

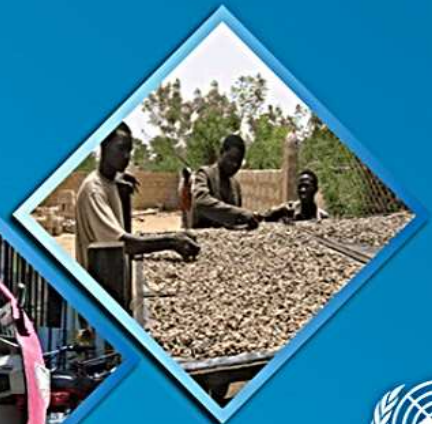
2016



2ND ANNUAL UN DESA ENERGY GRANT

“Powering the Future We Want”:

Eight Organizations that Reached the Top



UNITED NATIONS



Foreword



The 2016 “Powering the Future We Want” UN DESA Energy Grant highlighted noteworthy initiatives by innovative organizations making a positive and sustainable impact in the field of energy for sustainable transport. The Energy Grant Programme represented an opportunity to showcase some of the best examples that demonstrate how science, technology and innovation can be put into practice to induce change and to transform the world by providing tangible results in support of access to safe, affordable, accessible and sustainable transport systems for all.

Close to a quarter of energy-related greenhouse gas emissions come from transport and these emissions are projected to grow substantially in the years to come. The United Nations is committed to working together with stakeholders to ensure the availability of safe, universally accessible, reliable, secure, affordable, fuel-efficient, environmentally friendly, low-carbon, and climate-resilient transport services, systems, infrastructure and operations, with due attention to local, national and regional circumstances.

The eight finalists of the 2016 Energy Grant Programme presented projects ranging from sustainable maritime transport, to urban electric buses with state-of-the-art technology, to compressed air mechanization for emissions-free vehicles. The finalists demonstrated through their initiatives and actions on the ground how they are contributing to the United Nations vision of sustainable energy, as embodied in the 2030 Agenda for Sustainable Development. We recognize their commitment to enhancing the role of sustainable transport in connecting people and communities to jobs, schools and health care and to the delivery of goods and services to rural and urban communities.

Reflecting on the success of the second year of the Energy Grant Programme and on the number of very inspiring applications received, I am confident that this Programme will continue to provide valuable support in the implementation of the 2030 Agenda for Sustainable Development and the goals and targets relating to energy and transport. The significant capacity building opportunity that the Grant Programme has created is a distinguishing feature, and this feature will continue as workshops, seminars and practitioner-to-practitioner training opportunities disseminate and transfer the knowledge and experience associated with the Grant. It is not only a million dollar Grant; it is a partnership effort to catalyse sustainable and meaningful change for our collective energy future.

I am grateful to the High-level Steering Board and the Advisory Council members for their guidance and valuable support. I also recognise the leadership and commitment of the China Energy Fund Committee (CEFC), whose funding support has made this Grant Programme possible.

Energy is an essential factor for sustainable development and access to sustainable energy should be secured for every man, woman, and child on this earth. We look forward to the implementation of the 2017 Grant Programme and to continuing this important initiative in the future.



Mr. Wu Hongbo

Under-Secretary-General for
Economic and Social Affairs

Acknowledgments



The United Nations Department of Economic and Social Affairs (UN DESA) would like to express its gratitude to the 8 finalists that submitted inputs for this publication. In addition, thank you to each representative who attended the Capacity Development Seminar in December 2016 for playing an integral role in the success of the event and for being instruments of capacity building and knowledge sharing to all of those in attendance.

UN DESA would also like to thank the China Energy Fund Committee (CEFC), an NGO with Special Consultative Status to the UN Economic and Social Council (ECOSOC), for sponsoring the US \$1million Energy Grant; without this generous contribution, the grant programme would not be possible. Thank you for encouraging and rewarding excellence in the field of global energy.

Lastly, sincere gratitude is expressed to the Energy Grant Secretariat for their continued work in promoting the grant programme.

For more information please visit the grant website: <https://poweringthefuture.un.org/>

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Abbreviations

ADB	Asian Development Bank
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ANME	National Agency for Energy Conservation
BF	Buksh Foundation
BE	Buksh Energy
CEFC	China Energy Fund Committee
CO ₂	Carbon Dioxide
CREST	Center for Research in Engineering Sciences and Technology
DRF	Disaster Risk Financing
DSIR	Department of Scientific and Industrial Research
ESCO	Energy Servicing Company
E-trike	Electric Tricycle
GCF	Green Climate Fund
ITF	International Transport Forum
KPIT	Kirtaney Pandit Information Technologies
LAML	Lighting a Million Lives
NAMA	Nationally Appropriate Mitigation Action
NREAP	National Action Plan for Renewable Energy (NREAP)
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic
RE	Renewable Energy
SE4ALL	Sustainable Energy for All
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organization)
TERI	Technical and Energy Research Institute
TPM	Transporte Público Colectivo de Medellín
UN DESA	United Nations Department of Economic and Social Affairs
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

I. Introduction

In September 2015, Member States adopted the 2030 Agenda for Sustainable Development which includes 17 Sustainable Development Goals (SDGs) and 169 corresponding targets. SDG7 is a stand-alone energy goal that calls to "Ensure access to affordable, reliable, sustainable and modern energy for all." In 2016, the thematic focus of the grant was "energy for sustainable transport", which addresses both SDG7 and Target 11.2 of SDG11, which calls to "provide access to safe, affordable, accessible and sustainable transport systems for all..."

Prior to the 2030 Agenda for Sustainable Development, Member States realized that there had been success stories in advancing sustainable development but that the international community was not doing enough to replicate and scale up best practices and lessons learned from successful experiences. Member States encouraged the UN system to do more to identify and publicize best practices and lessons learned, in collaboration with Governments, business, civil society and other stakeholders. In response to this call, and to advocate for the SDGs, the grant programme aims to promote best practices while also featuring a strong capacity building component in support of the implementation of the 2030 Agenda.

In the context of 2030 Agenda for Sustainable Development, and recognizing the importance of advancing implementation in sustainable development through partnership initiatives to address gaps in implementation, UN DESA and the CEFC have agreed to strengthen and promote success stories and best practices in advancing energy for sustainable development building on past experiences. As part of the promotion of best practices, an annual grant is provided to individuals and/or institutions which have demonstrated leadership and ingenuity in promoting sustainable development, for replication and/or scaling up.

It was agreed to implement this initiative for an initial period of 5 years, from 2015 until 2019. The implementation process included the creation of a Grant Secretariat, an Advisory Council and a High-Level Steering Board. For its second award, the UN DESA Energy Grant received 156 applications. The winner was selected through a rigorous review and objective assessment of these applications, undertaken in multiple stages, guided by the Advisory Council and High-level Steering Board.

The 2016 Grant programme has been successfully implemented and the winner was announced at an Award Ceremony at United Nations Headquarters, New York on 14 December 2016. Secretary-General Ban Ki-moon gave opening remarks at the ceremony, "The transport sector is responsible for nearly a quarter of energy-related greenhouse gas emissions. It also has significant public health impacts," said the Secretary-General at the Award Ceremony. "The answer is not less transport – it is sustainable transport. We need transport systems that are environmentally friendly, efficient, affordable, and accessible," he said.

The US \$1million UN DESA Energy Grant was awarded to SINTEF, an independent non-profit research institute based in Norway. The project "Solar Fuelled Electric Maritime Mobility"

seeks to demonstrate the feasibility and the social, economic and environmental benefits of solar-fuelled electric boat transport in Tunisia and the wider region. It is implementing this demonstration project in partnership with the National Agency for Energy Conservation of Tunisia. The project in Tunisia combines many of SINTEF's research areas, like marine technology, solar energy, power systems, and future transport systems.

SINTEF will use the grant to develop technology for a traditional ferry, or other vessel with a plug-in hybrid electric powertrain and to construct an electric charging point. It will help also support data collection and analysis.

The project aims to generate the data and evidence needed to replicate sustainable transport in the region. It seeks to demonstrate the benefits of low cost electric vessels as key transport between coastal cities in the region, with a view to encouraging other stakeholders to implement such transport on a larger scale. This would in turn benefit the low- and middle-income parts of the population. The project will also contribute to the avoidance of transport related greenhouse gas emissions and air pollution, and it will help to prevent and reduce marine pollution.

Furthermore, the project will conduct capacity development workshops for Tunisian and other regional stakeholders, the preparation of a Tunisian Nationally Appropriate Mitigation Action (NAMA) to be submitted to the UNFCCC portal, as well as public outreach activities to spread knowledge of this low-cost, sustainable transport solution.

After the Award Ceremony and the announcement of SINTEF as the grant recipient, the UN DESA Energy Grant Secretariat hosted a two-day Capacity Development Seminar for the grant participants. The objectives of the seminar were to build capacities on best practices and successful implementation of energy for sustainable transport projects, and address challenges related to providing access to safe, affordable, accessible and sustainable transport systems for all.

At the Capacity Development Seminar, the eight finalists were given the opportunity to disseminate their experiences and knowledge in the implementation of their projects and programmes. Representatives gave statements and presentations to all participants, which included members of the Advisory Council, United Nations staff, international and national development organizations, and academia and students from universities.

II. Grantee Acceptance Speech, SINTEF

Alexandra Bech Gjørsv, President (CEO)

14 December 2016



"Your excellences, ladies and gentlemen,

We are deeply honoured that the United Nations Department of Economic and Social Affairs has selected SINTEF as the recipient of this year's "Powering the Future We Want" – energy for sustainable mobility - grant. Thank you very much!

And congratulations to all the other nominees – it is truly an impressive panel.

As the CEO of SINTEF, I have the privilege to work – every day - with incredibly talented researchers from more than 70 nationalities. Almost a small United Nations...

Our researchers come from all over the world, to work in a small country – sometimes dark and cold - at the outskirts of Europe. I believe what motivates them is what motivates me: SINTEF vision; "Technology for a better society".

And what is at the core of that vision?

I believe you have best described it yourself, Mr. Secretary-General:

"Energy is the golden thread that connects economic growth, social equity, and environmental sustainability" – the key ingredients of a "better society".

This Award really is for my SINTEF colleagues. For their daily dedication, perseverance and commitment to science and research for our vision.

Moez Jomâa, who is with me here today, is a great example. A scientist who works as a solar silicone expert in our Materials and Chemistry institute. He has inspired his Norwegian colleagues in SINTEF Ocean and SINTEF Energy to cooperate in developing a cross disciplinary project for a solar powered ferry in his homeland, Tunisia.

Hopefully, our project will be setting an example, inspiring a development that will make a meaningful contribution to combatting climate change, and using ships to make transportation efficient, safe and affordable to the billions of people living in coastal areas around the globe.

The project is drawing on SINTEF's long term, and extensive research projects to make renewable energy, batteries, grid operations and sea borne mobility more cost effective – and competitive - compared to well established technologies based on fossil fuel.

SINTEF is an independent, not-for-profit, applied research foundation, based in Norway. We were spun out from the Norwegian University of Science and Technology – NTNU – more than 65 years ago. Since then, we have grown to an organization of 2000 employees, working across a wide array of technologies and sectors of society. NTNU is still our most important research partner.

SINTEF's hallmark (probably because of our very low base funding) has always been to direct our research ambitions into the "triple helix" space – a close involvement with industry partners and with governments, for high impact research, focusing on industrial development to tackle societal challenges.

While most of SINTEF's research work is with Norwegian partners or part of the research programmes of the European Union, we also have significant involvement in technology transfer and the promotion of sustainable technologies in the developing world. This includes health and welfare projects in Africa, clean water projects in Africa and Asia, and climate gas reduction projects in the cement industry in India, China and Myanmar. In all these projects, national and local governments and institutions play a critical role. And a key challenge is always to draw on research developed in one part of the world, and adapt the solutions both to the physical, but not least to the economic conditions of the host country.

Hence, this Award is also for our project partners; Ecole Nationale d'Ingenieur de Tunis, Regional Environmental Center in Hungary, European Centre for Women and Technology and, in particular, the Tunisian Agency for Energy Conservation (ANME). ANME has the mission to promote the Tunisian Solar Plan aiming to achieve the target of 30% solar in the electricity mix by 2030. SINTEF is standing together with ANME in order to build competences and capacities required to tackle not only the technological, but also the legal and financial bottlenecks hindering the development of this plan.

And finally:

This is the first "Powering the Future We Want"- award given out after the COP 21. This historic conference where, thanks to the extraordinary efforts of the UN and the Secretary General, the countries of the world managed to unite around the Paris Agreement to save our climate. In that sense, this Award is – fundamentally - for humanity. We really need to get our act together – and I am somewhat of an optimist.

While there are some political clouds on the horizon, our day-to-day experience in SINTEF is that the Paris Agreement, curiously combined with the strong wave of interest in digital technology, has given a new push for disruptive, new thinking around resource use, energy efficiency and climate change.

Electricity and transportation stands for more than half of the world's climate gas emissions, and deserve the world's strong attention. Sustainable transport requires new technologies for cars, buses, ferries, trains, planes, fuel infrastructure and energy storage. Unless transport in the future is fueled by renewable energy, such as solar power, it will be difficult to achieve a sufficient reduction of greenhouse gas emissions, especially in urban areas, which are already built around cars.

SINTEF's home country, Norway, is an energy nation and a maritime nation. We see this recognition by the United Nations of SINTEF's role in sustainable development as a reflection of our starting point.

Thanks to Norway's multiple mountains, with waterfalls and winds, we are used to getting 100 percent of our electricity from renewable energy. We are pushing hard on our mathematic models and our laboratories to ensure the safe and efficient integration of more and more variable, renewable energy into the power grid across Europe. And Norway is taking steps to electrify society. By today, Norway has the highest electric vehicle concentration in the world! 5% of all cars are electric or plug-in hybrids and 28% of all new car sales are electric or plug-in hybrids.

From the hydropower, we have also developed a strong Norwegian science and industry base, turning that clean natural resource into valuable industrial products, such as solar cell silicone, in a sustainable way. Hence our northern country is playing some part in the phenomenal opportunity that clean solar energy represents for the world.

The Tunisian ferry project combines SINTEF's energy capabilities with the other area where we see Norway and SINTEF really making a contribution that matters on a global scale; harnessing the opportunities of the oceans in a sustainable way.

A climate friendly future will have to involve a much higher proportion of food, energy and materials coming from the sea than today. It will also, most likely, involve a higher portion of goods and passenger transportation moving on ships; reducing congestion and costs of infrastructure in coastal areas.

We think the ships will gradually be powered by electricity, and be designed for autonomous operations - not needing crew - thereby reducing operational costs and enabling much more

energy efficient ship design and the use of ships in sustainable, small and large scale transportation.

Jaques Cousteau once said: "The sea, the great unifier, is man's only hope. Now, as never before, the old phrase has a literal meaning: we are all in the same boat."

And, in climate change terms, we sure are – in New York, in Norway, and in Tunisia.

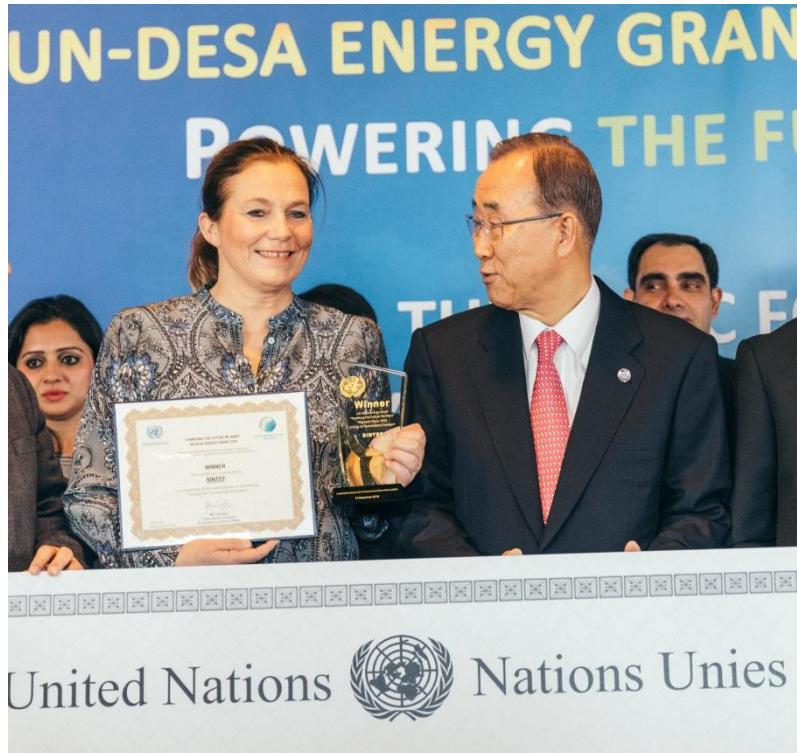
Jaques Cousteau was of course a great explorer. Working with research is also by its nature explorative. It is most exciting when you discover something unexpected!

Recently, SINTEF put an electric engine into a small local fishing boat. What was the biggest change for the fisherman? The peace and quiet out at sea! The much stronger ability to sense the ocean and the life within it. A surprisingly big change of experience, he said – the full consequences yet to be understood.

Well, I am really eager to get that solar ship demonstration under way in Tunisia, and study it in operation to see what we can learn for a sustainable future.

On behalf of SINTEF, thank you to the United Nations for your eternal commitment to sustainability. And thank you again to UN DESA for this magnificent award, and for recognizing the role of a research institution in delivering the ingredients of sustainable mobility!"

a. SINTEF
2016 Grant Recipient



Introduction

SINTEF is a non-profit research institute, organised as a foundation with subsidiary companies. SINTEF utilises its outstanding solution oriented research and knowledge production to generate significant value for its Norwegian and overseas clients, the public sector, and society as a whole. SINTEF's vision is *Technology for a Better Society*.

SINTEF's head office is located in Trondheim and it conducts most of its activities in Trondheim and Oslo. SINTEF has operational centres in several locations in Norway under the umbrella of the SINTEF Foundation and its subsidiary companies. SINTEF has established a partnership and joint strategy with the Norwegian University of Science and Technology (NTNU) in Trondheim. SINTEF also has close working relationships with the

University of Oslo, as well as a number of other Norwegian and overseas research institutes. These partnerships contribute to SINTEF's high levels of technical quality and strong international profile.

SINTEF's role is to assist in the development of society by means of contract research projects and innovation. SINTEF's main aim is to be a world-leading research institute which, together with its clients in the private and public sectors, develops solutions to some of the great challenges facing society today. SINTEF's overall strategy document outlines five joint areas of focus: renewable energy, climate-related and environmental technologies, oil and gas, ocean space technology, health and welfare, together with enabling technologies such as ICT, advanced materials, and biotechnology. This strategy is being followed up both at the eight institutes and at a variety of affiliated companies. It places great emphasis on the concept of "One SINTEF". This entails making use of the best skills and expertise available across the SINTEF organisation as a means of safeguarding its role in society and meeting its clients' needs.

Approach

Transport represents almost a quarter of Europe's greenhouse gas emissions and is the main cause of air pollution in cities (refer to Figure 1). The transport sector has not seen the same gradual decline in emissions as other sectors: emissions only started to decrease in 2007 and still remain higher than in 1990 (refer to Figure 2). Within this sector, road transport is by far the biggest emitter accounting for more than 70% of all GHG emissions from transport in 2014.

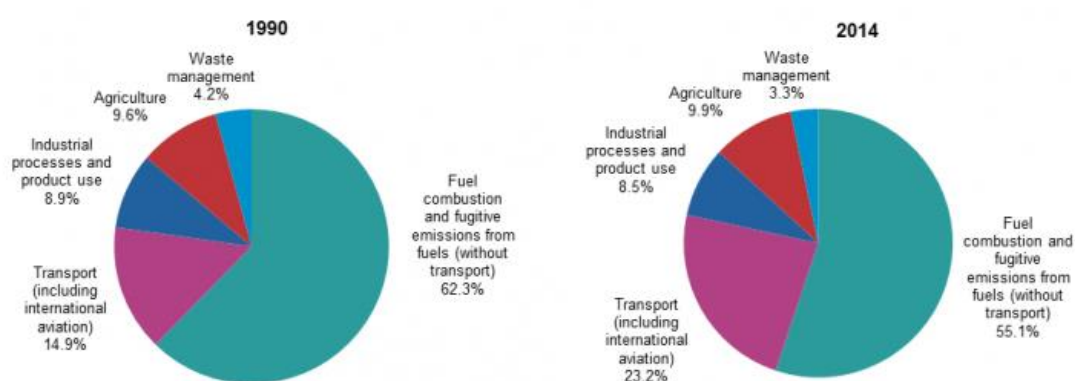


Figure 1: Greenhouse gas emissions in Europe, analysis by source sector, EU-28, 1990 and 2014. Source: European Environment Agency

SINTEF aims at promoting renewable energy fuelled electric maritime mobility. In addition to low emissions, ferries with electric propulsion have significant potential for providing

affordable public transportation services not dependent on the existing road infrastructure by diverting passenger traffic away from roads. If well designed, electric ferry routes can also decrease travel distances. In this respect, SINTEF is addressing all four approaches for mitigating transport related greenhouse gas emissions: efficiency gains, fuel switch, modal shift and transport demand moderation.

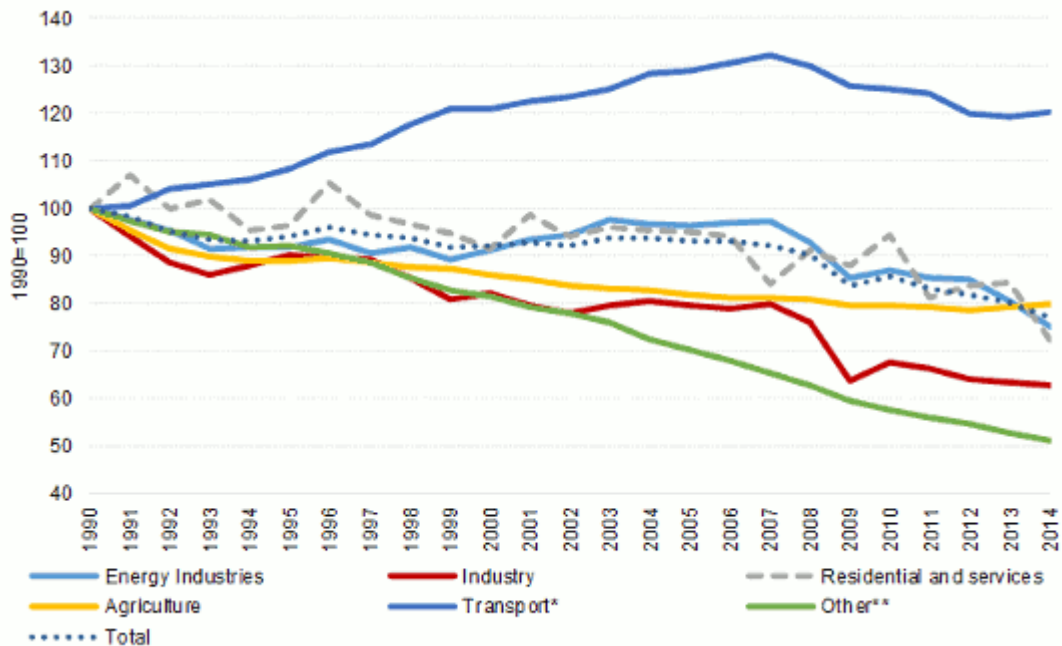


Figure 2: Evolution of GHE in Europe by sector in the period 1990-2014. Note: * Transport includes international aviation but excludes international maritime; ** Other includes fugitive emissions from fuels, waste management and indirect CO₂ emissions. Source: European Environment Agency.



SINTEF has comprehensive expertise in renewable energy and electric and sustainable mobility that when put together will develop a viable technical solution for low carbon public transport. SINTEF's approach on promoting this type of sustainable mobility is by demonstrating its potential and viability in a region where solar energy has great potential. Based on data collected from real operation conditions, social, economic and financial analyses will be performed to assess the viability of this transportation mode. Awareness by the public of the benefits of the renewable energy based public transport solutions is another pillar that needs to be achieved in order to promote sustainable mobility.

Achievements

Sustainable transport requires new technologies for cars, buses, ferries, fuel infrastructure and energy storage. SINTEF has extensive expertise in these technologies. Unless transport is fuelled by renewable fuel, such as solar, it will be difficult to achieve a significant reduction of greenhouse gas emissions, especially in urban areas which are already built around cars. Energy and transport must be integrated with city planning for complementary solutions. SINTEF's approach to sustainable mobility is resolving the main technical challenges hindering the development of carbon emission free society. Sustainable mobility encompasses four main technical challenges: 1) intelligent transportation systems; 2) affordable renewable energy sources; 3) energy efficiency and; 4) cost effective energy storage systems (refer to Figure 3).



SINTEF's approach to sustainable mobility

SINTEF, through its extensive existing and former projects has contributed to making renewable energy, batteries and electric mobility more cost effective and competitive to well established technologies based on fossil fuels. Through several international cooperation and projects, SINTEF has contributed to the technology transfer and the promotion of sustainable technologies to several developing countries.

Here are a few highlights from SINTEF's achievements in sustainability:

SINTEF's Energy Lab



One of SINTEF's recent achievements in renewable energies was the opening in 2015 of the SINTEF Energy Lab. This is one of Europe's most advanced laboratories of its kind, and is where SINTEF is developing the environmentally-friendly energy solutions of the future. Society-at-large relies on robust and reliable electricity supplies, and the new laboratory will be used to test and develop components for the renewable energy systems of the future – on land, offshore, and on the sea bed. The laboratory is a large structure. The high-voltage hall alone has a ceiling height of 24 metres. It is 5 metres wide, 30 metres long, and is the first building of its kind worldwide to be built on 'passive house' principles. No-one has previously attempted to comply with passive house standards for a building of this size. SINTEF's total investment in the Energy Lab is NOK 170 million, financed in its entirety by SINTEF Energy Research.

Renewable Energies

Without having energy from renewable energy sources it will not be possible to achieve a reduction in GHG emissions from the transportation sector. Renewable energy will increasingly replace fossil fuels as a future energy source. The world needs an energy revolution that will require large investments in new solutions and infrastructure. SINTEF partners with industry and government agencies to create more efficient, less polluting and more flexible energy solutions. Wind, solar and hydropower are among the energies sources where SINTEF is significantly active. SINTEF is also working to overcome the challenges of developing infrastructure and operation strategies for integrating new loads from battery charging by increasing shares of electric vehicles in the existing power distribution systems within the framework of SmartGrid technology. The high number of electric vehicles in Norway is leading to relevant challenges of power system integration, which SINTEF is

helping to assess and address in cooperation with utilities and service providers. SINTEF has also contributed to the development of technology for battery-based electrification of coastal ferries, which has been pioneered in Norway. In particular, SINTEF has enabled Norwegian industries to develop an unprecedented concept for contactless inductive power transfer in the MW power range, enabling a low-maintenance automated solution for battery charging of electric ferries operating with tight schedules and short docking times.

Unmanned Ocean Navigation

Currently, as many as 80% of all accidents at sea occur as a result of human error. Experts are now envisaging a future where unmanned vessels will be controlled from dedicated stations onshore by highly skilled operators piloting up to six vessels simultaneously. MUNIN (Maritime Unmanned Navigation through Intelligence in Networks) is an EU project which has for many years been conducting research and development into unmanned vessels. The SINTEF company *SINTEF Ocean* has been acting as technical coordinator. The project's achievements have included an evaluation of where unmanned vessels can first be used safely in the future. Moreover, maritime transportation could be powered by electricity or by hydrogen fuel cells. One suggestion is that offshore supply vessels would be ideal first candidates. Such vessels can operate within a relatively restricted area and their movements are subject to regulations stipulated by a single State. There will be savings in operating costs because of reduced crew requirements and more space for cargo. Future research will focus on assessments of the various unmanned electric vessel concepts.

Centres for Environmentally-Friendly Energy Research (CEERs)

SINTEF is an active participant in Centres for Environmentally-Friendly Energy Research (CEERs), a research scheme developed by Norwegian Research Council together with industrial partners and universities. The main objective of the CEERs scheme is to establish time-limited research centres which conduct concentrated, focused and long-term research of high international calibre in order to solve specific challenges in the energy sector. SINTEF is currently participating in 11 centres in the fields of hydropower, maritime transport, industrial energy efficiency, buildings and their neighbourhood communities, offshore wind power, carbon capture and sequestration (CCS), geothermal energy, bioenergy, smart grids, solar energy, and transport. The centres include about 150 partners from the industrial sector.

Hydrogen Technology and Energy Storage

Hydrogen will be an important supplement to electricity as energy carrier in future sustainable energy systems. In addition to being fuel for the transport sector, hydrogen will contribute to increased utilization of renewable energy sources. The need for energy storage will increase dramatically, and hydrogen will be the preferred option for large amounts of

energy and storage over longer periods. A substantial effort is devoted to hydrogen production primarily by water electrolysis, but also towards reforms. Next generation PEM water electrolyser technology is one of SINTEF's focus areas. Within fuel cells, PEM, Solid Oxide, as well as high temperature Proton Conduction systems are being developed, suitable for stationary as well as transportation applications. SINTEF's developments enable increased utilization excess of intermittent renewable energy sources by providing new, more efficient battery chemistries (both Li-ion based and alternatives), as well as more efficient and lower cost water electrolyzers and fuel cells. System control as well as prognostics and diagnostic tools are being developed and implemented to mitigate fuel cell and electrolyser degradation and prolong lifetime. New, more stable coatings and concepts for bipolar plates are under development and promising low cost candidates have been identified and are currently undergoing long term testing. Gas quality assurance is another key area within SINTEF's hydrogen activities, and advanced gas composition monitoring instruments and methodologies are being developed and applied at existing sites. SINTEF's hydrogen and fuel cell activity is carried out in close collaboration and with substantial funding from leading international industrial stakeholders, enabling SINTEF to remain in the forefront of the development.

International Participation

SINTEF is an active participant in international research projects. There has been much focus on SINTEF's involvement in the European Energy Research Alliance (EERA), which has an important strategic role in the field of European energy research. Together with NTNU, SINTEF is engaged in a strategic collaboration with leading research centres in Japan and the USA in the fields of energy and materials science.

Challenges

Challenges facing SINTEF's sustainable mobility endeavours are of five types:

Technical: Autonomy of the batteries and the ease of recharge are among some of the challenges that need to be solved in order to achieve sustainable adoption of electric mobility. Extending lifetime and cycling capabilities of the energy storage systems also needs further improvement.

Legal: Legislation should consider the carbon footprint in order to make a fair competitiveness of sustainable mobility with traditional. Regulation needs to evolve to adapt to a new era of autonomous cars, ships, and trains. New business models should be allowed like transport as a service (i.e. Uber), virtual power plants, etc.

Financial: Humankind has developed an incredible infrastructure for supply of fossil fuels – it's unparalleled. Finance of new infrastructure for sustainable mobility is a challenge.

Public awareness: Unfortunately, not everyone is aware about the urgency to act in order to save the planet from global warming. Public entities should play a leading role in promoting the best practices of sustainability.

International cooperation is needed in order to resolve the above-mentioned challenges. The United Nations is playing an important role here. The Paris COP21 agreement is an important milestone. The implementation of the agreement requires a strong commitment of all stakeholders.

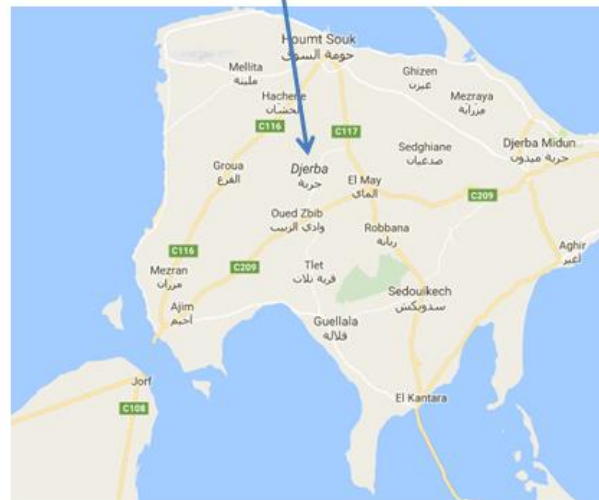
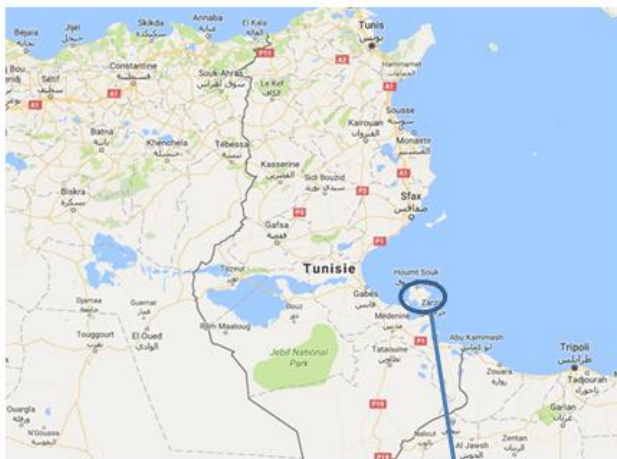
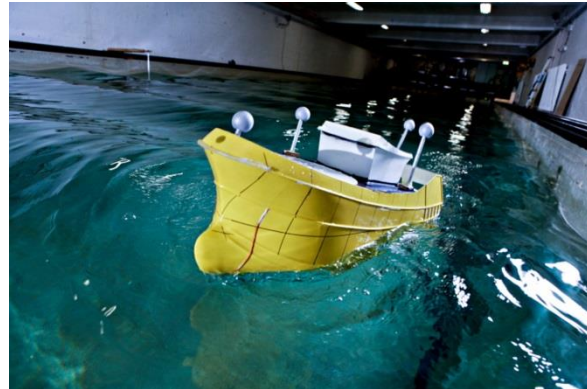
Future Plans

SINTEF is engaged at the national and European level in the promotion of sustainability not only by running R&D projects, but also by participating in the public debate. With the assistance of its leading expertise, SINTEF intends to make an active contribution towards achieving the public authorities' goals within fields of key social importance such as sustainable mobility. New technology has major significance for the development of solutions to the key challenges currently facing society at large. One of SINTEF's strengths is that it can offer multidisciplinary expertise and can combine technical teams working in collaboration across organisational boundaries. This facilitates the development of effective solutions for the society as a whole. Digitisation, automation and advanced robotic technology are exerting a major influence on the changes taking place in all aspects of the workplace and community life. Such changes and developments are often referred to as the fourth industrial revolution, and generate both challenges and new opportunities. SINTEF possesses high levels of skills and expertise in these fields, and aims to make an active contribution towards a successful restructuring of the business and public sectors.

SINTEF intends to concentrate its efforts on climate change technologies and adaptation, renewable energy, energy efficiency and carbon capture and storage (CCS). SINTEF is assigning high priority to their future research activities in these fields. In order to develop solutions that will contribute towards a better society, it is crucial to be fully aware of people and the communities in which they live and work. SINTEF's aim is to achieve a close integration of research in the fields of technology, natural, and social sciences.

Winning Proposal

SINTEF aims to promote solar fuelled electric ferries by demonstrating the large potential for offloading road transport between the cities along the Mediterranean coast, starting in Tunisia. The electric ferries will reduce transport related greenhouse gas emissions and air pollution. This project is built on actually developed pilot projects with many of SINTEF's partners.



The proposal has six tangible deliverables. The first and second deliverables are the reconstruction of one ferry to convert it to electric power and construction of at least one electric charging point. The third deliverable is operation, maintenance, and data collection. Fourth, a social, environmental, economic and financial analysis will be performed assessing

feasibility of renewable energy based maritime public transport in the region, including preparation of at least one Nationally Appropriate Mitigation Action (NAMA) to be submitted to the UNFCCC portal. Fifth, SINTEF will host four capacity-building workshops organized for relevant Tunisian and MENA region stakeholders and conduct at least two project presentations during the COP climate conferences. The final deliverable will be to conduct public outreach activities and develop a digital media strategy.

Benefits

The demonstration project will document technical, environmental and socio-economic results and raise awareness about the opportunities for national and local authorities, universities and business communities to utilise sustainable transport opportunities. This will in turn benefit in particular the low and middle income part of the population.

The direct benefits of one ferry will benefit a few hundred/thousand passengers each year, but the nature of public transport requires demonstration and testing of the technology and the electric fuel infrastructure to create awareness of the socio-economic benefits. Therefore, the real effects of the project will be realised in the awareness raising and spin-off projects as new transport plans and NAMAs towards 2020. Depending on the local processes of the development of new transport plans and NAMAs, a new coastal network of electric ferries could technically be constructed in 5 years from decision, while highways and intercity trains would require a time horizon of 10-15 years.

North-South Cooperation

The project has the potential to be a leading example of north-south cooperation and technology transfer. The project is to be developed in an upper middle income country such as Tunisia (OECD-DAC) due to the existing well established reference projects and partners in the electricity sector and universities as well as the recognized Tunisian track-record in NAMAs for the electricity sector. Other lower and middle income countries will benefit from these references projects and may be interested in replication.

The National Agency for Energy Conservation (ANME) will coordinate the Tunisian partners and will provide the required Letters of Intent and permits for the demonstration project.

The main impact of the project is to demonstrate the possibility of the technology and analyse the regulations and fuel savings to prepare for large scale replication in Tunisia with replication to the greater MENA region.

III. 2016 “Powering the Future We Want” Grant Finalists



The eight finalists that reached the final stage of the evaluation process represent a wide range of sectors, including the public and private sector, non-profit and research centres. This group of eight finalists is comprised of seven independent institutions or companies and one partnership initiative. Each institution or company maintains a unique set of expertise, while being bound by the common thread of a desire to increase access to sustainable transport in an environmentally sustainable manner throughout the world.

The following section of this report highlights the mission and initiatives of each institution and company. For these purposes, each of the eight finalists have voluntarily submitted reports providing an introduction to the their organization and the sustainable transport problem they seek to address; their approach to finding solutions; achievements made in the field; challenges along the way; and a discussion of future plans.

Through knowledge sharing and promotion of best practices, UN DESA aims to encourage long-lasting partnerships and increase support for capacity development initiatives in energy for sustainable transport by showcasing the commendable work of the eight noteworthy international institutions and companies.

b. Fiza Farhan



Introduction

Two professionals, a climate finance specialist and a clean energy specialist came together to develop a solution for the women of rural Pakistan and in partnership submitted a proposal to the Energy Grant. Fiza Farhan has demonstrated significant commitment to SDG 7 through the co-founding and leading of two social enterprises in Pakistan: Buksh Foundation (BF) and Buksh Energy (BE). Ms. Farhan is now a Global Strategic Development Advisor working with governments, UN Agencies and the development sector at-large. She is also a Member of the UN Secretary General's High-Level Panel on Women's Economic Empowerment.

Kashmala Kakakhel, the co-lead for this initiative, is a climate finance expert, who is globally involved in the process of the Green Climate Fund (GCF), the largest global climate change fund. Ms. Kakakhel's focus is in on ensuring that the mitigation projects approved by the Fund for developing countries are clearly aligned to country interests and that they address issues of access and affordability of energy. She is also currently conducting an analysis of existing policies of climate funds that allow for corruption during the procurement of large renewable energy projects at the national level. Engaging in solutions at the national level in Pakistan, she is also currently involved in designing a Disaster Risk Financing (DRF) model with the Asian Development Bank.

Approach



Implementation of *Lighting a Million Lives* (LAML)¹ was an initiative to provide solar energy access to rural, un-electrified villages of Pakistan. The Buksh Foundation partnered with TERI (Technical and Energy Research Institute) India to expand on its project of Lighting a Billion Lives, which is currently running in South Africa, Uganda, and Bangladesh. The project aims to light up the lives of a million people in Pakistan. In addition, it would generate permanent sources of income for the entrepreneurs. The project plans to reach out to 4,000 villages with a total of 1 million lives lightened by the end of 2017.

While working closely with women entrepreneurs in Pakistan through the programme, it became clear that rural areas in Pakistan pose three particular threats to women due to lack of safe transportation services: access to schools, access to health services, and proper linkages to urban markets for their home produced goods.

Building on these concerns, the idea of providing a low cost solar powered *rickshaw* to the female entrepreneurs in the village was born.



See: <http://laml.bukshfoundation.org/>

The idea was simple: this transportation solution will cater to girls who are generally not allowed to go to school in the absence of safe transportation, women who because of lack of transport facilities are unable to access proper health care, and other local women entrepreneurs that are victims of the ‘middleman’ due to lack of reliable market linkages. A solar powered *rickshaw* will result in a win-win situation for all: a steady income for the owner, lower transportation costs for the lady customer as compared to using more expensive alternatives that are run on fuel, and a community savings circle to which each lady driver will contribute 10-20% of her earnings that will then be used for the maintenance of the rickshaws.



The numbers also present a helpful case for the initiative: a traditional rickshaw in Pakistan approximately costs US \$1,500 whereas the proposed solar powered one costs roughly US \$ 4,000. However, with an annual fuel cost of US \$1,700, payback for a solar rickshaw is a quick turnaround of just two years.

FINANCIAL COMPARISON (US \$)		
	Traditional Rickshaw	Solar Powered Rickshaw
Capital cost	1,500	4,000
Annual cost of petrol	1,700	0
Approx. running cost in 2 years (excluding maintenance)	4,900	4,000
Payback period for solar rickshaw	Less than two years	

Achievements



The Buksh Foundation (BF) and Buksh Energy (BE), started in 2009, have had rapid success:

- Awarded “international best practice” for innovative models of access to affordable, reliable and clean energy by Dubai International Awards in 2015.
- In 2014, LAML was certified by the UN-Foundation and UN-Habitat as an internationally replicable international model for energy access.
- Pioneered Clean Energy Loans in Pakistan providing portable and affordable renewable energy (RE) solution to rural enterprise. Approximately 350 micro-entrepreneurs have currently been provided with the portable clean energy solutions for usage within their households and enterprise.
- The second Future Energy Leader from Pakistan at the World Energy Council to share and replicate models of rural energy access in deserving international regions.

- Pioneered RE solutions for commercial, residential and industrial roof-top sector replacing diesel generators.
- Pakistan's first Energy Servicing Company (ESCO) pioneering Energy Audits to advise clients towards efficient use of energy / energy conservation.
- Partnered with the government to launch Pakistan's first 10 MW Solar Power Plant to create a large impact on the national framework for renewable energy.
- Effectively lobbied the government in de-facto policy making from RE Policy to securing the first Up-front Tariff for Solar.
- Transformed multiple sectors, including commercial banks, dairy companies, and telecom to convert from conventional and hazardous diesel based fuels to solar-powered captive solutions.

There are no previous initiatives directed specifically at improving sustainable transport, however the need for such was identified through other initiatives aimed at poverty alleviation in Pakistan. Efforts are being made to find the sources to run this sustainable model for solar rickshaws in Pakistan.

Challenges



Rural Pakistan is a traditional society where historically predetermined gender roles have been adhered to over centuries. Increasingly however, through better access to information, greater demand for women's education, there has been a shift in defining a woman's role. Families are more receptive to women working and contributing to household incomes. While there are other examples of women taking to the roads and deciding for themselves

to be a part of the public transport system, it is critical to create the right enabling environment for women to step out comfortable and safely.

From that perspective, involving male members of the family from the very beginning of the initiative was difficult and still remains a key challenge. Social taboos still exist and breaking those stigmas can be troublesome in rural areas of Pakistan.

As a second tier, not only involvement of male members, but also ownership of local elders of the community becomes an equally critical challenge. These elders are responsible for maintaining cultural as well as religious etiquettes, and largely influence male positions on social matters as well. Therefore, getting them familiar to new operating models that are in their opinion in conflict with their 'traditional values', can sometimes be an uphill task.

These challenges have already been overcome for other initiatives as they face similar challenges. In the case of LAML, for example, to support the women entrepreneur, one male member (generally the husband or the brother) is technically trained to understand the solar panels and related equipment. He is also responsible for repair and maintenance. The same strategy can also be deployed for this initiative where the male members will be trained for repair and maintenance of the rickshaw.

Similarly, in order to gain acceptability and ownership of the elders of the community, before any initiative is introduced to the beneficiaries, the first step is always to meet directly with the village leadership. This includes the clerics of the village mosque, the school principal or some other respected elderly figure in the village. After complete satisfaction is guaranteed and they are fully on board, an 'elders consent form' is also signed, demonstrating their ownership towards the project. Once the initiative commences, the same elders are constantly kept in the loop from the design to the implementation phase, and are also made part of the decision-making process by involving them at critical strategic points.

Future Plans



For this initiative in particular, a 30-month plan was envisioned. This would cover 100 entrepreneurs in 100 villages. Since there is already a significant footprint in these villages and there are cordial working relationships where impact has already been demonstrated, villages will be receptive to innovative interventions. As part of the plan, village coordinators selected from among the communities would continue to play a role even after resources from the grant are no longer available – the project design itself has an embedded concept of savings circles, which will be used to continue to support the coordinator.

- This coordinator, once trained through the 30-month cycle of the funded initiative, would be ideally suited to not only support the existing entrepreneurs with their day to day issues, but also to introduce the concept to other women in the village who can join the venture in various ways. Such systems have already been successfully employed in other initiatives.

The main forms of partnerships that the initiative would require are funding bodies that are generally interested in supporting small scale community level clean energy and sustainable solutions. Such funding would only be necessary at the initial stages of each village set up, until they achieve sustainability, and can fund their own business cycles. Other than the funding for modelling, all other aspects involving the working model, implementation team and framework is already in place and sufficient for future scaling up prospects.

c. GerWeiss Motors Corporation

Introduction



GerWeiss 1st generation e-trikes that were built in 2008 and operated in the Central Business District in Bonifacio Global City, Taguig, Metro Manila

GerWeiss is an electric vehicle manufacturer and ecosystem developer based in the Philippines and is considered one of the pioneers in the electric vehicle industry in the Philippines. GerWeiss began as a husband (Gerard) and wife (Edelweiss) team but has since expanded to gain equity partners from Switzerland. They have been locally designing various 3- and 4-wheeled electric vehicles since 2008. The company has designed a unique, expansive and sustainable e-trike “ecosystem” to replace the highly polluting gas-powered tricycles, which they are bringing into the international market.



The ‘An Inconvenient Truth’ documentary by Mr. Al Gore inspired Edelweiss so much that she was determined to do her share in the cleaning the environment for their small children. At the outset, she encouraged and convinced her husband, Gerard, to do “anything” about the environment for their children and the next generations.

After some research and studies, they decided to address the replacement of the traditional tricycles (estimated 3.5 million units) that are the major source (67%) of air pollution in the transportation sector in the Philippines. Traditional tricycles account for more than 10 million tons of carbon dioxide emissions

per year. The tricycles are also the main source of noise pollution with levels measured at 83-97 decibels (dB). The instability and sight obstruction caused by the sidecar also make tricycles more accident-prone compared to four-wheeled vehicles. In its Global Status Report on Road Safety 2015, the WHO said 53% of reported road traffic fatalities in the Philippines are riders of motorized two- or three-wheeler vehicles.²

According to a 2006 World Bank Report, treating disease cases caused by air pollution amounted to over PHP962 million (US \$19 million) yearly. Deaths from air pollution-related diseases, such as pneumonia and lung cancer, resulted in a further PHP6.7 billion (US \$134 million) in lost income annually. The most vulnerable are young children, women, and seniors.

In a World Health Organization (WHO) report, noise has many adverse effects on people's health and well-being, such as "annoyance reaction, sleep disturbance, interference with communication, performance effects, effects on social behaviour and hearing loss. It was also noted that noise from traffic is the second biggest environmental problem affecting health after air pollution.

In a study of two major cities in the Philippines, it was discovered that 70% of the drivers earned a daily net income of P100-P150 (\$1.80-\$2.70). However, driving tricycles remains the most popular method of livelihood for the unemployed, as it does not demand any special skills or large capital investment.

In 2008, Gerard and Edelweiss locally designed and built their 200 1st generation e-trikes. It was operated in Bonifacio Global City, a major central business district in Metro Manila and a lot of passengers patronized it. It was considered a good complement to the bus routes as it operated along the peripheral roads. The fare was also cheaper compared to the buses and taxis. Not to mention, it was quiet and had zero emissions. Due to its popularity, the drivers increased the revenue up to five times. While this 1st Generation e-trike did not completely satisfy all the projected operational requirements, it demonstrated that the e-trike could be designed and manufactured locally.

In 2010, Gerard and Edelweiss were invited to the Asian Development Bank (ADB) to discuss the 1st generation e-trike project and how the e-trike replacement program can be developed as a local industry. During this period, ADB was proposing a "\$280M loan to bolster the Philippine government's clean air program."³ In addition, the ADB also donated 30 electric,

² <http://www.rappler.com/nation/110789-road-safety-report-2015-who-philippines>

³ <http://www.manilastandardtoday.com/insideMetro.htm?f=2010/august/25/metro1.isx&d=2010/august/25>

zero emission motorcycles to help the government of the Philippines in its anti-pollution campaign.

Gerard was eventually invited to become an ADB Consultant for the e-trike project. The goal of the e-trike pilot test was to demonstrate that the e-trike could be energy efficient, debunk the negative general impressions, and satisfy the operational requirements of the traditional tricycles. Further, the pilot test should bring out all the potential problems in operating an e-trike. All these goals were achieved.

ADB's previous plan of donating 30 electric motorcycles was changed to 20 e-trikes locally designed and developed by GerWeiss. The test e-trikes exceeded most expectations. The 2nd generation e-trikes were able to run 80+kms per charge, 70kph speed and could climb hilly terrain- particularly, Antipolo City, a hilly city adjoining Metro Manila. This model was also used as a basis for the \$500M ADB funded loan to the Philippine Government to replace 100,000 traditional tricycles.



Gerard with the ADB e-trike model he designed and locally manufactured in the Philippines

In 2012, GerWeiss designed, developed and operated the 3rd Generation e-trike model to be used in the hilly Boracay Island. Upon the invitation of the local government of Boracay Island, GerWeiss operated 10 test e-trikes on the island for more than a year at its own expense.

It was initially an uphill battle because of the largely negative perception about the e-trikes, due to many previous failed initiatives. It was during this test period where GerWeiss developed their “ecosystem” to ensure the sustainability of the e-trikes.



GerWeiss first batch of e-trikes delivered on December 2011 in Boracay Island, Aklan, Philippines

In May 2013, “BPI Globe BankO, the first and only mobile-based, microfinance-focused savings bank in the country, ventured into a tripartite agreement with the LGU of Malay, Aklan and Gerweiss Motors Corporation to finance the purchase of electric tricycles or “e-trikes”.⁴

This paved the way for other banks and micro-financing institutions to finance e-trike projects around the Philippines. More cities have started similar tricycle replacement programs. More tricycle Drivers and Operators are welcoming the e-trikes in their cities.

Considering that the Philippines is home to over 3.5 million combustion engine tricycles, the Philippine e-trike market alone is valued at more than \$20B. In Asia, the estimated number of three-wheeled vehicles used for public transportation is more than 100million.

In 2016, GerWeiss started to offer similar projects with like-minded people and companies in Africa and South America.

Approach

GerWeiss believes that the global problems presented in “The Inconvenient Truth” are everyone’s problem, wherever they are in the world. Each individual has to do their share, no matter how small, to help clean the environment.

⁴ <http://www.banko.com.ph/banko-supports-malay-lgus-efforts-for-a-cleaner-greener-boracay/>

The “divergent thinking” philosophy must be applied to find multiple solutions to solve one problem. The multiple solutions should include ground-breaking, never-before-tried solutions. The air pollution problem from the use of gas-powered tricycles can only be reduced through drastic solutions. Likewise, any solution must adhere to the triple bottom line (TBL) framework for sustainability.



A Traditional tricycle in the Philippines.

GerWeiss looked at the traditional tricycle and immediately decided that it should start with a clean slate. There is simply nothing that can be changed or upgraded in the traditional tricycle that will make it sustainable. It was poorly designed, did not consider the safety and comfort of passengers, under-powered, misused and abused.

The only sustainable solution would be to completely replace the traditional tricycles with a new design that would make it more efficient, safer and more comfortable. More importantly, the e-trike must be able to satisfy or exceed the operational requirements of the traditional tricycles.

The infrastructure to sustain the operation of the e-trikes had to be established. This would include the charging stations, swapping stations, parts and service personnel.

After satisfying the operational requirements, GerWeiss sought banks to provide 100% financing for the purchase of the e-trikes to the Driver and Operators. This is the hardest part as the Drivers and Operators belong to the bottom of the pyramid.

GerWeiss developed business models that demonstrated and convinced the financial institutions that the e-trike program could be commercially viable and sustainable.

In Republic Act No. 8749, An Act providing for a comprehensive air pollution control policy and for other purposes, otherwise, known as the Philippine Clean Air Act of 1999, mandates government agencies and local government units to implement measures to reduce air pollution and incorporate environmental protection into its development plans. The e-trike program is a very good strategy to be compliant to the subject law and reduce air pollution in the Philippines.

GerWeiss used the Clean Air Act to market the e-trike program to the local government units who control the issuance of the franchise to operate the three-wheeled public utility vehicles. Many of the local government units were also looking for programs to help clean the environment.

The final test of the e-trike ecosystem sustainability came from the drivers themselves. Most of the time, the tricycle is the only livelihood or source of income of the drivers for their families. These drivers will sacrifice anything and endure any hardship just to keep their daily income to buy the basic necessities for their families. They would reject any proposal that could even slightly reduce their already meager daily income.



The hands of the tricycle drivers which are full of calluses and blisters show the hardships they endured every day to support their families due to lack of alternative livelihood. Photos courtesy of Tijo Creatives, Philippines.

Achievements

The greatest achievement of GerWeiss is that they were able to provide a better livelihood and higher income to the Drivers and Operators. The increase in income is instantly achieved on the same day the tricycle drivers shifted to operating the e-trike. The fact that any tricycle driver that shifted to e-trike refused to go back to driving the traditional tricycles for the past several years showed solid proof that the GerWeiss e-trike ecosystem works.

GerWeiss is proud to contribute to the development of the e-trike industry in the Philippines through the following ways:

1. Do their share to prove that the Philippines can develop its local industry and be competitive in the international market.
2. Overcome the initial impression that the e-trikes could not satisfy the operational requirements of the traditional tricycle. The e-trikes were able to exceed the climbing

capability of the tricycles and most of the operational needs of the tricycles.

3. Convince the local banks and other financial institutions that the e-trike is a commercially viable and sustainable project without relying on government or public funds. This is a major accomplishment as the regular banks are strict in their credit evaluation and very risk-averse. GerWeiss is currently working with Small Business Corporation (SB Corp.), a Government-Owned and Controlled Corporation in the Philippines.



(Left to right) Ma. Linda Orsos, SB Corp. OIC, Financing and Capacity Building Sector, SB Corp. CEO Bartholomew Brillo Reynes, Edelweiss and Gerard

4. Provide a safer and more comfortable ride; this is considered the first/last line of public transportation of the general public.
5. Provided more humane driving conditions for the drivers. More women have become interested in becoming an e-trike driver. There were testimonies that the e-trike drivers could still play basketball after their duty, unlike before where the tricycle drivers were completely exhausted after their duties.
6. Contributed greatly to the technical development of the Asian Development Bank e-trike pilot project.
7. While the current achievements of GerWeiss barely scratch the surface in cleaning the environment, as a first mover, the other companies who have similar visions will not have to make the mistakes associated with pioneering companies. Others now have a basis for starting their own e-trike initiatives unlike when GerWeiss started.
8. Convinced small, middle and big suppliers to seriously give attention to the e-trike project in the Philippines.

9. Able to show, for the last 3 years, that the e-trike ecosystem works and is ready for scale up.



Gerard, Edelweiss and their son, Gabby, CTO, GerWeiss, who has been designing and assembling advanced lithium battery systems in the Philippines.

Photo courtesy of Joel Garcia / Fookien Times Philippines Yearbook 2017.

Challenges

Essentially, the e-trike industry in the Philippines was non-existent when GerWeiss started. The common challenges of a new company in a new industry were all present- if not worse.

GerWeiss did not have a business model to follow. Nobody had a track record or experience as far as the e-trike is concerned. There were no e-trike specifications that had been tested and satisfied the operational requirements of the traditional tricycles. All the previous initiatives failed and left a very negative impact on the market. There was no market demand at all for the e-trikes. Under these circumstances, an ordinary and astute businessperson will simply walk away immediately from this business. GerWeiss would have done the same if not for their vision and their resolute to help clean the environment.

Foreign parts suppliers did not believe that there was an e-trike market in the Philippines

and were not interested to supply the parts. For the few that were interested, the parts were of poor quality and expensive.

The banks or any financial institutions had no interest to evaluate, much less provide, financing for the driver and operators for the purchase of the e-trikes. Those who ventured into e-trike financing offered micro-financing interest rates.

Private investors are very few and rare and would withdraw and halt their investments in the middle of a project.

Despite all the odds stacked against GerWeiss, they yet ventured to do it the harder way by designing and manufacturing locally, as they believed that it will be best for the country. They stubbornly resisted the suggestions to simply buy Completely Built Up (CBU) e-trikes and import it to the Philippines. Hardly anybody believed that it could be locally done and sustained.

The only way to move forward was to learn the hard way, from trial and error. GerWeiss needed to try many suppliers and many parts before they could build an effective e-trike model. This was expensive and very risky, especially for a company that was undercapitalized and cash-strapped. But these costly mistakes and exercises saved a lot of money for other companies that started later.

Fortunately, there are a few very important people in important positions that believed in the vision of GerWeiss. That was all GerWeiss needed to bring them where they are now.

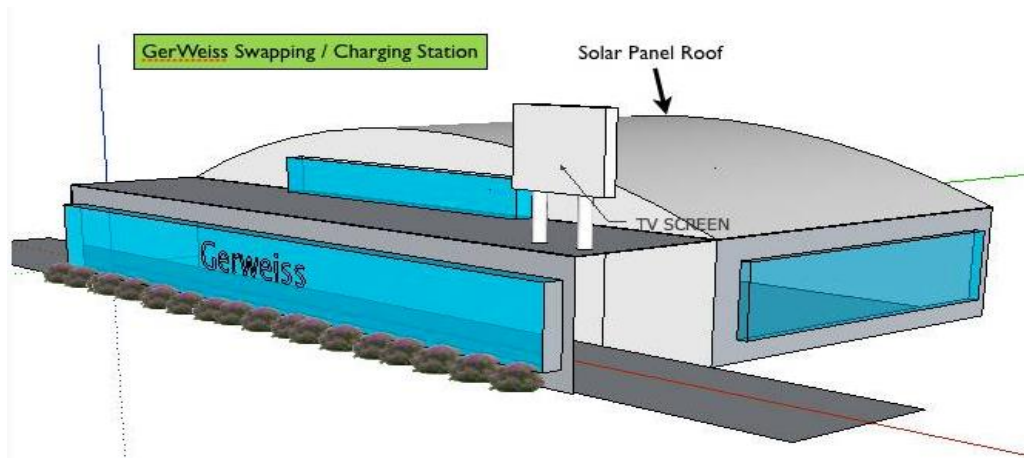
Without the invaluable intercession and the smart decision of the Asian Development Bank to do an actual e-trike pilot project, rather than come up with another documentary study, and its big international push to convert 100,000 tricycles, the e-trike market in the Philippines would not be in as promising of a situation as it is now. Further, the ADB e-trike initiative gave other countries a model to follow and adapt to their distinct needs.

Future Plans

GerWeiss believes in partnership and is currently offering Joint Ventures to like-minded companies and people; and is willing to share its manufacturing property and financial partners to scale up to other cities around the Philippines.

GerWeiss will provide technology transfer to cities, provinces, regions and countries that are interested in implementing similar initiatives. It will establish the complete infrastructure to sustain operations, including the 100% financing for the Drivers and Operators.

GerWeiss is working to establish solar powered charging stations and is planning to proliferate this in other cities with several solar companies.



Concept design of GerWeiss Solar Charging station. Courtesy of GerWeiss children, Garrett and Elizabeth.

GerWeiss is in the process of expanding its automation system for the monitoring of the e-trikes to improve the sustainability and strengthen the relationship with international partners to ensure that it will continuously use competitive technologies.

GerWeiss has started exploring partnerships in Africa and South America. They are trying to work with financial institutions similar to the Asian Development Bank to secure soft loans and grants. It is important that the ADB e-trike initiative in the Philippines be replicated in these countries and other developing countries with similar needs. They are looking for big companies to provide a portion of their CSR funds for the e-trike projects, in return, it will advertise their CSR goals on the e-trikes.

GerWeiss believes that the “polluter pays principle” must be legally enforced by mandating these companies to allocate a fixed percentage of their annual revenue to fund projects that can help clean the environment; and also hopes that laws will be written to implement this and to find companies that can support these efforts globally.

d. KPIT Technologies Limited

Introduction



KPIT is a global technology company specializing in providing IT consulting and product engineering solutions and services to automotive, manufacturing, energy and utilities and life sciences companies. Together with its customers and partners, it creates and delivers technologies to enable creating a cleaner, greener, and more intelligent world that is sustainable and efficient.

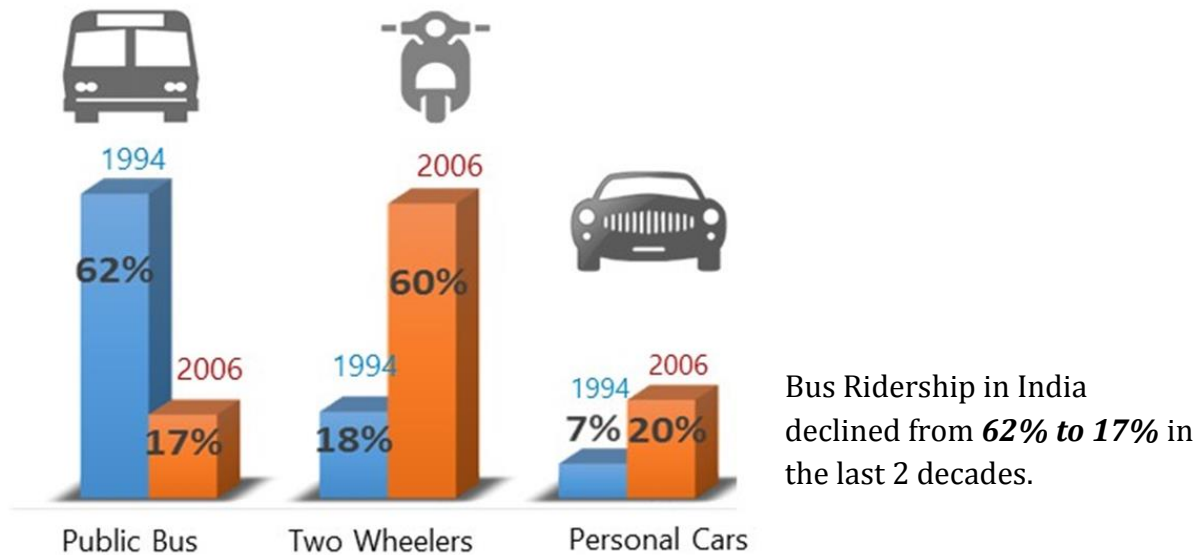
With over 10,800 employees world-wide, KPIT has 34 offices and 7 development centres in 16 countries including India, USA, Australia, Brazil, Canada, China, France, Germany, Japan, Italy, Singapore, South Africa, South Korea, Sweden, The Netherlands, UAE, and United Kingdom.



Founded in 1990, KPIT's headquarter is in Pune, India and is listed on National Stock Exchange (NSE: KPIT) and Bombay Stock Exchange (BSE: 532400).

The drivers of growth at KPIT are the DNA for Innovation sector, with focus on automotive and transportation, product engineering services for point requirements (solutions that ecosystems can leverage as products), the passion to deliver excellence and a strong customer focus. The KPIT R&D center called Center for Research in Engineering Sciences and Technology (CREST) is registered with Department of Scientific and Industrial Research (DSIR) and the Department of Science and Technology (DST), India as a recognized in-house R&D center.

Approach



Personal transport vehicles like two wheelers and cars are being used by many people which has led to tremendous congestion in India. If the situation is not addressed, it is estimated that by 2030, 52% of the total transportation demand in Indian cities will be fulfilled by cars and two-wheel vehicles. The key reasons for people not using public transport buses at present are operational inefficiencies, inadequate management, poor reliability, improper facilities, breakdowns, and pollution. An average diesel bus used in public transport in India can emit approximately 48,000 kgs of CO₂ per year.⁵

The objective is to provide a technology that can help convert new and existing buses to 'Smart Intelligent Electric buses'. Such buses can provide a comfortable ride experience to the commuters; i.e. quiet, vibration free and convenient, and attract people to public transport thereby reducing pollution and congestion.

⁵ Source - (a) KPIT internal research & analysis (b) FAME India report (released by Department of Heavy Industries and SIAM), page no. 175



Nearly all the public transport bus operators run by city administrations in India today are making losses. Replacing diesel buses with electric powertrain can help reduce costs for these operators and perhaps make them profitable. For example, one diesel bus that runs for 5,000 kms in one month with fuel efficiency of about 4 kmpl consumes diesel worth US \$923 (diesel @ US \$0.74/lit). If this bus is converted to electric, it will run at an energy efficiency of 0.84 km/electric unit. Then the electricity cost for one month of running will be US \$226 (electricity @ US \$0.054/unit). This amounts to a savings of US \$697 per bus per month.

Achievements

- KPIT has already received a letter of intent from Central Institute of Road Transport (CIRT) for the pilot project on design and retrofit of 2 new OE (Original Equipment) diesel AC Mini buses with battery operated electric power train for 2 years for the Ministry of Road Transport and Highways (MoRTH), Government of India. As a part of the same, India's first retrofitted electric bus (eBus) was flagged-off at the Indian Parliament by Shri. Narendra Modi, Honorable Prime Minister of India and demonstrated to members of parliament on 21st December 2015 in Delhi. This project is initiated by MoRTH with Research and Development carried out by KPIT Technologies Limited along with CIRT.

Given the uniqueness of the concept (i.e. retrofitment of electric powertrain on existing buses), regulatory authority Automotive Research Association of India (ARAI) has worked exclusively on creating the standards for this technology. The standard, AIS 123

(part 3), which are also published on the official website of ARAI, cover necessary testing requirements for 'CMVR Type Approval of Electric Propulsion Kit Intended for Conversion of Vehicles for Pure Electric Operation'.



- KPIT has received several recognitions for its technology Revolo. KPIT was recognized with the 'Promising Transport Innovation Award' at the International Transport Forum (ITF) 2016 Summit in Leipzig, Germany. It won the award for its indigenous technology that enables clean urban mobility by converting new and on road diesel buses into fully electric vehicles.



The International Transport Forum is a part of the Organisation for Economic Co-operation and Development (OECD). The ITF Awards honour exceptional achievements in three categories: the Transport Achievement Award, the Promising Transport Innovation Award, and the Young Researcher of the Year Award.

- KPIT has been honoured with the Technology Innovation of the Year (Suppliers) Award at the second edition of Auto Tech Review's Indian Automotive Technology and Innovation Awards (IATIA), which are organized by the reputed automotive technology magazine, Auto Tech Review. These awards honour organizations for their excellence in automotive technology and spirit of innovation. KPIT won the award for its ingeniously

developed non-plugin hybrid electric solution for buses, considered to be ground-breaking technology for urban transportation in India.

Challenges

The world is fighting a constant battle against air pollution as it depends mostly on non-renewable sources of energy, particularly, oil. This innovation can even take care of electrification of existing buses on-roads, and has a larger societal and economic impact, as it helps solve the problem of rising emissions from existing buses on-road at the same time reducing dependency on oil.

Globally, adoption of electric buses in public transport has virtually no presence except in China. The key challenges in adopting electric buses were initial investment and viability. In India too, no public spending on electric buses was seen as it was believed it was not viable.

- Regulatory push: KPIT recommends rules and regulations enforced by the Indian government to ban old vehicle usage, and to encourage usage of electric vehicles and vehicles utilizing renewable energy. In India, government schemes like 'Smart Cities Mission' and 'Atal Mission for Rejuvenation and Urban Transformation (AMRUT)' have created competition and encourage new technology adoption: There has been increased awareness about the need for Environmentally Sustainable Urban Transport Systems amongst the city authorities due to these various government initiatives.
- R&D in battery technology: Development of low cost batteries with high energy density as well as high power density will help in making electric buses more cost competitive with conventional buses.
- Infrastructure development: In order to make the electric bus technology convenient to use, development of wide spread infrastructure consisting of charging stations as well as service and maintenance centres would be required.



Future Plans

KPIT's electric bus system helps convert new and existing buses to electric. These electric buses have zero emissions and cause no pollution. Approximately 48,000 kgs of CO₂ is emitted by one public transport bus in India. There are approximately 1.2 million buses on Indian roads today of which approximately 150,000 buses are public transport buses operated by various government authorities. Replacing or

purchasing only electric buses will definitely have far reaching impact in reducing pollution. This is KPIT's goal to work at seeing this happen.

The largest component of operating costs for a bus operator is the fuel cost. Adoption this technology will drastically reduce fuel expenses. Also, the system will require lower maintenance. Electricity distribution companies will be able to sell excess electricity available at night due to overnight charging of buses.



A large nation like India which is going through rapid urbanization requires unique innovative technologies to address the problems of pollution and traffic congestion. The versatile system can be configured for any type and size of bus which is in sync with the diverse requirements across India. This technology will help reduce pollution and attract more people to public transport buses thereby reducing air pollution and traffic congestion. Large-scale adoption of this technology will also have an impact on oil imports.

India realizes the need to adopt alternate fuels to improve pollution levels and reduce dependency on foreign fuel imports. Introduction of new technologies necessitates new business models and the acceptance of a new technology faces multiple challenges, one of them being high initial costs. KPIT proposes unique business models like 'Pay-per-use' battery leasing to overcome these barriers.

e. Medellin Mayor's Office- Mobility and Transit Department

Introduction



Medellín. ACI Medellín.

Medellín is the second-largest city in Colombia and the capital of the department of Antioquia. It is located in the Aburrá Valley, a central region of the Andes Mountains in South America. With nine other cities, it creates a metropolitan area and the second-largest urban agglomeration in Colombia in terms of population and economy, with more than 3.7 million people.

The Aburrá Valley is steep and irregular, with altitudes ranging between 1,300 and 2,800 meters above sea level. At the heart of the valley is the Medellín River, which crosses the city from south to north, and is the backbone of the city's road and transportation system.

In the 1900's, Medellín began the arduous process of conurbation as a result of the city's industrial development and economic growth and in 1951, the Aburrá Valley had a

population of 526,756 residents; in 2000, that number was 3,004,344, accounting for 56% of the entire Department of Antioquia.

Medellín faced enormous transport, urban and social challenges in the 1980s. It became a destination for large numbers of people escaping the armed conflict and in the rural areas people looking for new economic opportunities settled in the outer reaches of the Aburrá Valley and its mountains. Medellín was not prepared to respond to this migratory phenomenon and provide the newly-arrived population with services like transportation.

To deal with these problems, efforts were made to strengthen the municipal government with the support of academia, the private sector and the different social leaderships and social and urban, and of course transportation projects with a transformational impact. Initiatives were always based on a methodology of participation and innovation to formalize property ownership, improve neighbourhoods and housing, mitigate geological risks and provide technical and academic training for the population along with job opportunities and health services among other crucial factors. A new approach emerged to address marginal settlements and their social consequences and to strengthen the city and its land.

Approach



Medellín. ACI Medellín

During the last few decades, the city of Medellín has experienced a phenomenon of high mobility motorization, characterized by a disproportionate increase in the vehicle fleet, these increases brought about high vehicular congestion, a significant increase in polluting emissions, and a considerable increase in accident rates. There are multiple reasons behind the cause of these phenomena; for this reason, the city is working in public transportation system that gives better services to people, in order to increase their use and access to it; Medellín acknowledges the importance of having a public transportation system that has the ability to close social gaps and improve the quality of life in a way that supports global principles of environmental sustainability and public health.

The problems of mobility have received permanent treatment in recent years through a strong intervention in mass public transport. During the mid '90's, a project defined the transformation and resilience that the city has displayed since then: The Metro. Besides providing mass public transportation services, this company has also been making urban interventions since its inception.

The idea was to enable easier and faster commuting, while building stations that would make their surroundings friendlier and safer. Hence, the Metro sparked the idea of raising the quality of life with urbanism. No wonder its corporate slogan states: "Metro: Quality of Life", but it is important to strengthen all public transport in the city and there are still significant challenges, one of which is to consolidate the integration in physical and operational aspects between Metro Medellín and Collective Public Transport system (urban buses), because both make all the mobility connections of the city. For this reason, the Mayor created the project "Medellin Collective Public Transport" (Transporte Público Colectivo de Medellín, or TPM, in Spanish) with the goal to improve the quality of life of the people by providing them with an efficient, safe, accessible, sustainable mass transit system that strengthens civic culture.

To achieve its goal the TPM project has different activities 1) It is working together with the transport companies of the city; 2) It is conducting an analysis of transport companies to advise and strengthen them administratively to improve their service indicators and coordinate their operations; 3) It is buying vehicles that are environmentally friendly and more optimal; 4) And it is developing improvements in the city such as preferred lanes for bus and better routes plans that allow better speeds and more efficient trips.

Mobility, for any government, always represents a challenge. However, the case of Medellín is special because mobility has provided the city with remarkable benefits that surpass mere transportation. Besides helping to modernise the city, the transportation projects have been pivotal in consolidating social inclusion as they have allowed the once economically and socially disadvantaged a newfound mobility and freedom case study to access jobs, amenities and opportunities across the city, beyond their slum neighbourhoods.

Achievements

The Medellín's pioneering multi-modal mass transportation system prioritizes pedestrians and promotes the use of non-motorized means of transportation. The efficient and inclusive management in an environment of education and civic culture and clear rules that govern mobility and road safety have made the system a success.

The city's modern public transportation system includes a metro, metrocable, metroplús or bus rapid transit system, a tramway and urban buses. It also has two airports, which connects Medellín to the major cities in Europe, the United States and strategic hubs throughout Central and South America.

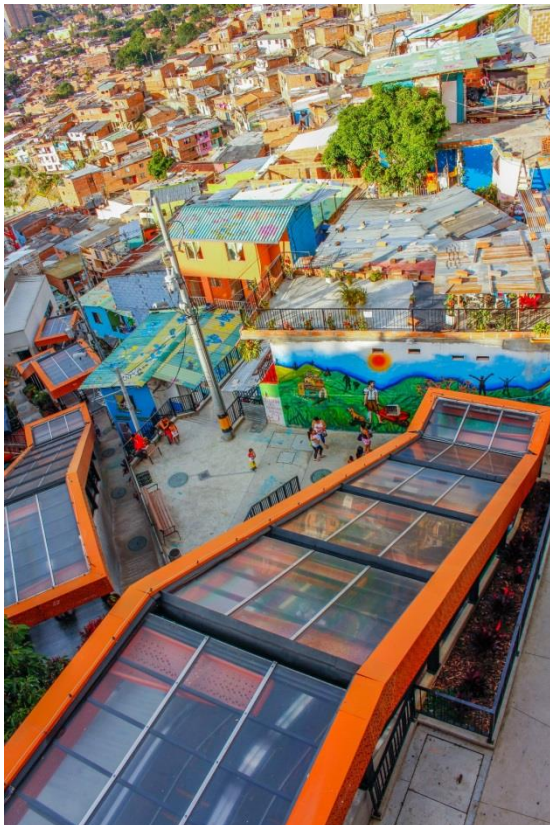


Public Transportation System Medellín

In 1994, the Medellín Metro set out to create a new culture among the people of Aburrá Valley by consolidating relationships of trust with the neighbours of the Metro's stations and lines. The Metro brought big changes, when the commercial operation of the first line of the Metro started; the city became connected from north to south. The trips on the Metro last about 30 to 45 minutes, helping the people that used to take two or even three diesel buses and a trip that lasted about two hours to cross the city.

With four lines that extend along twelve kilometres, the public transportation's cable system is connected to the Metro and Tram lanes, taking on challenges presented by the rough mountainous terrain.

The Metroplús, as an articulated bus system launched in 2011 and became part of the integrated transportation system. The system uses natural gas (GNV), which contributes to reducing the ecological footprint and toxic gas emissions that harm the environment.



Electric stairways. ACI Medellín

Based on a community initiative in 2011, six double stretches of electric stairways were built to connect the neighbourhood of “Las Independencias” on the hillside with the Integrated Public Transportation System. The project has become a model of social equity and improved the residents’ quality of life.

The EnCicla Public Bicycle System is an integrated alternative that compliments the city’s mass transportation system and plays a key role in the process of raising awareness and taking ownership of the bicycle as a transportation means.

In 2015 The Ayacucho Tram, the most modern one in Latin America, contributed to the wellbeing, culture and quality of life of more than 350,000 in its area of influence.

Implementation of the Civic card to pay for and access the Integrated Transportation System gives users the chance to get around the Metro, cable cars, articulated buses, feeder buses and the tram.

Mobility has been paramount to the city’s transformation given that it has improved social issues that seem unrelated, such as security.

A study conducted by Universidad Autónoma Latinoamericana research group GINVECO in 2011 revealed that “97% of the population of Commune 1 – where the first Metrocable operates – perceive that their quality of life has improved with the system, while 86% state that the system increased the presence of the city’s administration and hence, peace”.

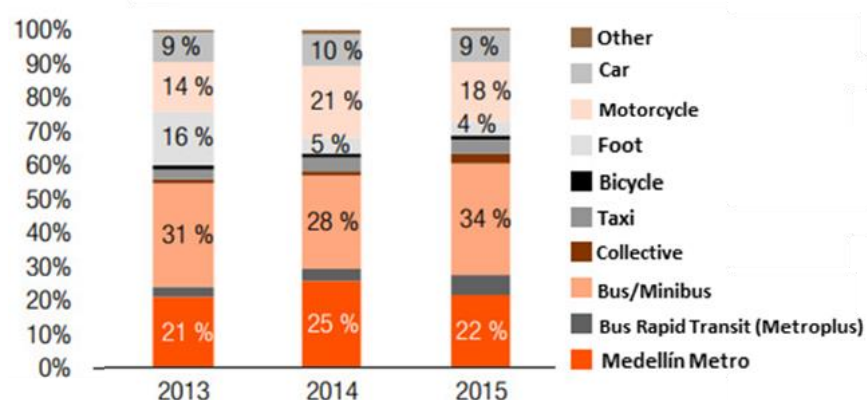
That same perception prevails in the rest of the city, given that the reputation indexes of the Metro have surpassed 92% since the year 2009. Likewise, in the past nine years, users have gained savings in time of 30 hours per week and more than 90% of the users are from strata 1, 2 and 3 – the poorer segments of the population.

Moving forward it is important to strengthen the integration of urban buses with the massive system to achieve greater social impact, since today the city relies on a Collective Public Transport system composed of 130 urban routes, plus 49 routes that feed the mass transit system. Mobilizing around 1,085,000 passengers daily, and with 25% trip participation, it has become one the most utilized methods of transportation by citizens.

Challenges

According to the origin-destination survey from 2012, there was an average per day of 1,083,000 trips within the collective mass transit system. Bearing in mind that the city is in constant growth, this has had a significant impact on mobility, especially regarding the mass transit system as can be observed in Figure 1. This continues to be the most used method of transportation, and therefore its shortcomings bring about difficulty for the city as a whole.

Figure 1: People in Medellín with high mobility⁶ responded to the following: What method of transportation do you primarily use to commute to work or school?



Source: Medellín Cómo Vamos. (2016, June), *Report on objective indicators about how we are doing: Mobility and public space 2012-2015*.⁷

⁶ People who work or study away from home. Source: Medellín Cómo Vamos. Public perception survey.

⁷ <http://www.medellincomovamos.org/download/informe-de-indicadores-objetivos-sobre-como-vamos-en-movilidad-y-espacio-publico-2012-2015/>

However, despite the importance of this transport system, serious limitations exist:

- Operation of uncoordinated routes, overlapping routes, and a disorganized entrance to the city center decreasing operating speeds and increasing pollution.
- Difficulty in inserting corridors with preferential lanes due to lack of design and road space in some areas.
- Lack of bus stops with adequate signage, space, and size.
- Lack of an adequate system for user information.
- Lack of logistic centers or patios (in Spanish) without having to invade public space.
- An affiliative business framework, which implies that businesses do not have effective control over operational planning, vehicle maintenance, and appropriate recruitment of operating personnel.
- Lack of an efficient fleet control system for the transportation companies that would guarantee best driving practices, data, route compliance, and service efficiency.
- A high level of pollution due to the age of the vehicle fleet and fuels used.
- Lack of a payment system that would allow for modernization of sector finances.
- Lack of a pricing matrix that promotes access to a higher number of users and their integration into other systems.
- Lack of culture regarding the appropriate use of the system on the part of users, agents (e.g. drivers), and the transportation business itself.

The aforementioned shortcomings discourage the use of the public mass transit system; having an inefficient system over the years has been an influencing factor on the decrease of user satisfaction over time. This decrease has led to a high level of motor vehicle use, which in turn has led to high vehicular congestion, an increase in polluting emissions, and a considerable rise in the roadway accident rate.

The TPM project involves some investments in infrastructure such as preferential lanes, the idea is to achieve a higher operation speed and improvements in travel times. The project also seeks the integration of the private sector working with the companies that have served for years to help them create dynamic business models in order to orient the system towards being one based on good service to the consumer, more socially and environmentally sustainable, and strengthen it as an economic trigger and revitalizer due to its significant impact on the conditions of the inhabitants' lives, it being the transportation method most used to move within the city.

Likewise, other measures taken to promote the use of public transportation and respond to existing social issues are infrastructure designs that promote the access of passengers with reduced mobility (PRM); new vehicles that comply with permissible emission standards as determined by the environmental authority; transfer stations; adequacy of bus stops with information for passengers; fare integration so more people have access; and a fare collection system, with float and communications monitoring, to bring security and information to all users, the authorities, and service providers.

All of the aforementioned improvements bring about a positive impact on travel times and move the system forward with affordable fares and better coverage, accessibility, security, and trust, all of which promote public transportation use, and thus increase the demand necessary to sustain such operations over time. In addition, progress in a city's mobility generates better social dynamics and economic connections because it optimizes city traveling for the ability of citizens to tend to their professional, academic, social, and leisure activities.

Future Plans



TPM. Alcaldia de Medellín

The TPM project was created with the objective of optimizing aspects of the urban buses system in the city of Medellín.

The goal of the TPM is to improve the quality of life of the people by providing them with an efficient, safe, accessible, sustainable urban bus system that strengthens civic culture.

- Efficiency: Lower travel times by coordinating system operations, necessary infrastructure renovation, and action implementation to improve service quality.
- Safety: Create peace of mind in users and in transportation companies by providing technologically monitored service with an electronic payment system and vehicles in prime condition.
- Accessibility: Provide the necessary conditions for all citizens to have access to the system, especially people with physical or sensory disabilities.
- Sustainability: Establish parameters that reduce polluting emissions within a financially self-sustaining system at an affordable price.
- Civic culture: Develop a cultural model around the system that promotes its appropriate use, encouraging change in the cultural habits of users.

TPM also proposes:

- A 12% fleet rationalization, a reduction of 394 vehicles.
- 16% reduction in annual distances travelled, which means going from 124.446.324 km/year to 104.772.954 km/year.
- Monitoring the implementation of the automotive fleet's inspection and preventive and corrective maintenance program by the operators.
- Training drivers in efficient driving.
- Adaptation of corridors with preferential lanes, specific stops, and new bus route layouts for the mass transit system in order to achieve improvements in commercial speed.
- Accelerated renewal of 2,634 vehicles that currently do not comply with emissions standards, meaning they operate with low or no emissions.
- Establish incentives and requirements for transport operators to ensure they implement strategies and utilize technologies for emissions reduction.

f. Motor Development International SA (MDI)

Introduction

Mr. Guy Negre, founder of MDI, has dedicated his whole life to technological innovations. As a real visionary, he always considered his inventions as a way to serve people. Years before the Rio Earth Summit, he integrated sustainable ideals into his research and established a pillar of MDI philosophy by saying as early as 1991: “Pour avoir un réel impact l’écologie doit être accessible à tous”. This can be translated as: “Sustainable development will have a real impact only if it is accessible to all”.



After several years of involvement with manufacturing companies, while developing Formula One and airplane engines, after having understood the way that cars were – and are – built, he realised the impact of such engines and manufacturing processes on each individual life and, on a global point of view, on the planet itself, then asked these questions:

- Why think so narrowly?
- Why not share in order to live better?
- Why buy from the other side of the world what can be produced in our own street?
- Why destroy what can be recycled?
- Why is sustainable transportation a luxury?

With MDI, an idea was born, and with it a challenge to make clean transportation available.

It took years to make viable the concept of running an engine and a car with air, in addition to returning to a local manufacturing environment and social friendly process of production, to avoid polluting supply chains and to bring back workers' value in the factories: local supply, local manufacturing, local jobs and local market.

Because of the unique synergy between a simple and efficient technology, that uses the air that we all breathe as the most available energy carrier on earth, and a specific production concept where the vehicles are locally built into many replicable micro factories, Guy Negre's

dream can now be reached. The historical agreement signed for the COP 21 in Paris has shown that it is the right time to do so.



The ultimate achievements allowed by the MDI philosophy are to produce affordable and accessible clean transportations, to bring back the human in the centre of all activities and as Former Secretary General Ban Ki-moon once said “to protect and cherish our only home: The Earth”.

Founded in 1991 in Luxembourg (Europe), Motor Development International SA has initially acquired intellectual property rights from Guy Negre. The company now holds, maintains and expands a portfolio of patents, develops the organisation of the licensing activities through the world and oversees its subsidiaries. To reach its goals, it has indeed incorporated a group of companies including an R&D facility as well as a demonstration production unit in construction for the launch of the first compressed-air vehicle: the AirPod.

Approach

While the question of sustainable transport is fundamental, it also poses problems in its current transposition.

In the best of cases, the renewable energy sector for transport focuses on “well-to-wheel”⁸ efficiencies, at worst only on “tank-to-wheel”. However, MDI believes that working effectively on sustainable transport should include a wider environmental aspect by improving heavy and polluting supply chains and whole life-cycles of vehicles. The enormous energy and water consumption as well as the soiling from mega-factories are also to be questioned.

The current widespread understanding of sustainable transport also neglects the social nature of this concept. Thus, it does not call into question these big, polluting and inhumane production factories established in countries where human rights are sometimes even at stake.

⁸ The well-to-wheel analysis is commonly used to assess total energy consumption, or the energy conversion efficiency and emissions impact of marine vessels, aircraft and motor vehicles, including their carbon footprint, and the fuels used in each of these transport modes. Wikipedia, January 2017.

The problems of exploiting non-renewable resources and of energy dependence from some countries on others are often pointed out when it comes to combustion engines. However, most of the current alternatives (such as the rare lithium⁹ from batteries) merely move the depletion problem of natural reserves and remake the geopolitical landscape and related conflicts based on other non-renewable resources.

Clean transport solutions almost always run up against economic viability. Most of the time, they add economic constraints instead of solving existing ones (i.e. rigid and expensive manufacturing processes). Ultimately, the result is an expensive technology, only affordable to individuals after government subsidies.

Zero emission solutions have a low energy potential compared to fossil fuels in respect to their volume or mass. This causes range and refill time constraints in the case of clean transport.



MDI Solutions

MDI vehicles, both standard and custom models, are sold at the right price at their place of manufacture. On the one hand, this is possible due to an innovative production concept: a net of small manufacturing units spread across the globe, which offers local employment and eliminates the negative effects of complex logistics.

Local manufacturing permits a flexible production and distribution process with no currency exchange and, furthermore, the use of composite materials at affordable prices. Eco-designed, the vehicle can respond to a real life-cycle analysis (LCA) “from cradle to grave”. Social benefits of fair local employment, local supply and independence become a priority in such a concept. As well, they match with the relocation process already underway and predictions of an increasing number of experts on economic growth¹⁰.

The MDI compressed air technology, which fits into this overall strategy, brings itself numerous advantages. In particular, it offers great opportunities in terms of energy storage.

⁹ *The trouble with lithium*, study by Meridian International Research, January 2007.

¹⁰ As Olivier Scalabre in his TED talk, *The next manufacturing revolution is here*, August 2016.

Lightweight, adaptive, secure¹¹, reliable¹², inexpensive and geopolitically independent, the air tanks have advantages over electric batteries. Many specialists recognize that it will be a key to energy conservation, inseparable from renewable energies.

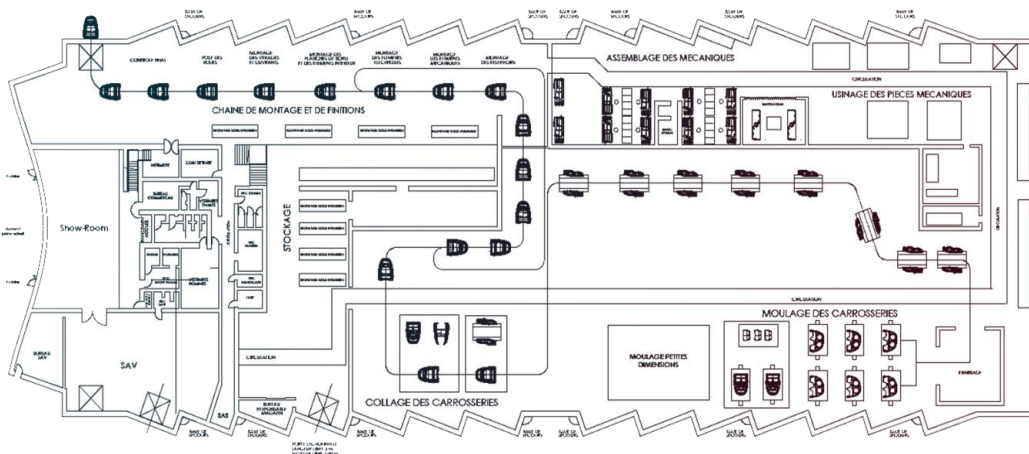
The well-known base of piston engines makes it a robust and reliable system for energy conversion. The vehicles use a universal energy carrier, air, which does not suffer from reserve limit on earth. Air can be acquired by renewable compression directly from hydro, tidal or wind turbines.

MDI responds to the problem of range constraint by providing a technology with fast refilling (two minutes on a compressed air recharge terminal and one hour and a half on an electrical outlet) and little constraining (the partial filling of the tanks does not have a negative impact on vehicle life).



Achievements

Production concept:



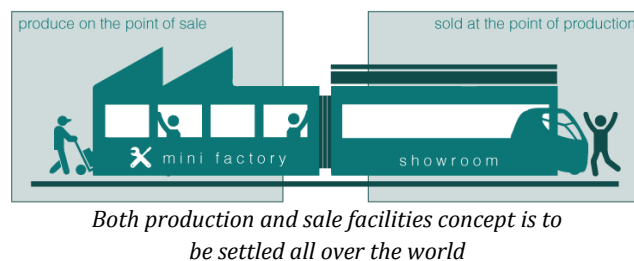
¹¹ The approved tank complies with the existing UN ECE R110 standards for NGV (Natural Gas for Vehicles), which has been used for several years in public transport, in particular for buses. The new composite tanks are made of carbon fiber and resin, very resistant and without fragmentation in the event of an accident.

¹² Designed for more than 20,000 cycles, which means more than 50 years of use. A filling test must be carried out every 5 years.

The replication of micro factories all over the world will allow manufacturing and selling locally with exclusivity in the territory booked, saving money, inventory and logistics costs and provides employment. The low capital investment required in these factories makes them feasible all over the world, promoting sustainable development everywhere.

The products based on MDI technology are intended for countries worldwide. Through its licensees (in India, Italy, Mexico, Australasia, Spain and growing), MDI continues to forge itself a truly international presence. One of the objectives of the company is to have 80% of the production at the point of sale. This brings advantages of employment, supply support and profit in the area.

The company has proven its leadership to several investors who have signed options of License for production and sale of certain products designed and developed by the MDI Group research centre, all over the world.



Compressed-air technology and Products

MDI has developed and continues to further develop a highly innovative piston engine technology based on compressed air. It caters to a wide variety of applications, such as clean, economical vehicles, electricity generation and storage systems.

For several years, Motor Development International SA and its subsidiaries have developed many applications and prototypes around its compressed air technology:

- The first MDI city vehicle: AirPod 2.0, Version 1 has been tested by institutions like Air France KLM and certified in Luxembourg. The evolution of the European Rules has driven MDI to upgrade the AirPod 1.0 to AirPod 2.0 (see below).
- Applications of the MDI Technology for Tata Motors Ltd products, through a contract in which MDI SA has granted Tata Motors a general license of its technology for India.
- Application of the MDI Technology for Veolia for a specific vehicle powered by compressed air for garbage collection and is already certified in France.
- Application of the MDI Technology for compressed air emergency generators whose industrialisation process is about to start.

The AirPod

MDI succeeded in realizing a 100% compressed-air running prototype in 2008: this was the first version of city tricycle AirPod, presented in 2009 and then certified in Luxembourg in

2010. In doing so, MDI has gained great experience in terms of body resin transfer moulding (RTM), thermodynamics, road testing and certification. Then after 2011, the closer collaboration with Tata Motors Ltd. (TML) led to great improvements on the MDI compressed-air technology that will equip some TML products. The evolution of the European Rules has driven MDI to upgrade the AirPod 1.0 to AirPod 2.0 which is a quadricycle vehicle including many enhancements (range, design, comfort).



MDI Group research team and AirPod 1.0

These environmentally friendly vehicles use light composite materials technology enabling improved energy efficiency and manufacturing efficiency, as it allows for the integration of functions into fewer parts. The AirPod's are easy and inexpensive to operate and to maintain, and will help preserve the atmosphere of our cities. The AirPod with its two seats, its range of about 120 km and its ample trunk space is ideal for car sharing in cities. MDI actively wishes to follow and promote such eco-friendly practices in the spirit of the times.



AirPod 2.0 - two-seater urban vehicle running exclusively on a patented 100% compressed-air technology

Challenges



Since the ambition of MDI is global, the challenges overcome, and to come, are numerous.

Technical

By their very nature, the MDI projects as well as the first challenges were highly technological. If the autonomy of the AirPod 2.0 can now meet urban expectations, it is thanks to the long work of the MDI engineers that solved the numerous constraints to increase the efficiency of the thermal cycle of the compressed air engine. Among main items, MDI focused on very low temperatures within the engine and the controls of the engine and its related systems.

Managerial

The small work team needs to deal with multi-skills human resources, which is a great interpersonal challenge.

Financial

Given the nature and scope of the project in light of the small size of the company, it is clear that the need for financing is a key issue. The monopolistic behaviour of manufacturers in the transport market, relayed by institutions, is also an obstacle with which MDI must cope.

Governmental

The transport market presents rigidity and a complexity of domestic standards, which have long been barriers. The past years of labour ensured MDI a certain experience in certification and approval.

Cultural

The reluctance to change by interlocutors, professionals, manufacturers or institutions will always create obstacles for MDI, which makes the development of new ideas its mission. However, perseverance has become one of the strengths of MDI and the concretization of different products will make it possible to influence this trend

Future Plans

Short term: AirPod 2.0 and Gensets Finalisation

Today, as the AirPod 2.0 study is complete and its production phase is about to start in Sardinia (Italy), opportunities are opening for MDI product range.

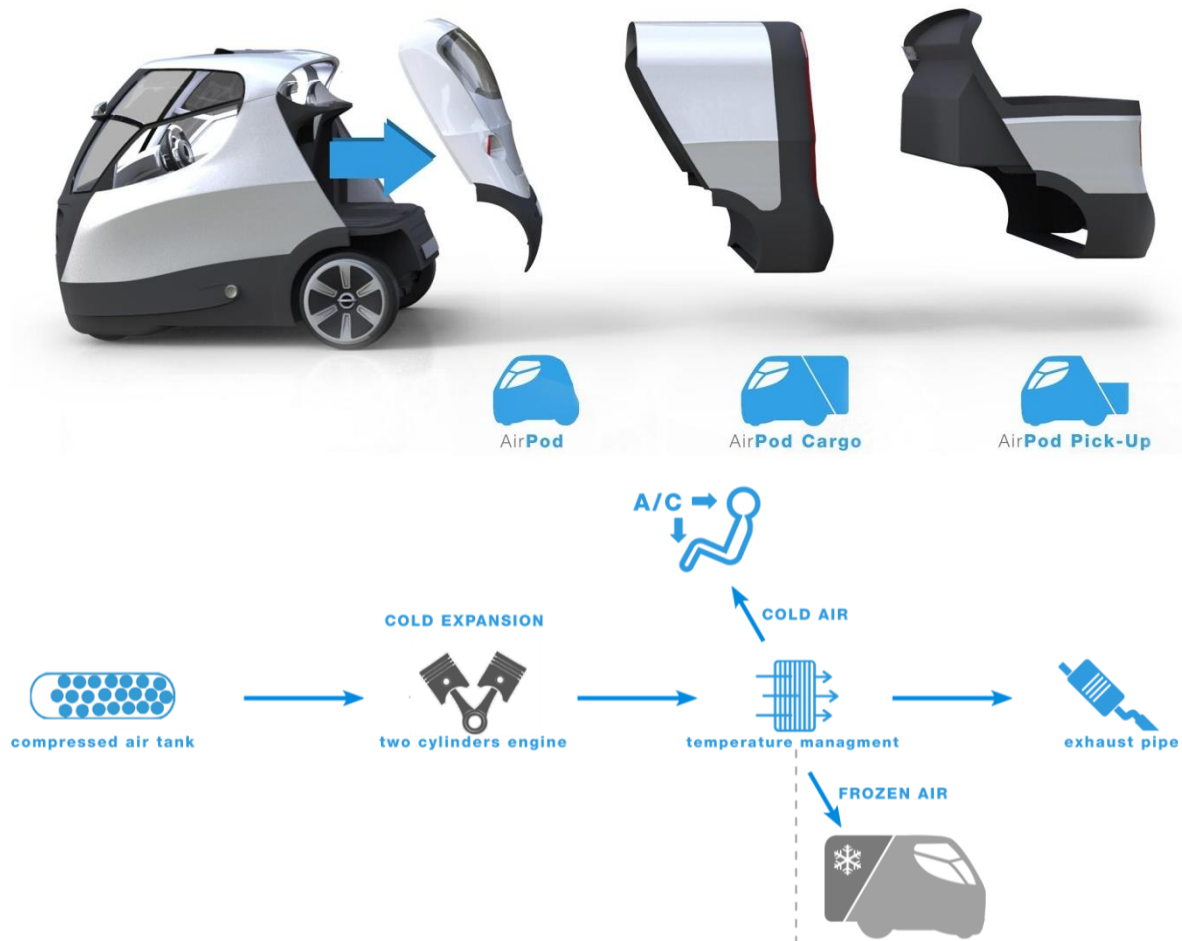
The MDI gensets are designed to convert electrical energy (with the best conversion efficiency) into air compression (with the lowest storage loss) and vice versa. In conjunction with very economical storage capacity, they have the potential to solve the intermittency problem of wind and solar energy, by providing cost effective storage.



This is expected to be of great benefit in achieving desirable uptake of renewable energy. It is an ideal solution in remote, small communities around the world.

Medium term: Widening of the Airpod Range and Refrigerated Transportation

The design of the AirPod 2.0 is thought to allow a quick extension of its range. This aims to minimise the investment for licensees and to reach very soon the widest possible part of the transport market. Furthermore, it is expected that extending the AirPod product's range will help implement charging air-stations in cities by creating further demand. This will restore fair competition with electrical charge stations (to which MDI vehicles can be connected to also, thanks to their reverse compression mode) which are the only ones to receive state subsidies.



It is today a matter of common notoriety that the on-board refrigeration systems are one of the major causes of pollution in the services sector and that this is not going to decrease, on the contrary. The Airpod Cargo, evolution of the AirPod 2.0 range, will be the first MDI vehicle to be equipped with refrigerated trunks.

The refrigeration of the AirPod Cargos is intended to achieve temperatures lower than 4°C (41°F) in a 2 m³ trunk even under high ambient temperature (45°C/113°F). This will be done thanks to the cold exhaust air flow of the engine. Thus, without any additional consumption,

the refrigerated AirPod Cargo will allow clean transportation of perishable food, medication or organs.



This can be replicated on all vehicles powered by MDI, where there will be benefits for the countries where it is warm and where perishable food transport is a key issue. Such suitable vehicles have already been studied by the Group's research centre, at least partially. For example, the AirOne and its improved suspensions can run on rougher roads of Africa.

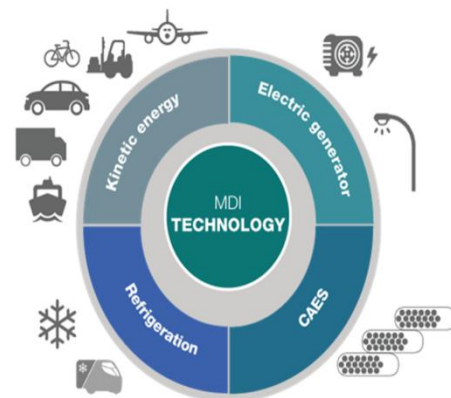


Long term: A Scalable Technology

MDI's vision permitted it to launch the design of other applications like road vehicles, multibus for urban transportation, forklifts, bikes, lights, etc. that are meant to materialise in the long term. Larger and powerful compressed-air energy storage systems (CAES) are also being studied.

It is also this forward-looking vision that MDI wants to cultivate in the years to come. Innovating, according to MDI, is to imagine a future that is not yet written, and always in the service of people.

MDI's multipurpose use of compressed air based technology



g. South Asian Forum for Environment (SAFE)

Introduction

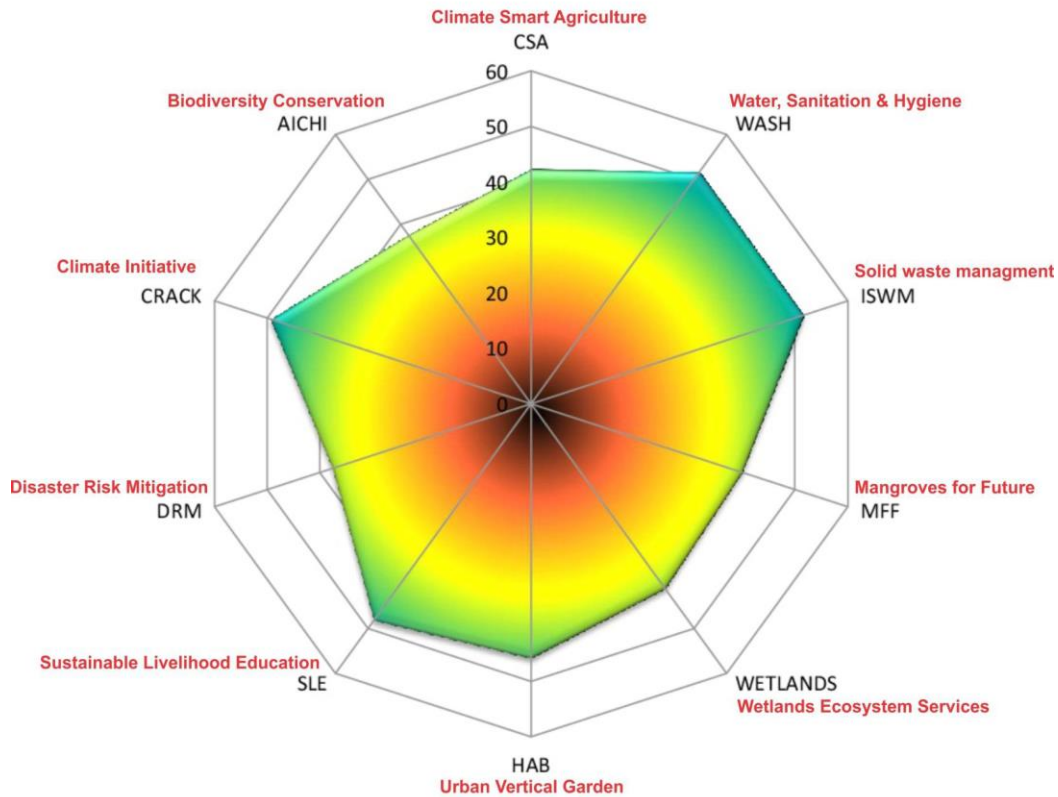


The South Asian Forum for Environment (SAFE) is a registered non-profit civil society organization started in 2004 to achieve sustainable environment development goals for poverty alleviation through empowerment, equity and reciprocity in the milieu of climate change in the Indian ecoregion. SAFE envisages global reciprocal partnerships and a participatory policy frame for 'Biorights' of commons to promote wise use of natural resources through community governance and inclusive growth for sustainable development.

SAFE aims to address environmental issues especially with reference to water, energy and food security through community based conservation initiatives for which it conducts action research and programs at a science-society interface for the Sustainable Development Goals. The organization aims to teach awareness and community preparedness for disaster mitigation and adaptive strategies for resilience to climate change among all stakeholders. SAFE also works to enhance capacity building for innovation and green technology cooperation in both rural and urban sectors and to encourage environmental stewardship for sustainable transport, health and sanitation for the poor.

SAFE was one of the finalists for the UN Water for Life Award 2015 and has received the UNFCCC Momentum for Change Lighthouse Activity Award in 2014, as well as other awards from UNEP and UNDP. SAFE has a very strong presence in countries in South Asia and Southeast Asia through its interventions and networking. As a civil society organization, SAFE has shown commendable leadership in its domain and has been duly recognized with memberships from the United Nations Environmental Assembly (UNEA), GEF-CSO Council, GCF and UNFCCC, UNCCCD, and VEF (UNITAR).

SAFE Interventions & Sustainable Development Goals (Agenda 2030)



Approach

Developing countries like India, with ever increasing energy demands and lofty potentials in renewable energy, while possessing abundant sunny days and a long windy coastline, considers the load of initial investments in materializing renewable energy solutions, like solar and wind, as the first predicament, whereas land and space crunch remains the next.

These setbacks have made new renewable energy more inaccessible to the marginal communities. Therefore, to meet the need, entrepreneurial sustainability is sought in renewable energy interventions. Areas with a growing urban population are vulnerable to climate impacts already and now have the pressure of anthropogenic encroachment and are succumbing to it. Above the demand of energy and fuel for water; agriculture, transport and other basic facilities are turning the situation graver. Urbanizing coastal areas in the global south have the worst of all situations in regards to salt water inundation of agricultural land, storm surges, and absence of grid power and lack of basic amenities. This compromised lifestyle is making the inhabitants targets of climate and poverty.



Sustainable Transport Problems

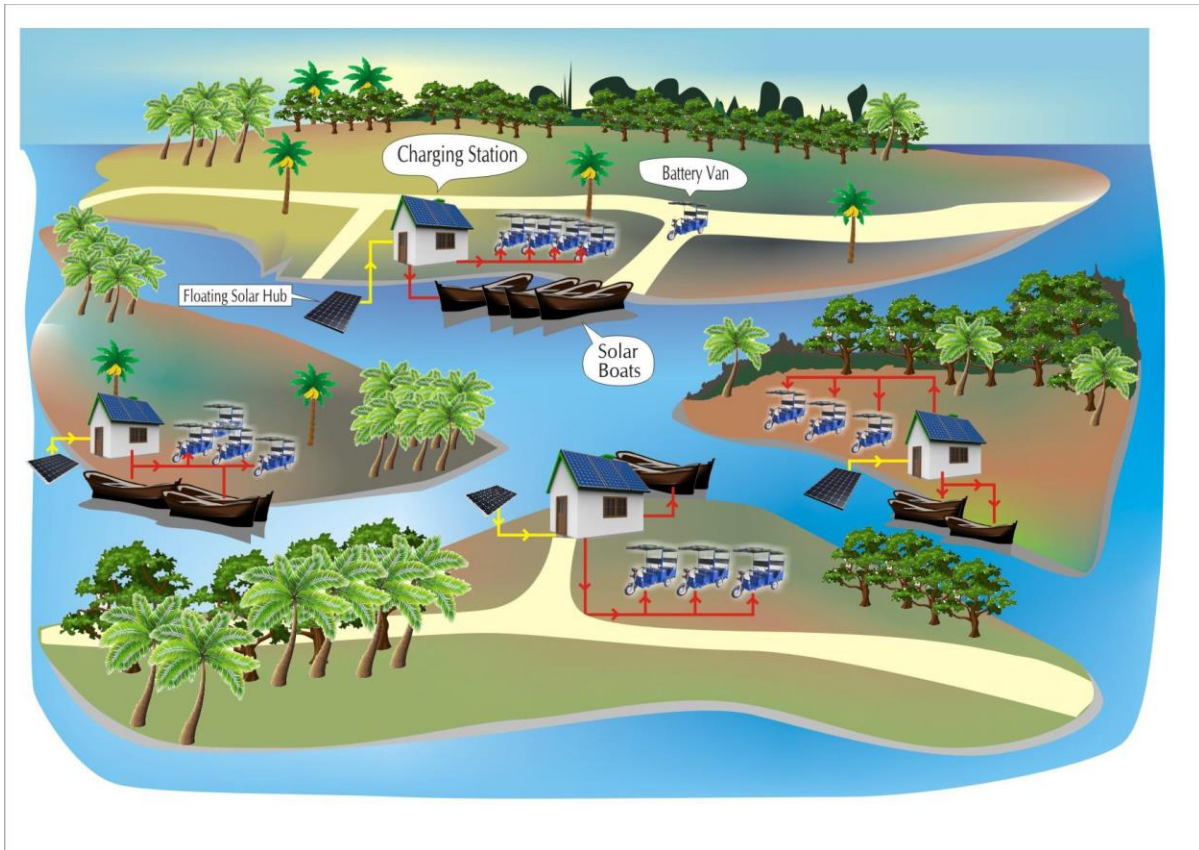
- 57% of air pollution is due to motor vehicles;
- Emission of GHGs and SPM (1.1 micron);
- 73.2% vehicles run on diesel or kerosene-mix-oils;
- Average age of vehicles in public transport is 14 years;
- Every 4th person suffers from respiratory tract diseases and asthma;
- Increase in road-noise (peak-hours) is 16.6%;
- Increasing private automobiles for point-to-point movement is decreasing urban carrying capacity;
- Swelling load on rural vehicles for limited public transport options is deteriorating air quality.

SAFE addresses the issue in a threefold way, the first is an awareness campaign to promote sustainable transport. Initially, a survey was launched by SAFE to understand the attitude of urban people in using shared transport, availing public transport systems and preferring emissions free transportation. During this survey an emissions footprint was done in the Sundarbans Delta area where several land transport vehicles and water transport boats use highly emitting fossil fuel like kerosene. The reports were published in local newspapers, and were followed by several agencies and stakeholders, who then protested the use of high emitting fuel in small public transport vehicles, which lead to a ban on the same from the apex judiciary.



The deltaic islands of Sundarban World Heritage site in India and Bangladesh are inhabited by six million people of whom 87% slouch below poverty level while also combating with climate disasters. These captive islands are ostracized from the energy grid and lack basic amenities for survival. The inter-island transport system consists of improvised motor-boats and land-vans that are highly unsafe and pollute the pristine ecology with emissions from crude kerosene fuel. However, this transport remains the lifeline for the livelihood of people. The shortlisted project for the grant, ASSIST (Aqua Solar Systems for Integrated and Sustainable Transport), tries to find a win-win solution for retrieving solar power potential through a sustainable energy network for inter-island transportation.

SAFE proposes floating captive solar energy plants of 10KVA intermittently placed on inundated lands and rivulets for charging up electrical motor vans and boats. Technology cooperation and capacity building is integral to this potential project. The intervention would be built-up on sustainability economics as a bankable model for credit linkage to facilitate scaling up. This would also facilitate entrepreneurship development in allied areas of spares, sales and services as well as increase the number and capacity of vehicles for a more sustainable lifestyle and livelihood for the locals.



Achievements

- Awareness Campaign for Attitude Change
 - Educating transport sector stakeholders, owners and dealers and carrying out on-road campaigns;
 - Action research at science-society interface for 500,000 commuters;
- Ban on polluting urban Autos – bringing in CNG and Battery-run vehicles in Kolkata in 2014;
- Rehabilitating the electrical Tram car in Kolkata, and now the government has introduced new trams on the roads.

- ‘*Chakra Satyagraha*’ – a mass campaign against the blanket ban on cycles in Kolkata:
 - The government has had made separate lanes and pavement for cycling in Kolkata;
 - Promoting battery run “Totos”, auto type rickshaws in peri-urban areas of Kolkata.
- Save Sundarban Habitat with ASSIST
 - Technology cooperation for a more economic new-energy paradigm;
 - Elimination of GHG emitting vehicles to save the habitat from pollution;
 - Awareness drive for safe and smart travel.

Challenges

The main obstacles and barriers for SAFE, pertaining to socio-economic situations, are very similar to that of any developing nation. However, there are some specific challenges which increase the dimension of the challenge in multi-fold. The first of its kind is the geographical remoteness of the area which prevents equitable access to market services. As a matter fact, the cost of technology transfer to these remote areas and to promote a sustainable service delivery in these isolated deltaic islands, which are only connected by water ways, poses the most uneven challenge.

The next challenge that follows is investment opportunities and direct funding for such innovative interventions. As SAFE is looking ahead with a sustainable revenue return model the assurance of funding in the form of either term loan or as equity shares becomes very important. In these climate vulnerable areas, it is difficult to find any investor who would invest after knowing the estimated risks and externalities in implementation of the project. Similarly, alternatives for risk spreading and assurance of risk coverage through incentivized schemes or insurance is also not possible. Therefore, the intervention doesn’t have the guarantee of core funding.

The last barriers that prevent the intervention to occur are the technology adaptation barriers. Since complimentary services and allied support to technology is not assured, the locals remain hesitant to go ahead with the technology adoption process.

In summary, the pace of growth becomes too slow to be sustainable. This can be altered only if the ecological quotients and the impacts in the climate milieu can be encashed for necessary resource allocation, only then can a sustainable kick start be guaranteed. Some challenges after implementation will still be there pertaining to capacity building for technology transfer and compensation of the opportunity cost incurred by the community partners. This challenge grows into separate problems. One of which is the environmental instability which keeps the livelihood opportunities dependent on vulnerable local market

and prevents community partners from shifting their trade habits. The other is the trend in the socio-economy in the locality that prohibits the local communities to take any economic risk at the cost of any participatory action like capacity building. Interestingly, climate finance as Foreign Direct Investment (FDI) for carbon credits can be a panacea to all these bottlenecks since such fiscal empowerment enables the development sector partners like civil societies to be proactive.

An obvious dilemma that arises in the given scenario is probable investment from government schemes and funds. In developing countries, the main problem of working with government funds becomes three dimensional. The first dimension is the funding priorities which exhaust the health, food and education sectors; therefore, sustainable transport falls back in the priority list. Secondly, implementation of a project through government norms always demands the economy in scale and cannot earn a sustainable status in stand-alone mode. To achieve the economy of scale the initial investment becomes too large to be possible. Lastly, the implementation of government projects in a given timeframe has to overcome a number of policy barriers and political hurdles.

To overcome these challenges, SAFE has proposed the entire model with a lower break-even value and investment relay process to enable a sustainability chain that automatically attains the scale of economy. The SAFE preposition considers a grant as the initial investment fund for which a joint liability is bestowed on the community partners. Up to 65% of the return on investment or 50% of internal rate of return (IRR) is conserved in the project as corpus fund for scaling up. Although this reduces the beneficiary pay out in the initial phase, it assures more inclusive growth due to scaling up of the project as well as a substantially good net present value (NPV) that can attract collateral funding as the risk of investment becomes low.

The thresholds of capacity building for technology cooperation are overcome through geographic based participatory action research, hands on training, and collective involvement of community partners. The opportunity cost is cross-subsidized with value added services like financial inclusion, equitable access and alternative livelihood. As the proposed intervention necessarily banks on development sector partnerships with CSO's, voluntary actions become instrumental in gearing up implementation with all the necessary momentum to achieve actualization. Conflict resolution and vested interest are subdued through participatory decision-making, thus social and economic sustainability could be guaranteed.

Future Plans



SAFE plans to implement a pilot intervention in a very remote traffic route on which people are necessarily dependent and do not have alternative choices. This pilot intervention can then be an easy success story to provide community partnerships in other areas. The initial funding is hoped to be through a climate grant will also be accounting for a seed grant for scaling up. It is envisaged that resources can be allocated from Green Climate Fund or Global Environment Facility Fund in a Public-Private Partnership model and this can create a win-win situation. The scaling up of the project will be phased proportionately with the returns in investment. However, owing to the estimated risk and environmental uncertainties, liabilities of credit linkage or equity is not proposed in the initial phase.

SAFE is a channel partner to the Ministry of Renewable Energy, Government of India, and has been a participant with Ashden International for the Energy Award. SAFE now looks forward to partner with international agencies like UNIDO and other corporate houses, which can promote the idea for sustainable replication and scaling up. SAFE also looks forward to partner with organizations and companies working on sustainable transport especially in the developing global south.

h. SNV Netherlands Development Organisation

Introduction



SNV is an international non- profit development organization founded in 1965, with headquarters in The Hague. SNV is active in 38 of the poorest countries in Asia, Africa and Latin America. SNV specialises in agriculture, renewable energy, and water, and sanitation and hygiene. SNV has been present in Niger since 1978.

Building on its 51 years of local presence and extensive experience in 38 countries, SNV uses a market-based approach that facilitates access to affordable and appropriate energy solutions to households, small/medium enterprises (SMEs) and public institutions. SNV works with the private sector, local communities, local capacity building organisations and government partners to strengthen energy value chains and to create an enabling environment whereby sound policies and regulations, quality assurance and good governance are developed.

SNV is the world leader in the implementation of domestic bio-digester programmes. Supported by SNV programmes, more than 663,000 households in Asia, Africa and Latin America have gained access to biogas to meet their cooking needs and boost their economic activities. SNV is an important player in the development of energy delivery models for cook stoves, fuel wood and briquettes, as well as solar solutions ranging from mini-grids to solar lamps. SNV is a founding partner of the Global Alliance for Clean Cook stoves and participates in Sustainable Energy for All (SE4All). SNV welcomes the inclusion of a Renewable Energy-

specific goal in the Sustainable Development Goals (SDG7), and is committed to contributing to meet the goal of universal access to sustainable energy.

In 2015, 1.5 million people made use of renewable energy sources through successful market development for improved cook stoves, solar PV lamps and solar home systems. SNV's impact increased substantially in 2015 compared to 2014 (1,475,329 people gained access to clean and affordable energy in 2015 vs 895,000 in 2014); 2.5 million people increased their income; 81,000 people with employment ; 2,060,930 tons of greenhouse gas emissions were reduced due to the adoption of clean energy and energy efficient solutions; 71, 000 people increased their resilience to climate change ;1.6 million people gained access to improved drinking water sources and 2.2 million people made use of improved sanitation facilities.

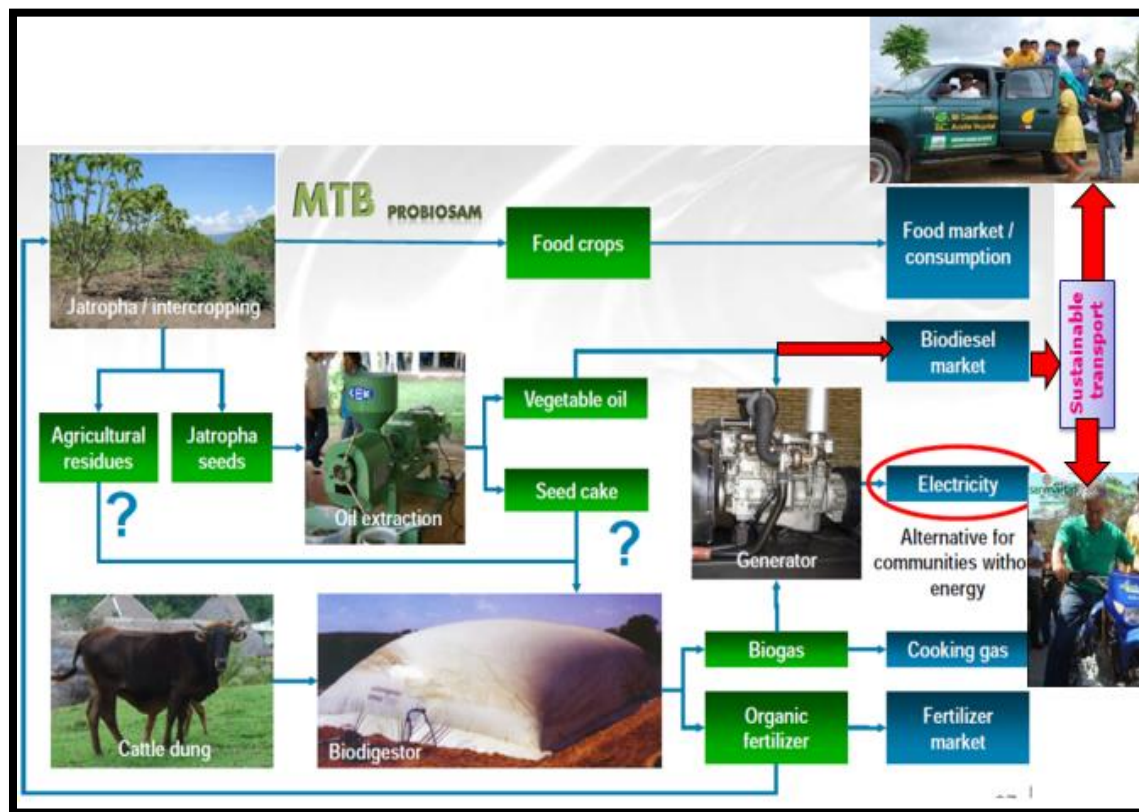


Approach

Transportation is a major contributor to several environmental problems; primarily because of its dependence on fossil fuels. Transport systems have significant impacts on the natural environment, accounting for between 20% and 25% of world energy consumption and carbon dioxide emissions. The majority of the emissions, almost 97%, came from direct burning of fossil fuels. Greenhouse gas emissions from transport are increasing at a faster

rate than any other energy using sector. Road transport is also a major contributor to local air pollution. Substitution of fossil fuels with renewable energy will greatly contribute to reaching the overarching energy and sustainability targets. So far, biofuels have played the most significant role in the substitution of fossil fuels for road transport. Migrating transportation from fossil-based energy to other alternatives such as renewable energy has been one of the key issues targeted by SNV.

SNV work through an integrated approach (illustrated in the chart below), while promoting sustainable transportation, enabling clean electricity generation, clean cooking and agricultural development.



According to the National GHG inventory report recorded in Niger INDC (2015) for COP21, the leading GHG emission sector is transportation (41% of total emissions).

SNV has discovered that the biofuel extracted from neem seeds, which are native to Niger, is uniform with conventional fossil fuels as gas oil and kerosene. All mixtures are combustible and burn easily with a viscosity that is even higher than that of diesel. SNV's experimentation was carried out with the least powerful of engines which is the motor pump with direct injection of small displacement. The results were much better in the heavy-duty engines equipped with pump injection glow plug system or turbo. Neem oil as a biofuel for vehicles

is an obvious contribution to sustainable transport that SNV seeks to scale-up and promote throughout Niger.

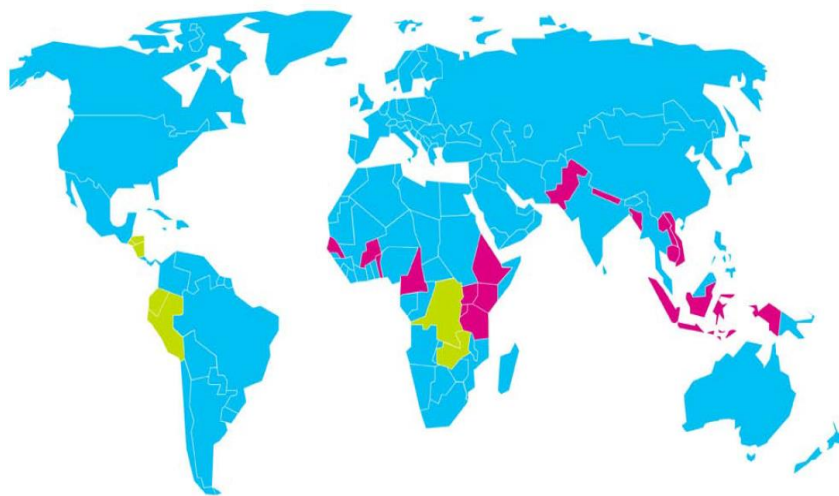
Since 2006, SNV has been implementing Bioenergy Programs in Latin America, Asia and some African countries (DRC, Zimbabwe) seeking economic and social inclusion, focusing on public policy development, inclusive business promotion and social empowerment.

SNV and INOVATECH in partnership have had many successful experiences in promoting bioenergy including biofuels. The two organizations have extensive expertise in this field. SNV has global expertise in biofuel projects and INOVATECH has successfully produced biofuel made of Neem seeds in Niger. With an expertise of over 38 years in Niger, this innovative biofuel industry for the promotion of sustainable transport and rural development is an opportunity for both organizations to widen their energy track records and meet the beneficiaries' needs more precisely. This will substantially support the Government's efforts to achieve the objectives of the National Renewable Energy Action Plan (NREAP).

Achievements



SNV has been implementing various bioenergy programs in Latin America, Africa and Asia. The map below shows the bioenergy interventions of SNV around the world.

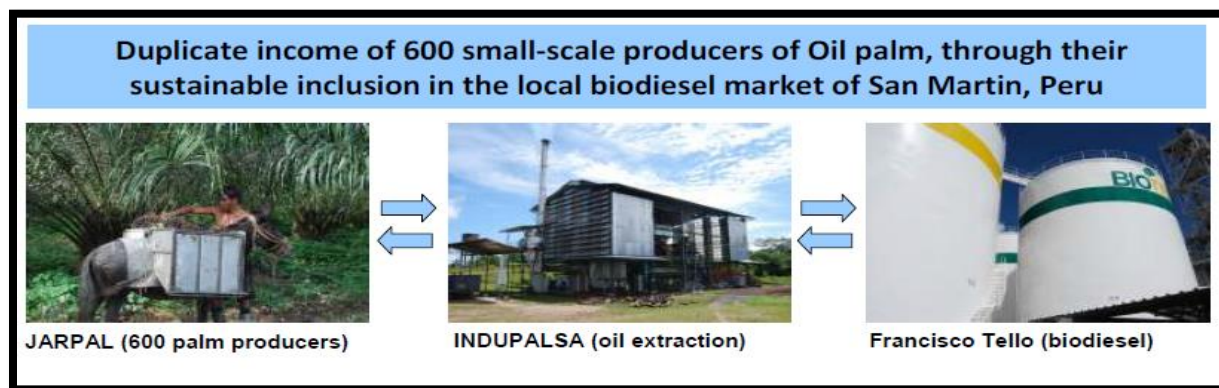


Biofuels **Domestic biogas**

Sustainable transportation, economic, environmental and social inclusion, have been some of the targets of SNV projects through focusing on public policy development, inclusive business promotion, social empowerment, jobs, income and access to energy through sustainable inclusion in biofuel value chains.

In Latin America (Peru, Honduras, Nicaragua) and Africa (DRC) biofuel projects implemented are based on jatropha, palm oil or neem seed.

In Peru, Jatropha oil has been oriented for use in vehicles converted to straight vegetable oil (with a conversion kit from Elsbett, Germany), of which 3 units were installed; 2 in pick-up trucks, 1 in a transport truck of the Jatropha farmers' cooperative. 700 gallons per year would be needed for operation of each vehicle. The oil is sold at the local price of diesel: 12.50 Peruvian Soles per gallon in May 2011 (US \$4.50). In 2009-2010, a cooperative produced 800 gallons of Jatropha oil. Some 600 small scale producers of Palm oil duplicated their income through their sustainable inclusion in the local biodiesel market.



With this palm oil project, 600 gallons per day of biodiesel, 300 direct jobs and 2,000 indirect jobs have been created. This project also enabled: market power and economies of scale; a cooperation with other parts of the value chain; an expert knowledge to improve raw material quality and yields; an expert knowledge and collaboration for cleaner production; effectively informed the public of energy, climate, and biofuel policies; promoted national governmental support through collaborations with SERNA and SIC; garnered political support in national and international institutions; and influenced creating a supply push and demand pull to increase/facilitate market penetration.



In Niger, the project implemented focused on the promotion of an innovative biofuel derived from the Neem tree (*Azadirachta indica*). This raw oil from neem has enabled the production of electricity, pumping of groundwater, and running local equipment. Tests were performed successfully over a period of one month with a new diesel motor pump that did not involve any special modifications to the structure of the apparatus. Chemical analysis of the quality of the biofuel was done by the German laboratory ASG ANALYTIK SERVICE. The resulting fuel fits standards specifications. This biofuel has been processed innovatively and mills and pumps have functioned with this biofuel in three target villages of Kollo: Souga Dossado, Manga Koiria, and Tounga Baouchi. A census of the Neem trees in Niger revealed that 70 million trees exist across Niger, their annual oil production is estimated at 278 million liters of biofuel. The oilcake byproduct generates organic fertilization which is very suitable for increasing agricultural yield.



The project has impacted more than 2,000 people and greenhouse gas emissions were reduced. Neem trees CO₂ sequestration is 26.11 kg per tree per year. For the global community, Neem plantations can help to mitigate climate change, while also providing a source of carbon income for local communities. For the national government, there is also the possibility of creating rural employment, increasing income, improving the environment and displacing oil imports.

When blending 70% neem oil with 20% kerosene and 10% petrol; this combination costs US 54 cents compared with US \$1.22 for a liter of diesel. A field test from using this oil blend to run flour mills and motor pumps has revealed optimum results.

Challenges



Biofuel projects and programmes have been stagnant in some ways due to various constraints, such as financial barriers, technical expertise, land availability, and government policies.

- *Land and Food Security*

Recent food security crises have invigorated the debate of biofuel production potential in developing countries, given the fact that most of them depend on local agriculture for sustenance. Land plays a crucial role in the livelihoods of poor countries; therefore, food security and poverty alleviation will be achieved if the land is first prioritized to people's needs and is then catered to biofuel industries.

Nevertheless, countries with favourable climate conditions and land potential are at an advantage for the biofuel sector and have the possibility of developing their agricultural regions.

Therefore, it is pivotal for governments to regulate the distribution of land in order to prevent the exploitation of people, especially impoverished small-scale farmers, by the biofuel markets.

- *Technical*

One of the technical obstacles that biofuel projects face is the challenge of scaling-up the process. At a micro scale, technical challenges are easy to handle because there is no need of very complicate machineries and technology. Often times, some of the machines break down

quickly after project closure because of the lack of proper maintenance and a poor local expertise.

R&D is the primary solution to technical challenges, as well as knowledge development through capacity building of the stakeholders involved, technical innovation and concrete test-cases to demonstrate best practices.

- *Financial Challenges*

In either Latin America or Africa where SNV has been intervening, financial challenges are crucial regarding the development of the biofuel market. Conventional forms of financing are typically not available for implementing emerging technology operations, as many institutional lenders are not accustomed to managing the risks associated with unproven or ill-understood technologies used in the manufacture of products for unproven markets¹³. These risks are familiar to financiers of biotech enterprises, however. In addition, the specialized financial mechanism of 'project finance', typically used for funding large long-term infrastructures under conditions of limited financial recourse, could perhaps be a suitable enabler, provided revenue streams can be accurately projected and secured.

In order to provide solution for this challenge, SNV has developed financial models for small producers to access to credit and has also contributed to the development of adequate business models and the identification of production schemes based on sustainability and inclusivity that contribute to local economic development. In the case of palm oil biofuel in Peru, SNV has developed and implemented financial mechanisms (credit systems) in order to increase productivity in existing plantations (1000 hectares) and to install new areas (2000 hectares).

- *Governmental*

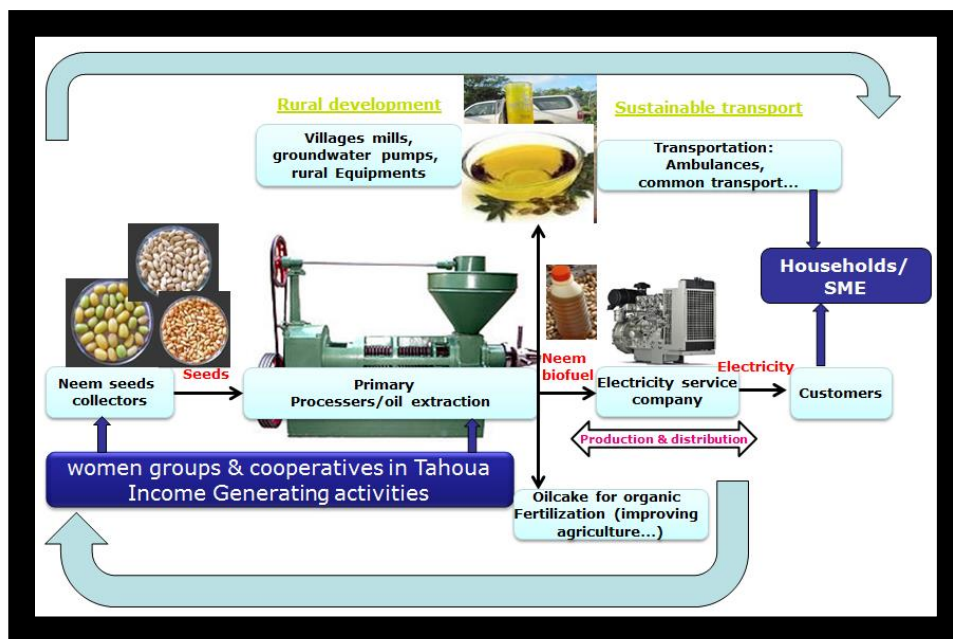
In most of developing countries, national biofuel policies are not often very clear. The institutional framework is not conducive to the promotion of biofuels. Though some countries have national renewable energy policies and strategies, most of them do not focus on the biofuel sector.

As a development organization, SNV works with governmental agencies through advocacy and awareness and shares with them best practices and experiences from other countries to have them improve their vision. SNV has promoted public-private partnerships and development of integrated policies needed to facilitate a sustainable and inclusive development for the biofuels sector. There has also been the need to look for synergies

¹³ Keller, J.B. & Plath, P.B. Appl. Biochem. Biotechnol. 77–79, 641–648 (1999).

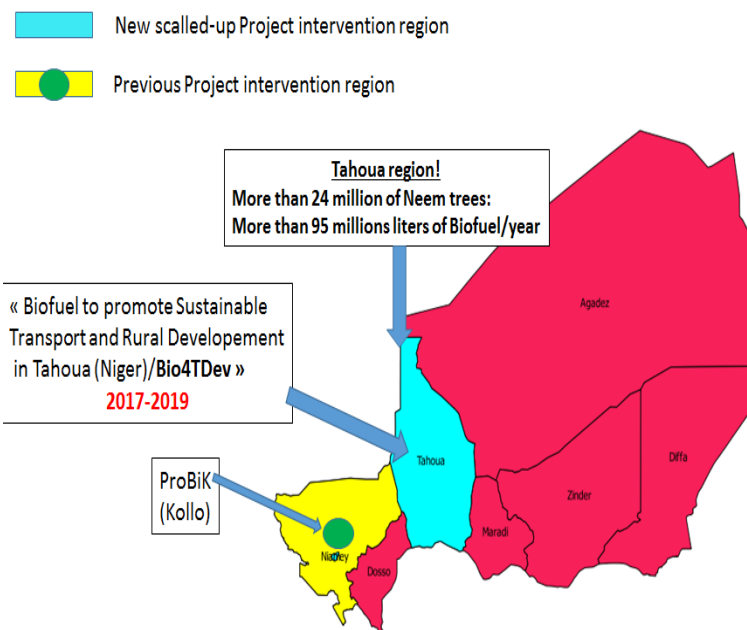
beyond the biofuels for transport market, i.e. use of by-products, opportunities for rural electrification, carbon credits, etc.

Future Plans



The Niger government prioritizes the energy sector for both socio-economic development and climate adaptation. Specific targets have been set: by 2020 10% renewable energy (RE) in the energy mix, and 40% access to basic energy by 2018. Based on the achievements and lessons learned from previous experience, SNV and INOVATECH intend to develop the Bio4TDev project in order to improve the living conditions for rural households and promote sustainable transport in the Tahoua municipality.

While the medicinal, agricultural, and environmental benefits of neem are well known, the biofuel possibilities have not been fully explored in Niger, though it seems



an achievable goal for its biodiesel potentials. The oilcake by-product is an excellent organic fertilizer which will help improve the productivity of crops in Niger. The competition between biofuel production and food is not applicable in this case because neem could be valued for energy without

compromising food safety, while allowing income generation for the poor. Niger has large tracts of Neem trees, with a total of 69 million and more than 24.5 million are planted in Tahoua municipality, the project zone. A deep involvement of local populations and beneficiary communities and the propensity of people to adopt the neem based biofuel as an alternative fuel for their engines will be critical for success.

In the National Action Plan for Renewable Energy (NREAP) adopted in March 2015, the Niger government plans to increase by 5% biofuel consumption by 2030. Anticipated results imply sensitization and capacity building sessions for involved actors. Direct investments for community use (diesel transit vehicles, ambulance, mills, motor pumps) are necessary. These machines will consume 37,600 liters of biofuel per year for a GHG emission reduction estimated at 85.35tons of CO₂ per year. The monetary gain on the use of this biofuel is US \$33,710 per year, rewarding at least 7,120 households from 7 different villages involved in seed collection. More than 1,330 neem trees will be planted by beneficiaries in various communities. The budget is US \$989,626. The project will be implemented jointly by SNV and INOVATECH through a Project Management Unit. Local NGO and municipalities will be involved to ensure sustainability and skills transfer.

IV. The Way Forward

The Powering the Future We Want Grant Programme completed a successful second year promoting innovative solutions and recognising leadership and commitment in meeting the global energy challenge. The 8 Grant applicants who reached the top of the evaluation process demonstrated through their initiatives and actions how they are contributing to the United Nations vision of access to safe, affordable, accessible and sustainable transport systems for all.

This vision is a key priority for the United Nations, as it is reflected in Target 11.2 of the 2030 Agenda for Sustainable Development. UN DESA and the China Energy Fund Committee have ensured their commitment to sustainable development by agreeing to implement the Grant programme for an initial period of five years, from 2015 to 2019. As a result, the Grant will continue to be an opportunity to show the world the best examples that demonstrate how science, technology and innovation can be put into practice to induce change and transform the international energy landscape.

Each year, the US \$1million Grant will support a brighter future for many citizens across the world, as it will help to accelerate implementation of Sustainable Development Goal 7 which calls to ensure access to affordable, reliable, sustainable and modern energy for all, in addition to many other important nexus Goals. UN DESA and the Energy Grant Secretariat look forward to the 2017 Grant cycle and to hearing from many more inspiring international organisations working in the field of energy for sustainable development.

For more information about each finalist please visit the websites provided.

1. Fiza Farhan: <https://www.linkedin.com/in/fiza-farhan-84691911/>
2. GerWeiss Motors Corporation: <http://gerweissmotors.weebly.com/>
3. KPIT Technologies Limited : <https://www.kpit.com/>
4. Medellin Mayor's Office- Mobility and Transit Department:
<http://www.acimedellin.org/en-us>
5. Motor Development International SA: <https://www.mdi.lu/>
6. South Asian Forum for Environment: <http://www.safeinch.org/>
7. SINTEF: <https://www.sintef.no/en/>
8. SNV Netherlands Development Organisation: <http://www.snv.org/>