

tera



Integrated Solutions for Efficient Energy Management

Workshop organized by the European Commission Joint Research Centre Institute for Energy and Transport

## S3P Energy: Smart Mediterraneo

Best practices, innovation and pilot projects in smart grid development in the Mediterranean region

*BARI – Camera di Commercio 23-24 June 2016*

Dissemination of innovation and "barriers and challenges" to new investments. Lessons from implementation cases

## Energy Efficiency Innovation Projects

Antonio SACCHETTI – CEO TERA srl

# About us

**TERA** is a knowledge-intensive SME launched some years ago by 20-years working experienced persons, with industrial and R&D expertise in different fields, such as energy efficiency, renewable energy, automotive, environmental monitoring, in regional, national and European R&D&I cooperative projects.



## TEAM

- ❖ Designers, R&D engineers (HW/SW)
- ❖ Administrative
- ❖ Marketing
- ❖ Sales



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# The TEAM

20+  
years

Energy  
Efficiency field

20+  
years

R&D and production

5+  
Start-up

Founder

15+  
years

Sales&Marketing  
Experience



# Prizes

**2015 INCENSE - Internet Cleantech ENablers Spark project**



**2011 Menzione speciale Premio per l'eccellenza "Andrea Pininfarina" -  
Confindustria**

Confindustria premia le Eccellenze



"Non abbiamo la possibilità di fare molte cose nella vita, ma ognuno di noi dovrebbe eccellere. Perché questa è la nostra vita"  
*(Steve Jobs)*

"Il futuro appartiene a coloro che credono alla bellezza dei propri sogni"  
*(Eleanor Roosevelt)*

Attestato di Eccellenza

TERA S.r.l.

Torino, 24 ottobre 2011

La Presidente

A handwritten signature in black ink, likely belonging to the President of Confindustria.

# Dissemination, Acknowledgments

**2015 Finalist @ South Summit, greatest Spain competition for SMEs and startups**



**2015 Finalist at BPI Prize– Best Practice for Innovation – Salerno (IT)**



**2015 “100 ITALIAN ENERGY STORIES”, SELECTED AND MENTIONED By ENEL and Symbola Foundation @ COP21 meeting, Paris 19<sup>th</sup> April 2016 inside European Parliament**

**100 ITALIAN ENERGY STORIES**

**2016: selected for GREEN INNOVATION AND INVESTMENT FORUM - STUTTGART**



**2016: selected for FIWARE EXCLUSIVE MATCHMAKING EVENT - KARLSRUHE**



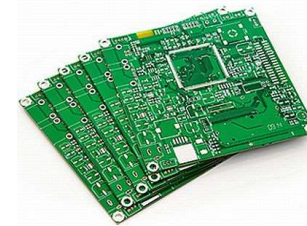
**2016: selected for the greatest French SME competition VIVATECH ENGIE LAB - PARIS**



# Business Activities, Background, Customers

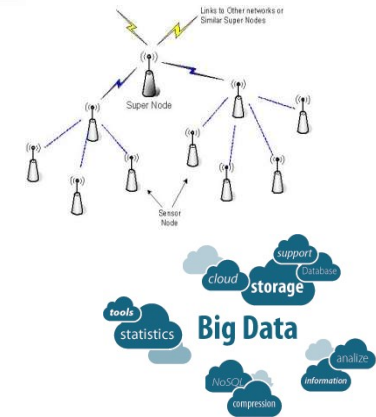
B2B market (energy, ICT, mechatronic, environment)

- ✓ Custom ICT solutions for Energy Efficiency, environmental monitoring, smart industry
- ✓ Prototype production management



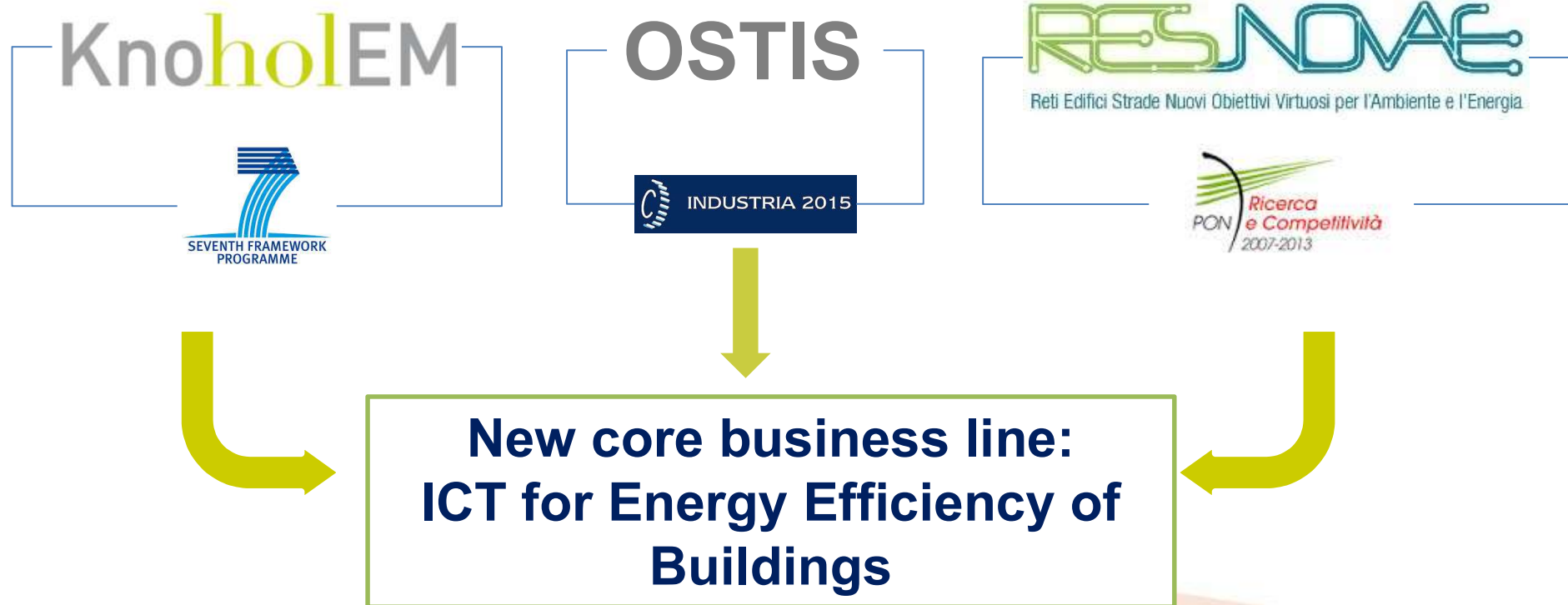
Know-how

- ICT (web services and applications, systems, infrastructures)
- Embedded Electronics (HW/FW, also RTOs based)
- Wireless sensors networks
- Thermography (certified operator)



# R&D gained experiences

- ✓ *Several industrial R&D contracts*
- ✓ *Most relevant Regional, National and European cooperation projects:*



# MAIN TERA INNOVATION PROJECT

BEETA™ Building Energy Efficiency Trusted AVISOR

## SME-Instrument PH 1

Winner of the call 2014 “Low Carbon Systems ...”



## SME-Instrument Ph 2

SEAL OF EXCELLENCE for  
Tera Business Plan



*Certificate delivered by the European Commission,  
as the institution managing Horizon 2020,  
the EU Framework Programme for Research and Innovation 2014-2020*

The project proposal 733610, BEETA



# «Energy Efficiency» Products

- BEETA Smart Gateway (from IoT to Cloud)
  - Energy Box (including «Light BEMS» SW), Remote Guardian – PV monitoring system

Together with partners...

- Hydraulic Power Transmission control system
- Hybrid Power Management “station”: from PV to ElectroChemicals Battery and H2 production (Electrolyzer)-  
.. “power to gas”

# BEETA Smart Gateway



Building Energy Efficiency  
Trusted Advisor



- Multiprotocol gateway, interoperable with off the shelf devices
- Remote upgrading, Cloud Enabled
- Double case, office/industrial form factor

3x USB  
Internal sensors  
Ethernet

Local device Network LED  
Power State LED  
LAN/Internet LED  
Programmable key

On/off key  
Join key  
SD slot  
Power supply/  
microUSB OTG

2x RS485  
4 x S0 input  
2 x Clean Contact input  
2 x Open Coll. Output



# Beeta pillars

Leading edge gateway



User specific info



Digital and physical feedback



**Technology**  
(Monitoring, controlling, automation)



**Insights**  
(habit changing)



**User engagement**  
.....**over time**

# KPI, Alarms, tips&tricks, suggestions



Detailed consumptions/production profiling and classification



Alerts for overloads



Peak shaving



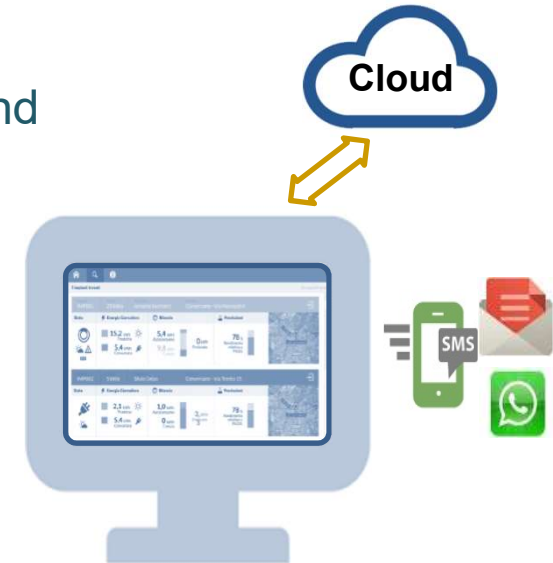
Appliances and devices faults/derating



Behavioral changes suggestion (i.e. set-points); automatic switching on/off appliances



Tariff profile/provider changes & Storage adoption



# Energy Box (including «Light BEMS» SW)

TERA HW – 2 versions  
Linux based

- Rapyd prot.
- Full custom HW



INPUT	OUTPUT
<ul style="list-style-type: none"> <li>• Energy Meter</li> <li>• RS485 , USB</li> <li>• Ethernet (Web interface)</li> <li>• Zigbee, Z-Wave, Bluetooth, WiFi Devices</li> </ul>	<ul style="list-style-type: none"> <li>• SMS</li> <li>• GPRS (data to server); ADSL</li> <li>• Relay ; RS485 (Modbus)</li> <li>• WiFi , Ethernet,( data to Server/Cloud GUI)</li> </ul>



Energy Meter



Air quality sensors



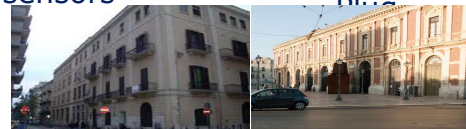
Smart Plug



Weather Station



Temperature/humidity sensor



Repeaters/gateway



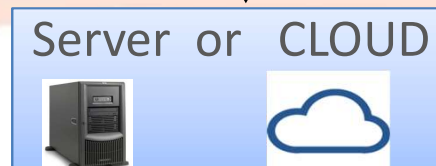
Thermostatic valve



Presence/movement/brightness sensor



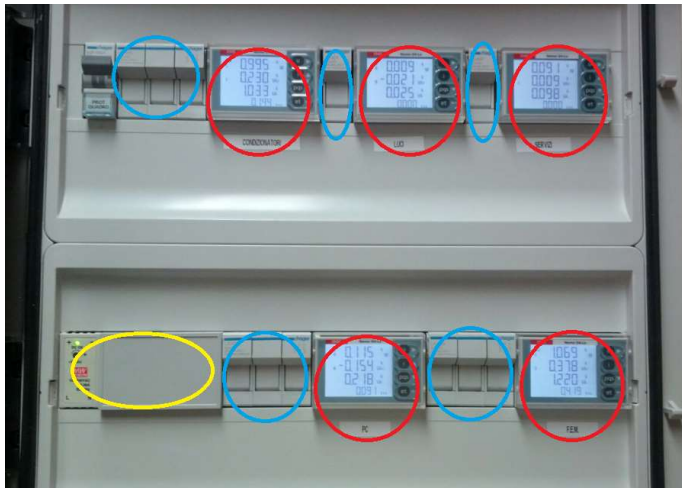
Thermal energy monitoring



# Energy Box – Field Experience - Large Buildings/Facilities



# Energy Box – Field Experience - Large Buildings/Facilities



# Energy Box/Gateway + Light BEMS Functionalities

- **Electrical Power and Energy monitoring (Main and sub-metering ) and control**
- **PV plant Power and Energy monitoring, Alarms and selective load activation**
- **Thermal Power, Energy Counter (also sub-metering), water and gas consumptions**
- **Smart Thermostat functionality, single radiator control**
- **Energy Storage monitoring...**

## Enabling Smart grid functionalities control

- **Demande-response...**
- **Peak shaving.....**
- **Active load balancing....**



# Example of heating CEP rule at offices



Period of time monitored



Condition

Presence in the room

$T_{\text{indoor}} < 20^{\circ}\text{C}$

Output

Air conditioning on :  $TAC = T_{\text{setpoint}}$  (Typ.  $25^{\circ}\text{C}$ )

# Remote Guardian – PV monitoring system

TERA HW  
Rtos on full custom  
HW



INPUT	OUTPUT
<ul style="list-style-type: none"> <li>• Energy Meter</li> <li>• RS485 (Inverter)</li> <li>• Ethernet (Web interface)</li> <li>• Zigbee</li> </ul>	<ul style="list-style-type: none"> <li>• SMS</li> <li>• GPRS (data to server)</li> <li>• Digital ( Relay )</li> <li>• RS485</li> </ul>

PV Forecast  
Service



Server



Weather  
Forecast  
Service



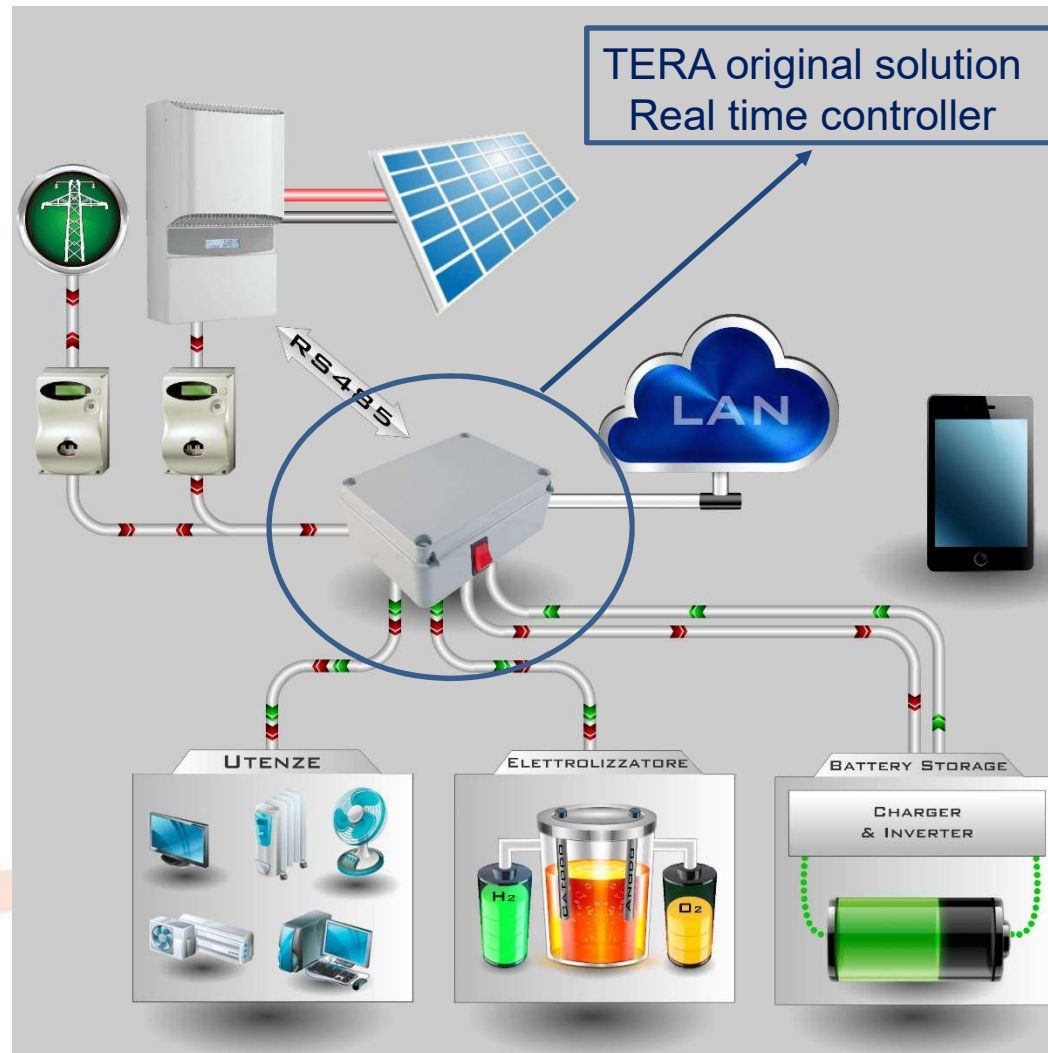
Browser

The screenshot shows the 'REMOTE Guardian' web interface. It includes a header with the product name and logo, a navigation menu, and a main content area with a data graph and system parameters. The graph displays 'Generazione prodotta' (Generated production) over time, with a legend for 'Generazione prodotta' and 'Consumo' (Consumption). The system parameters section lists various metrics like 'Inverter', 'Inverter 1', 'Inverter 2', 'Inverter 3', 'Inverter 4', 'Inverter 5', 'Inverter 6', 'Inverter 7', 'Inverter 8', 'Inverter 9', 'Inverter 10', 'Inverter 11', 'Inverter 12', 'Inverter 13', 'Inverter 14', 'Inverter 15', 'Inverter 16', 'Inverter 17', 'Inverter 18', 'Inverter 19', 'Inverter 20', 'Inverter 21', 'Inverter 22', 'Inverter 23', 'Inverter 24', 'Inverter 25', 'Inverter 26', 'Inverter 27', 'Inverter 28', 'Inverter 29', 'Inverter 30', 'Inverter 31', 'Inverter 32', 'Inverter 33', 'Inverter 34', 'Inverter 35', 'Inverter 36', 'Inverter 37', 'Inverter 38', 'Inverter 39', 'Inverter 40', 'Inverter 41', 'Inverter 42', 'Inverter 43', 'Inverter 44', 'Inverter 45', 'Inverter 46', 'Inverter 47', 'Inverter 48', 'Inverter 49', 'Inverter 50', 'Inverter 51', 'Inverter 52', 'Inverter 53', 'Inverter 54', 'Inverter 55', 'Inverter 56', 'Inverter 57', 'Inverter 58', 'Inverter 59', 'Inverter 60', 'Inverter 61', 'Inverter 62', 'Inverter 63', 'Inverter 64', 'Inverter 65', 'Inverter 66', 'Inverter 67', 'Inverter 68', 'Inverter 69', 'Inverter 70', 'Inverter 71', 'Inverter 72', 'Inverter 73', 'Inverter 74', 'Inverter 75', 'Inverter 76', 'Inverter 77', 'Inverter 78', 'Inverter 79', 'Inverter 80', 'Inverter 81', 'Inverter 82', 'Inverter 83', 'Inverter 84', 'Inverter 85', 'Inverter 86', 'Inverter 87', 'Inverter 88', 'Inverter 89', 'Inverter 90', 'Inverter 91', 'Inverter 92', 'Inverter 93', 'Inverter 94', 'Inverter 95', 'Inverter 96', 'Inverter 97', 'Inverter 98', 'Inverter 99', 'Inverter 100'.

Graphic User Interfaces (GUI)

# Smart Energy Management @ Building and District Level – Small Scale Demonstrator

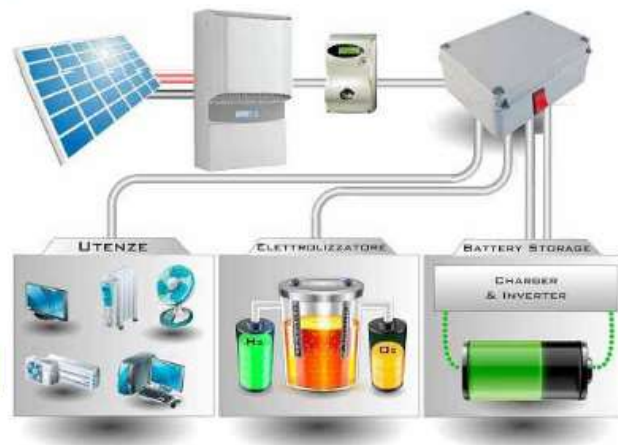
Real time control:  
from  
Photovoltaic  
source to  
Loads /  
Batteries /  
Hydrogen  
production



# Smart Energy Management Demonstrator

17:03 21 - 06 - 2016

<b>Inverter FV: 02</b>		<b>Settings</b>	
Energy From Inverter	1563.45 [kWh]	Pot. Electrolyzer [w]	50 <input type="button" value="Update"/>
Power From Inverter	325.12 [w]	Pot. Storage [w]	120 <input type="button" value="Update"/>
<b>Electrolyzer</b>		<b>Controllo</b>	
Status	ON	Funzionam	Auto <input type="button" value="Update"/>
Energy Input	630.12 [Wh]	Power Storage:	No <input type="button" value="Update"/>
Press. in aumento	ON	Power Elett:	Off <input type="button" value="Update"/>
Liv. H2O basso	OFF	<b>Alarms</b>	
<b>Storage</b>		No Alarms	
Status	ON	<b>Warning</b>	
Energy Input	421.78 [Wh]	No Warning	
Energy Output	124.01 [Wh]		
Carica 100%	OFF		
Carica 60%	OFF		



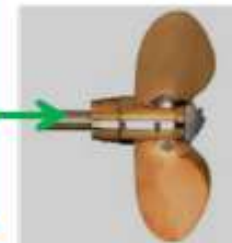
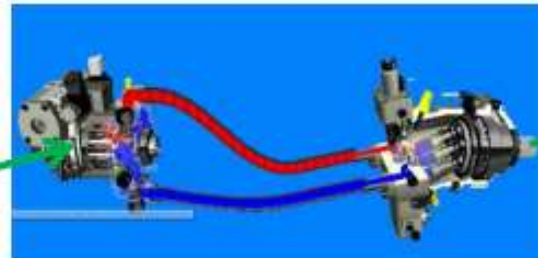
# HPT Controller - Real time control system for power transmission main features

## Hydropack: Real time Hybrid Engine control system

**Hydropack**® is a management system developed in collaboration with AS Service (Labruna Group) a leader company in the Energy and Movement fields (diesel engine, Marine propulsion, hydraulic truck mounted cranes, aerial platforms).



**Hydropack**® is an hybrid engine solutions that combines modularity, scalability, flexibility, and re-configurability.



# Tera HPT Controller

## Real time control system for power transmission

### main features

- an automotive-grade mainboard (embedded, custom),
- a display (commercial) with customized (Tera) user-friendly GUI,
- a multi-parametric Configuration Software able to set up the system depending on the engine powers and numbers, the type of work loads (electric and hydraulic) and the type of sensors.

- possibility to independently manage the speed (rpm) both for primary and secondary engines (or hydraulic loads);
- **multiple primary engines** (i.e. diesel engine), suitable for several situations, simple ones (single engine) and also more complex situations.
- **multiple hydraulic pumps**: manifold combination of pumps to engines and so to Logging functionalities for post-process data analysis
- Remote monitoring hydrostatic motors (loads)



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# Conclusions..

**in the field of “Smart Energy” it is possible, even for SMEs, starting from the achievements of R&D projects, come to industrial and entrepreneurial innovation projects, thus setting the stage for the market uptake of new products and services.**

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Thanks for attentions!



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