RAMseS project
Renewable Energy Agricultural Multipurpose System for Farmers
Renewable Energy Agricultural Multipurpose System For Farmers

A project financed by the European Commission D.G. Research within the

SPECIFIC TARGETED RESEARCH OR INNOVATION PROJECT
Renewable energies for Mediterranean specific needs
SIXTH FRAMEWORK PROGRAMME

PROJECT PARTNERSHIP

Università degli Studi di Firenze - UNIFI (Italy) - Coordinator

University of Ulster - Center for Sustainable Technologies - CST (United Kingdom, partner 1)

Institute of Technology and Life Sciences - ITP (Poland)

Sociedad Española del Acumulador Tudor, S.A. - TUDOR (Spain)

Oelle Costruzioni Meccaniche srl - Oelle (Italy)

National Energy Research Center - NERC (Jordan)

Lebanese Agriculture Research Institute - LARI (Lebanon)

Royal Scientific Society - RSS (Jordan)

ADMElectric SAL (Lebanon)

Association Libanaise pour la Maîtrise de l’Energie et pour l’Environnement - ALMEE (Lebanon)

Centre pour le Développement des Energies Renouvelables - CDER (Morocco)

www.almeelebanon.com
This project is aimed to giving rural communities on the Southern bank of the Mediterranean area a new tool to assist them in their agricultural work: an integrated solar power system which includes battery storage, usable as to power an all purpose vehicle.

RAMseS electrical vehicle is an original idea under several aspects: it has been designed from scratch as an electric vehicle, not as the retrofitting of an existing one. Also, it was conceived with production in series in mind, not as destined to remain a single prototype. It uses standard components, which can be serviced or replaced with a minimum effort. It is not just an electric vehicle, but also a complete energy system designed for use in a world where fossil fuels are polluting, CO₂ producers and destined to become less and less abundant.

www.almeelebanon.com
A 10 kWp photovoltaic plant, based on monocrystalline silicon cells, generates electricity. It has been built at the final destination where the system was installed and tested: the monastery of Mar Sarkis and Bakhos, in Lebanon, about 35 km from Beirut. The plant was built and is maintained by the Lebanese company ADMElectric. The produced energy is accumulated in the power storage system: a pack of lead-acid batteries capable of storing about 2000 Ah, complete with inverters for providing standard electric power to the farm. This energy has a dual use: it gives electricity to the convent and powers 16 (6V 180 Ah) lead-gel batteries that give power to the RAMseS multipurpose vehicle. All batteries for the RAMseS project were provided by Tudor (Spain).

The main result of the RAMseS system is to couple a renewable energy source (in this case a photovoltaic plant) with a multipurpose, battery powered electric agricultural vehicle. The system also includes a stationary battery pack for energy storage. The energy produced is used in the farm, stored in the vehicle's batteries, in the stationary batteries; it can be also sold to the grid. The batteries of the vehicle can also be used for powering the farm if needed. It is a complete energy system that makes the farm - potentially - independent from fossil fuels.

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**Option 1: Dual Photovoltaic System**

- Solar Panels 125 Wc x 100
  - DC 10 KW AC
  - DC 10 KW DC

- Shorter time to refill truck batteries
- Solar energy used either for refill or for farm electricity needs, priority for batteries refill

**Option 2: Grid connected Photovoltaic System**

- Solar Panels 125 Wc x 100
  - DC 10 KW AC
  - 7 KW DC AC

- 30% Longer time to refill truck batteries
- Farm will benefit from solar energy for its electricity needs all day, priority load for batteries refill
ADM Electric, Farm, Lebanon

Battery 48 V

2 x Sunny Island 5048
Nominal Power 10 kW
Maximum Power (1 min.) 16.8 kW

3 x SB 3300
Nominal Power 9.9 kW
Maximum Power 10.8 kW

Photovoltaic 10 kWp

Public Grid

Farm Grid
RAMseS
Renewable Energy Agricultural Multipurpose System for Farmers

Monastery of Saint Sarkis and Bachos
Lebanon

www.ec-ramses.org
10 KWp PV Plant
100m²
PV Load Factor: 35%

Daily energy generated by 100 m² PV modules

Energy, [kWh/100 m²/day]

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www.almeelebanon.com
PV: 100 m², Batteries: 2000 Ah 48 V

www.almeelebanon.com
• Vehicle can transport a load of 500 kg agricultural products with 2 persons on a distance of 30 km and return.

• Working time in the greenhouse or garden 4 – 5 hours (pure time) per 24 h day.

• Max. charging time: 6 – 8 hours per day.

• Supplying Energy for necessary Farm equipment (Lighting, TV, fridge, air conditioners etc.).

• May be connected to the grid in feed in/out or net metering schemes
Machines that can be attached to RAMseS vehicle
Surface tilling: Labour de surface
Deep tilling: Labour profond
Chisel plough: Labour aux disques
Seed bed preparation: préparation du lit de semence
Sowing: semis
Thinning out: Eclaircissage
Grafting: Greffage
Harvesting: Récolte
Pruning: Taille
Harrowing: creusage des trous dans le sol
Mowing: Taillage des herbes
Rolling: Paqueter en rouleaux
Transportation: Transport
Clod breaking: désagrégation s de sol
Fertilization: Épandage des engrais
Remote Monitoring in real time by internet

https://www.sunnyportal.com/Login
How much does it cost compared to a conventional System?

If we calculate the external costs (pollution and global warming) the RAMSES system has a significant advantage. However, these external costs are not paid directly by farmers and, despite the fact that the RAMSES system does not need fuel, there are monetary costs in terms of investment and in terms of the periodic replacement of batteries and other parts.

Our calculations indicate that the RAMSES system in its present configuration is slightly more expensive than a conventional, diesel powered system over a life cycle of 30 years. In order to have the same life cycle costs for the two cases - RAMSES and conventional - diesel fuel would have to cost more than 1.5 EUR/liter currently. That is higher than the present cost (0.7 €/Liter) at the pump in Lebanon, even without considering subsidies given to farmers. Nevertheless, this result is encouraging.

In the future, the cost effectiveness of the system may be improved eliminating the stationary batteries and relying only on the grid as storage, but at present this is not possible in Lebanon because of the local grid situation and regulations.

The advantage of the RAMSES system, anyway, goes beyond a simple cost comparison: it lies in being independent from fossil fuels and therefore not sensible to supply interruptions and oil price fluctuations.
## Life Cycle Analysis

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<th>SO$_{2}$</th>
<th>NOx</th>
<th>CO</th>
<th>PM</th>
<th>HC</th>
<th>As</th>
<th>Cd</th>
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### Emissioni per VCCI

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[www.almeelebanon.com](http://www.almeelebanon.com)
Can it replace conventional systems?

1- RAMseS vehicle can be practical for agriculture?
The RAMSES vehicle doesn't pretend to be compared to giant agricultural machines. It has been conceived and designed to be used in a specific environment: in a farm in Lebanon where the main product is olive oil. And now, the vehicle is being used for a variety of light agricultural tasks too. Because of the specific climatic conditions there, the vehicle is working for 2-4 hours in the morning, then being recharged over midday, when the temperature is so high that it is impossible to work in the fields. In the afternoon, the vehicle is used again for 2-4 hours and being recharged again overnight. In the present configuration, the vehicle is being able to perform these tasks, but modifications may be needed for different conditions. If more endurance is needed, for instance, there is space in the present prototype for adding more on-board batteries
The Ramses Project ended in 2011 ... And the vehicle is still running