



LA MIA ENERGIA Scarl
Sede Legale: via M.T. Cicerone 14/L - 86079 Venafro (Is)
Direzione: Forum Ricerca via Cerro snc - 03043 Cassino (Fr)
Sede Tecnica ed Operativa: via Cavallara snc - 03030 Castrocielo (Fr)
P.IVA 10656421004
Tel / Fax 0776.300717

PV-MOREDE
PhotoVoltaic
panels
MOBILE RECYCLING DEVICE

Business and marketing plan

DELIVERABLE D 5.1
DRAFT

AGREEMENT NUMBER:
ECO/12/333078/SI2.658616

Cassino, 30/09/2015



LA MIA ENERGIA Scarl

Sede Legale: via M.T. Cicerone 14/L - 86079 Venafro (Is)

Direzione: Forum Ricerca via Cerro snc - 03043 Cassino (Fr)

Sede Tecnica ed Operativa: via Cavallara snc - 03030 Castrocielo (Fr)

P.IVA 10656421004

Tel / Fax 0776.300717

1. Business Summary

La Mia Energia (LME) is a limited liability consortium, which manages the waste life cycle and it makes ESCO (Energy Service Company) and recently became recently it became Collective System adhering to the WEEE Coordination Centre that manages the transportation, treatment and recovery of WEEE throughout the country.

La Mia Energia works in all Italian territory and it works inside the waste material sector and its produced energy, managing all aspects, from its collection to its treatment and energy transformation.

La Mia Energia was born to offer technological high-innovative solutions to solve real problems in the International market about management and treatment of certain type of electric waste and solar panel at the end of their life of use (EOL). The leading product is a mobile solution for the collection and treatment at the place of installation of the panels EOL , which allows the recovery of the constituent materials (glass and metal) making them ready for re-use , the selection of other semi-finished products (e.g. Precious metals) ready for subsequent processes of separation and purification.

The patented device named PV-MOREDE makes the disposal of small quantities solar panels EOL more accessible and more environmentally sustainable and cheaper than industrial system of waste management. The device aims to be used by a wide range of potential users: producers and solar panels installers; waste dismantler and transporters, local administrators.

Since LME has business only in the national territory, considering the business size and problems that LME innovative solutions solve, we aim to internationalize our business, which makes us one of the highly innovative companies with high potential growth.

Company Summary

LME has been funded by the cooperation of physical and juridical subjects with high level experience in the environment sector and disposal treatment and applied research. Our mission is to provide integrated services of high professionalism for integrated RAEE waste management, from its collecting to its transportation and treatment, counting processes of recovery of waste through the recovery of valuable raw materials or conversion into energy. They are partners of Local Authorities and of private companies for the spreading of innovative solutions for solving environmental problems.

Born in 2009, LME is qualified as centre of research registered at National Register Office of Research (Anagrafe Nazionale delle Ricerche) established at MIUR (Ministry of Education in Italy), id. code 605223DKA. LME focused its research activities on disposal of solar panels and it's subscribed at register of environmental managers. Last, it holds the certification for quality and environment management according to regulations ISO.

The innovative development activities made LME able to develop hig innovative solutions by the realization of the first mobile device for the collection and treatment of solar panel, named PV-MOREDE, which has



LA MIA ENERGIA Scarl
Sede Legale: via M.T. Cicerone 14/L - 86079 Venafro (Is)
Direzione: Forum Ricerca via Cerro snc - 03043 Cassino (Fr)
Sede Tecnica ed Operativa: via Cavallara snc - 03030 Castrocielo (Fr)
P.IVA 10656421004
Tel / Fax 0776.300717

been patented.

Technological innovation and the validity of the technological solution have been recognized and supported also by the European Union through the financing of a project in order to penetrate the international market, with a grant of over € 450,000. This project that will end in 2016, has been realized by a consortium of an international partnership extremely distinguished of private and public subjects: PVC Cycle established in Brussels (probably the biggest world network for solar panels disposal at their life-end); LEITAT established in Barcelona (one of the most eminent Research Centre in Europe), the University of Florence (Mechanic and Industrial Engineering Department).

Products and Services

The mobile device PV-MOREDE is made by a truck with a container in which there are the equipments that makes possible the treatment of solar panels. The device is suitable for first generation solar panel treatment and it makes possible to get at least three kind of recyclable waste:

- Glass with predefined grain size characteristics, ready for the oven
- Metal Material light sensitive, rare and precious that can be separated with the following chemical process
- "Light Compound", essentially made by material with high heat power (plastic) that can be re-used for the energetic recovery.

The PV-MOREDE device creates several concrete advantages compared to current solutions:

- It's extremely flexible and it's portable "de-facto"
- It's an alternative solution more convenient than industrial recycling plants
- Reduced initial investment compared to the industrial system that treat little amount of material
- It offers a competitive advantage to European SMEs producers of panels because it enhance their connected services in this more expanding sector.
- It offers to waste disposal companies and transporters the opportunity to diversify the service offer, creating the opportunity for the competitive development in this sector.
- Semi finished materials outcome can be re sold directly to the closest user
- It deletes the stocking (also temporary) of panels, reducing the pollution (e.g.: lead percolation in the soil).



LA MIA ENERGIA Scarl

Sede Legale: via M.T. Cicerone 14/L - 86079 Venafro (Is)

Direzione: Forum Ricerca via Cerro snc - 03043 Cassino (Fr)

Sede Tecnica ed Operativa: via Cavallara snc - 03030 Castrocielo (Fr)

P.IVA 10656421004

Tel / Fax 0776.300717

The system foresees the development of a high and innovative tech global service named M.A.D.T. (monitoring, analysis, disposal and tracking system) combined to the use of PVMOREDE device.

The portable plant Pv_MoReDe (patent BO/20163/A 000701) uses an innovative technology of photo voltaic panels' mechanical treatment able to almost totally recycle the panels; it maximizes the recovery of materials that can be re-used for new production processes and for using CDR as fuel made by waste.

The mechanical technology has a very low environmental impact, despite the fixed plants (incinerators or leaching plants) that use thermo chemical processes: use of low raw materials, low acoustic emission production, low dust, low CO2 and low waste.

Portability factor, that allows the intervention in situ, reduces logistics costs (transport, interim stocking, loading and unloading).

MADT system includes tracking of all intervention from stocking to disposal or to store in warehouse for certified panels. Tracks have been made by wireless protocol tools, in real time, transferring panel's data (identified by original and assigned service barcode) to the storage system. The track keeps records of the product from its disassembly to its assembly (efficient panel) or to its entry inside the portable plant Pv_MoReDe (EOL panel).

MADT exploits, by a revised methodology, the Rfid (Radio Frequency Identification) for identification through radio frequency of the photovoltaic panel or valuable component that have to be tracked and easily identified in intermediary and final stocking areas; information, gathered in strategic yard's gates, transferred by wireless to the management system, allows in real time to detect each element in each single process inside the yard.

Production

Safe disposal of solar panels suggests the decommissioning of solar panels in such a way that no harmful materials are released to the environment. If not properly decommissioned, the greatest end-of-life health risk from crystalline solar modules arises from lead containing solders.

In order for a solar company to succeed in this competitive market, companies need to reduce the cost of their product; one solution is to use reclaimed materials in lieu of raw materials. By recycling and reclaiming various materials during the panel's end-of-life stage, materials can be used for the manufacturing of new panels.

At the end of the panel's life cycle, both solar modules and the various parts involved in manufacturing could be recycled. Furthermore, parts can be reclaimed if modules are defective, broken, or not needed by the customers. During the recycling process companies can reclaim the semiconductor materials used to make the PV cells, as well as aluminium, copper, glass, and other materials used. Once these parts are separated, either the same company or a third party can recycle the reclaimed materials using the existing recycling methods. Once recycled, solar companies can then use these materials to create new modules, bringing down their cost of manufacturing.

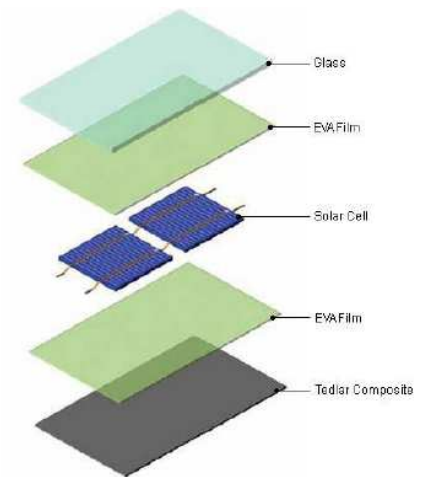
Type of materials recovered from the panels' treatment.

The typical crystalline silicon PV module consists of four main components: the front cover, encapsulate, solar cells, and the back cover as shown in Figure below. The front cover is primarily made of glass, in some instances the front cover can be made of a polymer film. The encapsulant acts as an adhesive and connects the front and back covers to the solar cells. Typically this is made of ethylene-vinyl acetate (EVA), but polyvinyl butyral (PVB) can also be used. The solar cells in a silicon based PV module are either made from mono-crystalline or poly-crystalline technology. The back cover is tedlar film which is made from polyvinyl fluoride, providing a durable, weather-resistance back sheet for PV modules.

PVMOREDE is suited for first generation of Si and a-Si PV panels. The following data was gathered from the field, when the device was used.

Solar Panel Composition	% Raw Material	% of PV recoverable by using PVMOREDE	Current Recycling Rate	Recycled Material Value (Euro/Tons)
Glass	66%	95%	95%	50
Aluminium	10%	95%	95%	1.200
Cu	1%	95%	30%	6.500
Ag	0%	95%	30%	650.000
Sn	0%	95%	30%	17.900
Pb	0%	95%	30%	1.640
Solar Cells	10%	95%		
OKM	14%	95%		

Legenda:
 OKM: Other Key Material (EVA - Tedlar - Adhesives)





LA MIA ENERGIA Scarl

Sede Legale: via M.T. Cicerone 14/L - 86079 Venafro (Is)
 Direzione: Forum Ricerca via Cerro snc - 03043 Cassino (Fr)
 Sede Tecnica ed Operativa: via Cavallara snc - 03030 Castrocielo (Fr)
 P.IVA 10656421004
 Tel / Fax 0776.300717

Productive yield of the device. On theory, every portable device PV-MOREDE should have had a production yield of 3 tons/hour. However, in order to estimate the yield, we necessarily must consider its OEE (Overall Equipment Efficiency), meaning the time of use actually useful according to the available time for the treatment.

It is influenced by how long the device will be involved in the treatment compared to the time needed to reach the places of treatment, by maintenance and cleaning time, by time used for discharging the device.

Most important, after production in real conditions, the hourly production have to be re-set under the following scheme:

Work hours	8	hours / day
Work Days	220	days
Annual Production	1760	hours x year
Hourly Treatment production	40	Panels
Panel weight	20	Kg
Max Potential Production	1408	Tons / year
Productivity	0,8	Tons/Hour
Max Potential Production (KW)	18773,3	KW treatable / year
Productivity (KW)	11	KW treatable / hour
Efficiency Loss	90%	Displacement, Maintenance
Net Productivity	140,8	Tons / year
Productivity	0,08	Tons/Hour

The production yield is mainly influenced by the feeding system. The faster the system, the higher the hourly yield. The feeding system requires an automation for removing the frame and let the panel get in to the first stage of treatment.

Moreover to date, the efficiency still remain very low because of time wasted in displacement of device.

The resulting overall production capacity of 1408 Tons/year – when operating every working day – must be reduced sensibly in order to consider time wasted for displacement, maintenance and cleaning. Efficiency loss can reach 90% of the operating time.