multitude of opportunities to empower individuals and communities in remote regions beyond the reach of the electricity grid.

Industry and Business: Low-cost sources of low-grade heat (generally considered to be heat below 370 degrees celsius) are in high demand across industry sectors ranging from hotels and gyms, to textile factories and food processing. Solarus' PowerCollectors provide an efficient and economical source of low-grade heat to partially or completely supply the demand of these processes, thereby reducing reliance on conventional heating solutions that are becoming increasingly costly. Furthermore, PowerCollectors can provide an integrated decentralised solution for cooling, desalination, heating and steam, which can be customised as per requirement of the customer.

Schools and Universities: Schools, universities and other public buildings demand significant quantities of hot water to supply student bathing facilities and swimming pools. Solarus' PowerCollectors offer an alternative to conventional gas or solar hot water systems that can reduce energy costs, making additional funding available for investment in services for students. Solarus' is also developing educational programs targeting schools that aim to develop understanding and an interest in sustainability among the next generation. Solarus' hopes that this will contribute to raising a generation of leaders that are committed to social and environmental sustainability, and the UN Sustainable Development Goals.

Public Health

Air pollution is a significant environmental health hazard that was responsible for over 3.7 million premature deaths globally in 2012 (WHO, 2014). Energy production from fossil fuels is a significant source of air pollutant emissions to ambient air, which can be transported by wind to impact on the health of individuals living far from the source. In developing countries, indoor air pollution due primarily to the use of solid biomass fuels for heating and cooking, presents an even more significant risk to health. The World Health Organization (WHO) ranked indoor air pollution as the second largest environmental contributor to poor health following unsafe water and sanitation (WHO, 2015)

In addition to reducing reliance on fossil fuel powered electricity, Solarus' PowerCollectors provide an alternative to traditional biomass and coal burning for the supply of hot water for cooking and bathing. This provides a dual benefit of avoiding air pollutant emissions within the household and at large-scale power plants.

Table 3 presents estimates of the quantity of air pollution emissions avoided per Solarus PowerCollector panel installed in each of Solarus' target markets. As Solarus has not yet been able to measure the air pollution reduction benefits realised through the operation of the PowerCollector system in practice, these benefits have been estimated based on modeling using robust life cycle inventory data sourced from the Ecoinvent database (Weidema et al, 2013). The results presented represent the difference between the estimated life cycle emissions of particulate matter (PM10), nitrogen oxides (NOx) and sulfur dioxide (SO2) associated with Solarus' products and the life cycle emissions of the energy technologies that they replace in the following scenarios:

- **South Africa and India (Developing Country Markets):** Solarus PowerCollectors are assumed to replace heat from coal-fueled stoves and electricity from the national electricity grid.
- **Sweden, the Netherlands, Spain, Italy and Belgium (Developed Country Markets):** Solarus PowerCollectors are assumed to be primarily used for heating swimming pools and replace heat pump heaters powered by electricity.

As shown, the greatest impact on air pollution is achieved in the developing country markets due to the displacement of highly polluting coal stoves and the relatively high emissions intensity of the national electricity grids in South Africa and India. Air pollutant emissions reductions are also significant in developed country markets. In all markets and across all pollutants, air pollutant emissions are reduced by in excess of 90%.

TABLE 3 A NET AIR POLLUTANT EMISSIONS REDUCTIONS PER ANNUM PER POWERCOLLECTOR INSTALLED IN SOLARUS TARGET MARKETS

TARGET MARKET	NET AIR POLLUTANT EMISSIONS REDUCTION COMPARED TO THE DISPLACED TECHNOLOGY (kg per panel per annum)						SOURCE
	PM_{10}	%	NO_x	%	SO_2	%	
Developing Country Markets							
South Africa	3.6	99%	2.6	99%	8.8	99%	Solarus Data Ecoinvent Database (Weidema et al 2013)
India	4.2	99%	2.3	98%	8.5	99%	
Average per PowerCollector	3.9	99%	2.4	98.5%	8.7	99%	
Developed Country Markets (Sweden, The Netherlands, Belgium, Spain and Italy)							
Average per PowerCollector	0.6	92%	0.7	95%	1.4	93%	

Key Assumptions

- Life cycle air pollutant emissions per kilowatt-hour of electricity produced by the national electricity grid in each target market were estimated based on data extracted from the Ecoinvent database (Weidema, et al., 2013), applying the ReCiPe impact assessment methodology (Goedkoop M., 2009).
- Life cycle air pollutant emissions associated with heating supplied by coal stoves were assumed to be equivalent to heat production from hard coal briquette stoves of 5-15kW capacity as reported in the Ecoinvent database (Weidema, et al., 2013), applying the ReCiPe impact assessment methodology (Goedkoop M., 2009).
- Life cycle air pollutant emissions associated with swimming pool heaters in Europe were assumed to be equivalent to those of an air water heat pump of 10kW capacity as reported in the Ecoinvent database (Weidema, et al., 2013), applying the ReCiPe impact assessment methodology (Goedkoop M., 2009).
- Life cycle air pollutant emissions associated with Solarus' PowerCollector product were estimated by combining records from the Ecoinvent database (Weidema, et al., 2013) for a conventional solar photovoltaic panel of 3kW capacity and a conventional copper plate solar collector hot water system, and scaling for relative energy generation and surface area.

The Environment

A key advantage of the Solarus PowerCollector system, whether it is implemented to supply heat, electricity or both, is its capacity to deliver energy with zero direct greenhouse gas emissions during the operation phase. While GHGs are emitted in the manufacture, transport, installation and disposal of the PowerCollector, these emissions are negligible when compared with the emissions associated with fossil fuel based energy in Solarus' key target markets. As such, Solarus' PowerCollector technology offers significant opportunities to deliver net reductions in GHG emissions in both developed and developing country markets. This will support national governments in achieving their GHG emissions reduction commitments under the UN Framework Convention on Climate Change, and ultimately make a contribution to limiting the health, social and environmental impacts of climate change.

Table 4 presents the annual net GHG emissions avoided per Solarus PowerCollector installed in each of Solarus' target markets. As Solarus has not yet been able to measure the actual emissions avoided in practice due to the installation of the PowerCollector system, this benefit has been estimated based on the scenarios described in the previous section and drawing on data from the Ecoinvent database (Weidema et al, 2013). The net GHG emissions reductions represent the difference between the estimated life cycle emissions associated with each PowerCollector installed and those of the technologies that are replaced in each scenario (as described in the previous section). As shown, GHG emissions are reduced by more than 95% compared conventional technologies in all of Solarus' target markets.

The GHG abatement benefits of Solarus' PowerCollectors will only increase as global demand for energy increases worldwide, particularly in the developing world. Furthermore, these modelled GHG abatement benefits do not account for specific measures adopted by Solarus to make the company less carbon intensive. These include local sourcing of components for PowerCollector manufacture and the distribution of manufacturing operations across the key markets to reduce the need to transport finished products long distances to market. Solarus also relies heavily on e-materialisation techniques to minimise unnecessary resource use and virtual mobility to reduce staff travel, in an effort to reduce the company's carbon footprint.

TABLE 4 ANNUAL NET GREENHOUSE GAS EMISSIONS (tonne CO_2e) REDUCTION ACHIEVED THROUGH THE DISPLACEMENT OF CONVENTIONAL ENERGY SOURCES WITH SOLARUS POWERCOLLECTORS IN KEY MARKETS

TARGET MARKET	NET GREENHOUSE GAS EMISSIONS AVOIDED PER POWERCOLLECTOR (TONNES CO_2e PER ANNUM)	PERCENTAGE REDUCTION IN GREENHOUSE GAS EMISSIONS AVOIDED PER POWERCOLLECTOR PER ANNUM (%)	SOURCES
Developing Country Markets			Solarus Data Ecoinvent Database (Weidema, et al., 2013)
South Africa	1.7	99%	
India	1.8	99%	
Average per PowerCollector	1.7	99%	
Developed Country Markets (Sweden, The Netherlands, Belgium, Spain and Italy)			Solarus Data Ecoinvent Database (Weidema, et al., 2013)
Average per PowerCollector	0.5	97%	

Key Assumptions

- Life cycle greenhouse gas emissions per kilowatt-hour of electricity produced by the national electricity grid in each target market were estimated based on data extracted from the Ecoinvent database (Weidema, et al., 2013), applying the ReCiPe impact assessment methodology (Goedkoop M., 2009)).
- Life cycle greenhouse gas emissions associated with heating supplied by coal stoves were assumed to be equivalent to heat production from hard coal briquette stoves of 5-15kW capacity as reported in the Ecoinvent database (Weidema, et al., 2013), applying the ReCiPe impact assessment methodology (Goedkoop M., 2009).
- Life cycle greenhouse gas emissions associated with swimming pool heaters in Europe were assumed to be equivalent to those of an air water heat pump of 10kW capacity as reported in the Ecoinvent database (Weidema, et al., 2013) applying the ReCiPe impact assessment methodology (Goedkoop M., 2009).

- Life cycle greenhouse gas emissions associated with Solarus' PowerCollector product were estimated by combining records from the Ecoinvent database (Weidema, et al., 2013) for a conventional solar photovoltaic panel of 3kW capacity and a conventional copper plate solar collector hot water system and scaling for relative energy generation and surface area.

The Underprivileged and Unemployed

There is a positive association between access to solar water heaters and the alleviation of poverty in South Africa (Ellis, 2015). Solar water heater technology reduces the need for unsafe, less clean and more expensive fuels such as paraffin for water heating; improves indoor air quality; decreases fire safety risks associated with the use of traditional biomass for fuel; and reduces household expenditure.

According to the South African government, Solar Water Heating technology has the potential to create 100,000 jobs through local manufacturing of systems and the emergence of an installation and maintenance industry. However, there is a shortage in available skills within the industry, which has the potential to be four times as labor-intensive as the conventional electric hot water geyser industry in South Africa (Gonclaves, D., 2011). Solarus addresses this problem by promoting the employment of low- or unskilled workers who are given training as assembly line staff or installation technicians. Solarus currently works with local licensees and installers to reach customers in remote areas. The growth in Solarus' business will provide an invaluable source of income for the families of these local operators.

Table 5 presents Solarus' targets for direct and indirect employment in developing country markets by 2016 based on projected sales growth and expansion to new markets. As shown, Solarus expects to employ over 25 staff in India and South Africa respectively by 2016 in roles relating to PowerCollector assembly, sales, logistics and installation.

TABLE 5. SOLARUS PROJECTED FULL TIME EQUIVALENT EMPLOYMENT BY 2016 IN KEY TARGET MARKETS

TARGET MARKET	FULL TIME EQUIVALENT EMPLOYMENT POSITIONS BY 2016	SOURCE
India	25	Solarus Data
South Africa	25	
Total Solarus	50	

Competitive Advantage

Solarus operates in the highly competitive renewable energy technology market across multiple countries in the developed and developing world. This presents challenges in maximising the company's competitiveness with alternative renewable and fossil fuel based energy technologies in each market, and increasing the company's capacity to expand its market share and reach into new markets. Solarus has a number of key competitive advantages that will aid the company in achieving its commercial goals social and environmental impact objectives:

- **Cost effective Proprietary C-PVT Technology.** Solarus has developed and owns the rights to an innovative integrated C-PVT panel technology capable of achieving significantly higher efficiency than competing solar panel technologies on the market today. This enables Solarus to deliver renewable energy solutions across a range of

applications at a lower cost per unit of energy produced than its competitors, which are largely focused on producing either photovoltaic or solar thermal panels. Solarus' superior cost competitiveness will enable the company to access key markets in the developing world where demand for energy is rapidly increasing but energy poverty remains a significant concern.

- **Established Partnerships.** Solarus has established strategic partnerships with leading manufacturing firms and logistics and installation service providers that will provide Solarus with strong and efficient distribution channels into its target markets in the developed and developing world.
- **Patented Technology.** Solarus' PowerCollector product range is based upon a suite of patented technologies including proprietary concentrator optics and solar collector design, the use of composite materials in high temperature collectors, the photovoltaic hybrid design, solar thermal absorber technology, and a range of other novel component designs. This provides a barrier to potential competitors in the market and positions Solarus as a leader in state of the art research and development in solar power technology.
- **Customised Decentralised Solutions.** Solarus' PowerCollector panels are modular and can be scaled and adapted to address the needs of the company's customers across a wide range of energy supply applications. This includes the application of the PowerCollector panels for electricity supply, heating, cooling, water purification, desalination, steam production, and drying, or any combination of these applications. This flexibility positions Solarus as highly adaptable and agile in the market, enabling the company to capture new opportunities as they emerge. Furthermore, the flexibility of the system enables the empowerment of local communities to design energy solutions that address their specific local needs.

4. ACTIVITIES & OPERATIONS

Solarus' Core Activities

Solarus' core business activities are grouped around the following key functions:

- **Marketing, Sales and Technical Support:** Solarus' marketing and sales support activities, along with project management support, are centralised at the company's headquarters in Venlo, the Netherlands. This office supports sales and marketing across all of the markets in which Solarus operates.
- **Manufacturing and Assembly:** Solarus' first production facility was established in Venlo, the Netherlands, and has a production capacity of 500 PowerCollector units per week. The production facility incorporates a sophisticated testing and quality assurance division, where all PowerCollectors produced are evaluated for defects and output rated prior to distribution and sale. In the future, Solarus plans to shift the assembly of the PowerCollectors to local assembly facilities in the target markets, with specific high-value components manufactured in Venlo and shipped to the local facilities. This approach will aid the creation of local employment and economic opportunities whilst reducing product transport.
- **Research and Development:** Solarus was founded as a spin-off of the R&D division of Vattenfall Europe and has a strong foundation in research. The company draws on patented technologies developed through close collaboration between senior engineers at Vattenfall and scientists affiliated with Universities in Sweden and elsewhere in Europe. This research and development activity is ongoing and will remain one of the pillars of Solarus' operation – hosted by the Swedish office in Gävle (north of Stockholm).
- **Licenses and Strategic Partnerships:** Solarus head office in the Netherlands coordinates and oversees the company's strategic partnerships and licencee relationships across all of the company's target markets. Solarus is investing heavily in the development of a network of local distribution and installation partners that will enable expansion into new markets with reduced capital investment, whilst contributing to the creation of economic opportunities in the target markets. Solarus' initial focus markets in this regard include South Africa, a country with a carbon-intensive energy system, and India, a country with high energy poverty and unreliable grid electricity supplies. Solarus' distributed network of local installers will be key to the company's expansion; however, Solarus will continue to monitor the outsourced activities to ensure consistency and quality. Solarus also partners with established energy and engineering businesses in order to provide complete bundled energy solutions to suit a range of common energy requirements.
- **Environmental and Social Value Management:** Solarus operates under a triple-bottom-line management system in which the company measures its performance based not only on its financial performance, but also on its social and environmental performance. This approach is consistent with Solarus' certification as a B Corp and as a prospective member of the Social Stock Exchange. This management system is reliant on accurate and timely monitoring of the company's social and environmental performance, and Solarus is investing in enhancing its capacity to collect and monitor this data. Key principles that Solarus has adopted to support its social and environmental value creation include: embracing the local work force; creating local jobs; and delivering locally relevant solutions to achieve an environmental net benefit.

Linking Business Activities to Social Outcome

Table 6 described how Solarus' core business activities are linked with, and deliver outcomes for, our beneficiaries in accordance with their needs.

TABLE 6: LINKING BUSINESS ACTIVITIES WITH SOCIAL AND ENVIRONMENTAL OUTCOMES

ENGAGEMENT WITH BENEFICIARY	ACTIVITIES	OUTCOMES (OR CHANGES EXPECTED) FOR BENEFICIARIES
Customers: Homeowners	Site assessment and design of tailored energy solutions to meet household needs. Installation of household scale PowerCollector systems. After sales technical support.	Access to cost effective household heat and electricity Increased energy securing through increased resilience to service interruption and future energy price rises by reducing household dependence on centralised energy sourced by up to 50%.
Customers: Rural/Isolated Communities	Design and installation of off-grid heat and energy solutions that do not depend in established grid infrastructure or significant inputs After sales technical support	Access to cost effective and clean heat and electricity for communities beyond the reach of national energy grid systems, or subject to unreliable energy supplies. Increased energy security and resilience in periods of electricity grid service interruption. Reduced electricity costs relative to grid energy supplies.
Customers: Industry and Business	Site survey and assessment. Design and installation of large-scale PowerCollector systems that are tailored to the specific needs of diverse industrial applications. After sales technical support.	Access to cost effective and clean low-grade heat for use in industrial processes. Reduced energy costs resulting in potentially increased competitiveness. Increased energy security and protection of business continuity where grid energy supplies are interrupted.
Customers: Schools and universities	Site survey and assessment. Design and installation of large-scale PowerCollector systems that are tailored to specific applications such as the provision of hot water for bathing, or heating of swimming pools. After sales technical support. Provision of educational programs for students focusing on the environment and sustainable development.	Reduced energy costs and increased resilience to future rises in the price of conventional energy sources. Release of operating funds that would otherwise be spent on energy, for use to improve student education and services. Access to support for environment and sustainability education.

ENGAGEMENT WITH BENEFICIARY	ACTIVITIES	OUTCOMES (OR CHANGES EXPECTED) FOR BENEFICIARIES
Underprivileged and unemployed	Provision of unskilled employment opportunities and on-the-job training opportunities. Creation of opportunities for the establishment of new small businesses to be contracted as Solarus installers.	Increased employment opportunities for disadvantaged opportunities. Development of technical and work skills that are demanded in the market. Opportunities for career development. Flow on benefits to families and communities associated with reduced unemployment. Decreased income inequality in disadvantaged communities.
The Environment	Installation of PowerCollectors to displace fossil fuel based energy at the household and industrial scale. Use of smart logistics, local sourcing and telepresence technologies to minimise product transportation and staff travel.	Reduced greenhouse gas emissions from energy generation where Solarus products displace fossil fuel based energy sources. Reduced carbon intensity of households and businesses.
Public Health	Installation of PowerCollectors to displace fossil fuel based energy at the household and industrial scale.	Reduced emissions of harmful air pollutants such as NOx, PM10 and SO2. Reduced health and environmental impacts associated with outdoor and indoor air pollution.

5. STAKEHOLDERS

Table 7 described Solarus' key stakeholder groups and the means by which the company engages with them in the implementation of its business model and creation of its social and environmental value.

TABLE 7: SOLARUS KEY STAKEHOLDER GROUPS AND ENGAGEMENT STRATEGIES

STAKEHOLDER	DESCRIPTION AND ENGAGEMENT
Customers	Solarus' residential, business and public sector customers represent its most important stakeholder and are the conduit through which much of the company's social and environmental value is created. The installation of Solarus PowerCollectors at customer properties enables the displacement of conventional fossil fuel energy and enables Solarus to deliver reductions in greenhouse gas and air pollution emissions. Solarus' customers benefit directly from reduced energy costs associated with the effective design, skilled installation and low-cost energy generation capacity of the PowerCollector product. They also benefit indirectly from the environmental and health benefits which all members of society share. Solarus will soon implement remote monitoring of the PowerCollector installations to actively monitor energy production and inform the development of future generations of the technology. Solarus business model is highly responsive to needs of its customers, whether they are households, industrial facilities or remote communities, and regardless of their location in the developed or developing world. Solarus specialises in the design of PowerCollector systems that are adapted to meet the end-use needs of customers. Solarus' marketing and support teams regularly engage with customers to better understand their needs and devise strategies to improve the service the company provides.
Staff	Solarus' operations are expanding at a rapid rate and this has required the recruitment of additional staff and the establishment of partnerships with strategic partners and licensees, which also employ staff. Solarus' direct and indirect employees benefit from fulfilling employment under good working conditions, and with opportunities to develop their skills and capabilities through training. Solarus employees also have opportunities for advancement within the organization as their careers develop.
Students	Solarus has a strong background in R&D and works in close collaboration universities and colleges. This collaboration creates opportunities for between five and ten students to engage in research projects in partnership with Solarus each year. This offers an invaluable opportunity for students to gain experience in commercially oriented research while making a contribution to Solarus' social and environmental impact. These students also have opportunities to join the Solarus research team as employees in the future. Solarus' senior researchers are also in the process of establishing research programs outside Europe in the company's target markets.
Distribution and Installation Partners	Solarus is committed to collaboration with the company's extended network of local distribution and installation partners. Solarus benefits from the extensive local market knowledge of its partners, and works with them to design locally appropriate energy solutions in Solarus' target markets. Solarus partners share in the economic benefits of the sale of the company's products, creating flow-on benefits for the local economies in which they operate.
Suppliers	Solarus is establishing partnerships with suppliers of components and services in the creation of a supply chain that supports sustainable procurement and efficient sourcing. Solarus has strong working relationships with suppliers in Sweden, Italy, China, USA, Germany and Netherlands. This includes an established relationship with Wacker Chemie AG for the supply of silicon, Ecoprogetti for the supply of tabbing equipment, Scheuten Glas for the supply of high durability glass panes and AP Systems for the supply of electrical micro inverters. Solarus works closely with each of these partners to create business relationships that generate value for all parties.

STAKEHOLDER	DESCRIPTION AND ENGAGEMENT
Investors	Solarus has received investment totaling over €8 million since its establishment from investors including banks, industrial corporations, investment funds and private individuals in Sweden, Netherlands, South Africa, India, USA, and Germany. Solarus regularly communicates with its investors through its annual reporting processes, meetings and ad-hock reports to individual investors.
Governments	Solarus seeks cooperation with local governments (mainly municipalities) to devise and develop energy solutions that benefit local communities. This includes, for example, projects to provide heat and energy to off-grid communities, and the supply of low-cost energy to affordable housing projects for underprivileged communities.
Sustainable Business Organizations	Solarus has relationships with the following sustainable business organizations: • **B Corp:** Solarus is a certified B Corp (Benefit Corporation) and is a member of the international B Corp organization of companies. Worldwide over 4,000 companies have joined B Corp to support its promotion of ethical business principles. • **Zero Emissions Research Initiative:** Solarus is affiliated with the Zero Emissions Research Initiative (ZERI), a global network of over 3,000 scientists and scholars focused on the development of zero emissions solutions. • **Blue Economy:** Prof. Gunter Pauli, writer of The Blue Economy, has mentioned and included Solarus as one of the building blocks for sustainable development of local economies. Prof. Pauli is pro-bono advisor for Solarus and introduces the company to local governments around the globe.
Technology Partners	Solarus has established partnerships with leading technology developers to produce novel applications of the PowerCollector technology. This includes a partnership with the Dutch company, Advanced Waste Water Solutions BV (AWWS), to develop a solar powered desalination product; and Thermaflex for the joint installation of heat distribution networks connected to PowerCollector generators.

6. EVIDENCING SOCIAL VALUE

Solarus is committed to the robust measurement, monitoring and verification of the social and environmental value that the company creates, and communicates this to its beneficiaries, stakeholders and the public through reporting and active engagement. Solarus' social and environmental value derives from the performance of the company's innovative products and a business model and strategic growth strategy that emphasizes the creation of shared value for its customers, partners and stakeholders. As such, Solarus' social and environmental value will only grow as the company expands to access new markets and applications of the PowerCollector technology.

As a newly established company, Solarus has not yet collected comprehensive primary data on the social and environmental benefits created by its products as utilised by its customers. As such, Solarus has estimated the social and environmental impacts of its products based on robust modeling and published environmental datasets, and used this to set future impact targets. As Solarus develops and expands, the company will invest further in developing the capacity to measure and monitor its impact in the real world, in order to improve the robustness of the company's reporting, disclosure and strategic planning. The modeling methodologies and data sources underpinning the targets set in the following table are described in Section three of this report.

Evidencing Social and Environmental Impact

TABLE 8: SOLARUS' SOCIAL AND ENVIRONMENT TARGETS

BENEFICIARY	OUTCOME	INDICATOR	TARGET				DATA SOURCES
Customers	Reduced Fuel Poverty	Percentage reduction in heat and electrical energy costs per kWh realised via the displacement of conventional energy sources with Solarus PowerCollectors	India- 37%				Solarus Data (EUROSTAT, 2015) (Wilson, 2015)
			Netherlands- 28%				
		Total annual renewable heat and electrical energy (MWh) generated by Solarus PowerCollectors installed in 2016*	Country	Solarus Heat energy	Solarus Electricity		Solarus Data
			India	64843	10249		
			South Africa	81934	12951		
The Public	Reduced Health Risks Associated With Exposure to Air Pollution	Annual net reduction in air pollution emissions (kg) per annum per PowerCollector installed for the displacement of conventional energy sources	Country	NOx	SOx	PM	Solarus Data Ecoinvent Database (Weidema, et al., 2013)
			India	2.3	8.5	4.2	
			South Africa	2.5	8.7	3.5	
			Europe	0.7	1.3	0.6	
		Annual net reduction in air pollution emissions (tonnes) per annum due to the displacement of conventional energy sources with Solarus PowerCollectors installed in 2016*	Country	NOx	SOx	PM	Solarus Data** Ecoinvent Database (Weidema, et al., 2013)
			India	66	243	120	
			South Africa	92	316	128	

BENEFICIARY	OUTCOME	INDICATOR	TARGET		DATA SOURCES
The Environment	Contribution to Combating Climate Change by Reducing Greenhouse Gas Emissions	Annual net CO_2e emissions avoided (kg) per Solarus PowerCollector installed via displacement of conventional energy sources	India	1800	Solarus Data Ecoinvent Database (Weidema, et al., 2013)
			South Africa	1664	
			Europe	493	
		Total annual net CO_2e emissions avoided (tonnes) via displacement of conventional energy with Solarus PowerCollectors installed in 2016*	India	51252	Solarus Data** Ecoinvent Database (Weidema, et al., 2013)
			South Africa	59877	
Staff	Creation of Employment Opportunities	Number of new full time equivalent employment positions created in India and South Africa in 2016 by Solarus ***		50	Solarus Data

*India:28470 panels, SA:35974 panels
**Data only available for developing countries
***India:25 staff; South Africa:25staff

Current Management

Solarus was established with the objective of increasing access to solar power as a clean and economically competitive source of electricity and heat, whilst creating employment and business opportunities in the markets in which the company operates. This has lead to the integration of Solarus' social and environmental objectives into the company's business model and growth strategy. To date, Solarus has initiated the following activities to enhance the social and environmental value that the company creates:

- Solarus solicits feedback from its stakeholders on its social and environmental performance through an online stakeholder forum.
- Solarus has identified key performance metrics to guide the collection of monitoring data and enable the company to measure progress in the delivering of its social and environmental objectives.
- Solarus' business strategy actively supports poverty alleviation throughout the company's supply chain by prioritizing partnerships with cooperatives and small businesses with fewer than fifty employees.
- Solarus is investing in smart logistics, local sourcing of components, and local assembly facilities to reduce the need to transport its products to markets across the globe, along with the environmental impacts associated with this.
- These initiatives represent just the beginning of Solarus' efforts to maximise the company's social and environmental value. Solarus remains a newly established start-up business and has not yet commenced full-scale commercial scale of its products. As a result, the potential to increase its social and environmental impact as the company grows is great.

Solarus already monitors its impact on its stakeholders and gathers data on its social and environmental performance in order to meet the requirements of its B Corp certification. Solarus plans to increase its capacity in this area as the company grows to allow it to improve disclosure and reporting on the company's impact, and to better inform the management team and its strategic planning and business development activities. The influence of Solarus' social and environmental objectives on the company's business strategy is evident in its choice of initial expansion markets, targeting countries with the greatest need for renewable energy, and in its focus on sharing the value created by its products through local sourcing, local assembly and the creation of local distribution and installation partnerships. This integration of social, environmental and financial value creation will be further strengthened as Solarus develops and expands.

Future Commitments

Solarus is committed to continuously improving its processes for monitoring and managing its social and environmental impacts. Solarus plans to grow rapidly over the next five years and will invest in improving its monitoring and reporting capacity to improve its robustness and verifiability. Specifically, Solarus commits to undertake the following actions in the next year to improve the monitoring of its social and environment benefits:

- Solarus will establish a partnership with the University of Stellenbosch Sustainability Institute to better understand the needs of poor communities in South Africa and devise novel locally appropriate energy solutions. These solutions will be trialed in local areas before the implementation of lessons learned in future products in South Africa and elsewhere.
- Solarus will engage with local partners to develop new applications of its Solar Collector technology to meet specific community needs, including a planned oven heating system for local bakeries, and a containerised cooling system for the storage of refrigerated food.
- Solarus will develop a strategy and plan to undertake a cradle to grave evaluation of the full range of components and inputs to the company's products, and the packaged solutions that the company offers in conjuction with other equipment manufacturers. This activity will be supported by one of Solarus' current investors, Thermaflex, and a recycling partner that is yet to be identified. This cradle to grave assessment will provide Solarus with a more detailed understanding of its social and environmental impacts across the supply chain, enabling the identification of impact 'hotspots' and more effective targeting of investment to improve the company's social and environmental performance.

Solarus also makes the following future commitments to improve its impact monitoring and reporting capacity in the longer term:

- Increase on-site environmental monitoring in the most common applications of the PowerCollector technology to better understand its environmental performance in practice, and the types of energy technologies that it replaces. This will enable Solarus to more accurately quantify and report on the greenhouse gas and air pollution reduction benefits achieved.
- Investigate the feasibility of developing new impact measurement methods to enable the quantification of a broader range of environmental and social impacts, such as the impacts of employment creation, energy security, and economic development.

- Set quantitative and time-bound targets for future impact based on measured impact data and robust future sales projections. The targets presented in this first impact report are based primarily on modelling and will be refined in future years based on improved access to real-world monitoring data.
- Investigate the feasibility of adopting a company-wide formal environmental management system such as ISO 14001.
- Develop training programs for installers and technicians employed by Solarus partners to improve their technical skills and the quality of the service they provide. This will be achieved by, for example, engaging with the South African Renewable Energy Technology Centre (SARETEC) regarding the potential collaborative development of a generalised training program focusing on the installation of solar thermal systems, with a specialization option focusing on the Solarus PowerCollector system. These discussions are currently at an early stage but will be advanced in future.

7. OTHER SUSTAINABILITY & REPUTATIONAL ISSUES

Note on Potential Negative Externalities

Key potential impacts associated with solar energy systems relate to the occupation of land, demand for scarce minerals and the energy required to manufacture the solar collectors. While it is acknowledged that Solarus' products are likely to create negative impacts in these areas, they are expected to be lower than that of competing solar power systems due to the significantly higher efficiency of Solarus' systems. This increase in efficiency reduces the number of panels (and the material, energy and land) required to supply the energy requirements of a given application. Furthermore, any potential negative impacts are expected to be small relative to the scale of the social and environmental benefits delivered by Solarus' products and activities. As noted in Section six, Solarus is investing in its capacity to measure its social and environmental performance, and will be better placed to quantify and mitigate any significant negative impacts in the future.

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