EXPLORING & EXPLOITING MGT POTENTIAL

EMGTF Forum
Madrid – Nov. 26-27th 2018

INTRODUCTION

- **Thanks**
- **Why I am here**
- **A different perspective**
- **Are we talking about a technology or a product ?**

DISCUSSION ITEMS

1. **Positioning the issue**
2. **A Methodology**
3. **The Dish Stirling experience**
4. **The MGT case**
5. **Key take aways**
6. **Q&A**

Is there a commercial future for MGT?

If yes, how can it be achieved?

1 - POSITIONING THE ISSUE

" …..The case for Distributed Generation

The Industrial Revolution saw the birth and growth of power stations of increasing capacity, in pursuance of economies of scale that could yield efficiency gains. Urbanisation and industrialisation of many commercial activities brought about an exponential rise in energy demand which could not be satisfied locally. The current paradigm of centralised generation, very large power generation nodes coupled to long and often inefficient transmission lines became the norm.
More recently, there has been a rising concern for a more globally efficient power system. Downscaling traditional technologies does no longer cause a performance decay and the irruption of innovative (certainly not new) power generation and storage technologies like fuel cells, Stirling engines, photovoltaic panels, batteries enable efficient and reliable production of electricity and heat (even cooling) locally. Furthermore, not only does this paradigm shift change the current structure of the power system but it also modifies the role played by the consumer who is now a consumer-producer with the ability to trade energy with other producers and consumers……."

" ….Why Micro Gas Turbines?

Gas and steam turbines form the backbone of the power generation system in the world. Whether for the direct (internal) combustion of natural gas and oil or for the indirect (external) firing of coal, biomass and nuclear fuel, this large rotating equipment achieve very high efficiency, environmental friendliness (to the extent possible depending on the fuel) and reliability simultaneously. At the very low scale, there are certain features of this technology that set it apart from other direct competitors like reciprocating engines: compactness, weight, noise, environmental performance (virtually NOx-free operation), fuel flexibility, high-grade process heat and, very interestingly, adaptability….»

1 - POSITIONING THE ISSUE

The case for Distributed Generation

The Industrial Revolution saw the birth and growth of power stations of increasing capacity, in pursuance of economies of scale that could yield efficiency gains. Urbanisation and industrialisation of many commercial activities brought about an exponential rise in energy demand which could not be satisfied locally. The current paradigm of centralised generation, very large power generation nodes coupled to long and often inefficient transmission lines became the norm.

More recently, there has been a rising concern for a more globally efficient power system. Downscaling traditional technologies does no longer cause a performance decay and the irruption of innovative (certainly not new) power generation and storage technologies like fuel cells, Stirling engines, photovoltaic panels, batteries enable efficient and reliable production of electricity and heat (even cooling) locally. Furthermore, not only does this paradigm shift change the current structure of the power system but it also modifies the role played by the consumer who is

now a **consumer-producer** *with the ability to trade energy with other producers and consumers.*

Why Micro Gas Turbines?

Gas and steam turbines form the backbone of the power generation system in the world. Whether for the direct (internal) combustion of natural gas and oil or for the indirect (external) firing of coal, biomass and nuclear fuel, this large rotating equipment achieve very high efficiency, environmental friendliness (to the extent possible depending on the fuel) and reliability simultaneously. At the very low scale, there are certain features of this technology that

set it apart from other direct competitors like reciprocating engines: **compactness, weight, noise, environmental *performance*** *(virtually NOx-free operation), fuel flexibility, high-grade process heat and, very interestingly,* **adaptability**.

Where can I buy it ?

Nowhere !

Why ?

1 - POSITIONING THE ISSUE

- The standard answer:

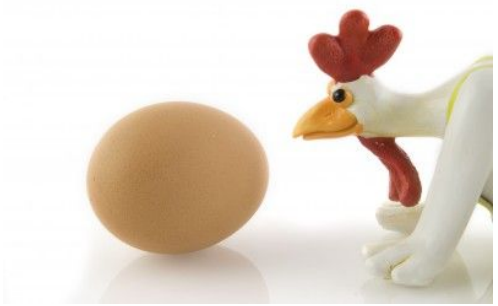
«….Costs, critical mass….., investments, ….. suppliers, ….
…. trade,…. consumer and institutional awareness…»

- Another answer:

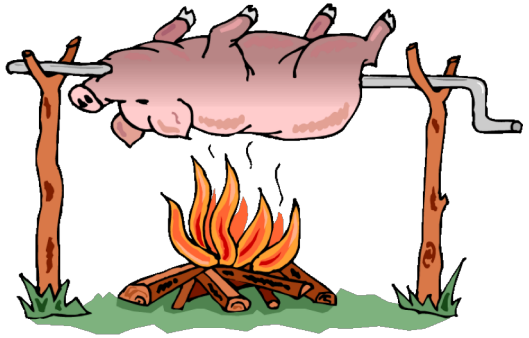
be specific about

→ what you want to sell
→ to whom
→ how
→ find a U.S.P.
→ … commitment !

1 - POSITIONING THE ISSUE - The difference between involvment and commitment ?



Chicken was involved



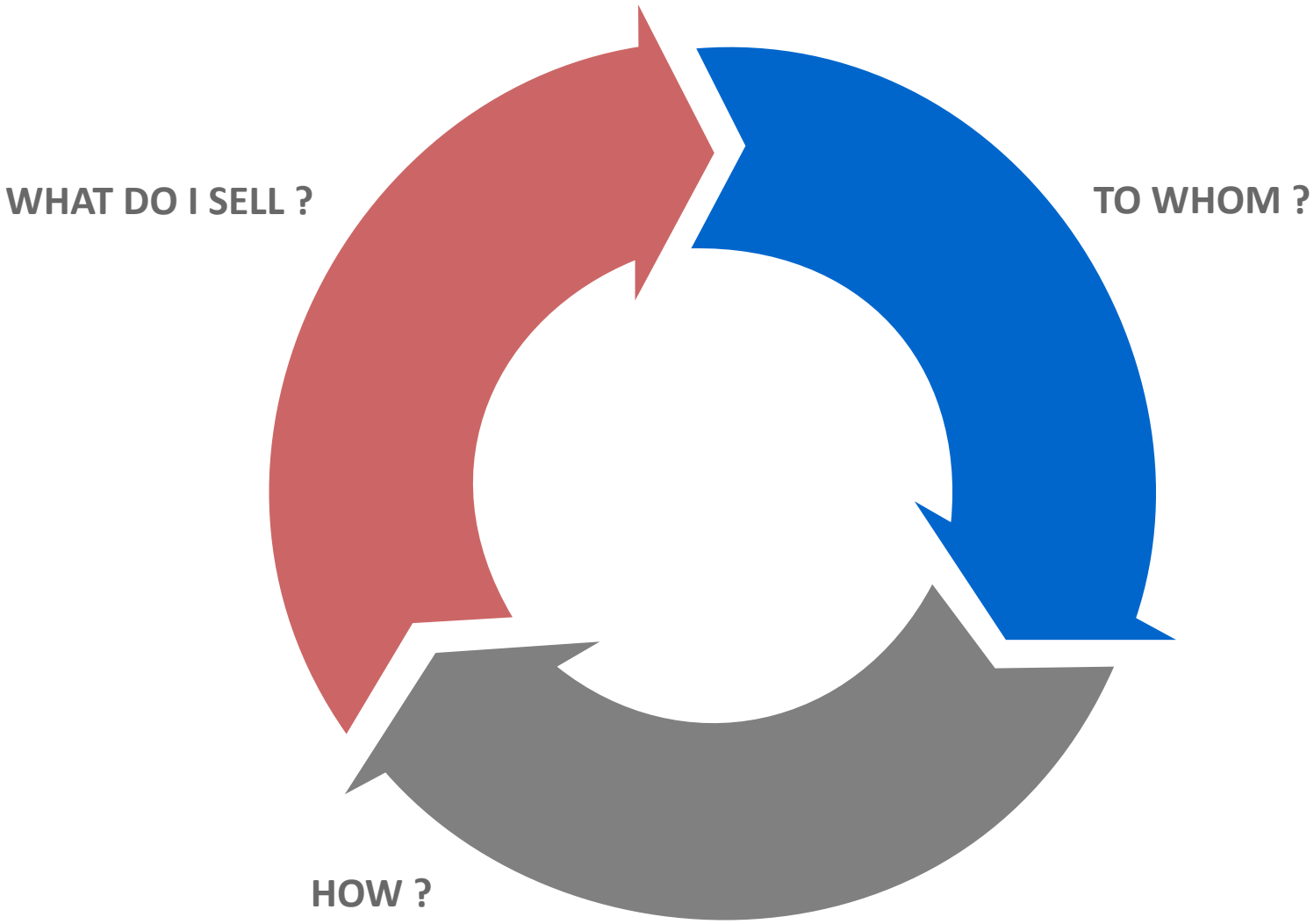
Pig was committed

DISCUSSION ITEMS

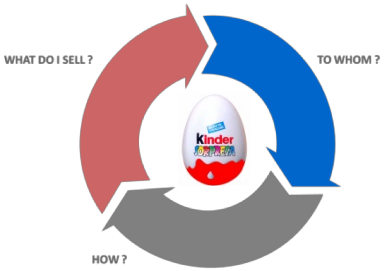
1. Positioning the issue
2. A Methodology
3. The Dish Stirling experience
4. The MGT case
5. Key take aways
6. Q&A


+LATTE
-CACAO
kinder
SORPRESA

2 - A POSSIBLE APPROACH: The 3 Basic Questions



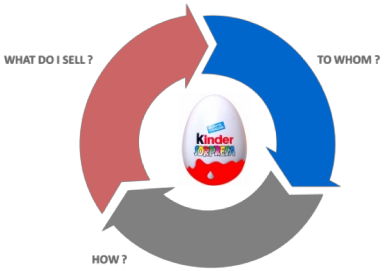
2 - A POSSIBLE APPROACH: The 3 Basic Questions



WHAT DO I SELL?

They are not buying an easter egg.
They want an inexpensive solution to manage situation (kids' appetite/anger)…
in a healthy and fast manner.

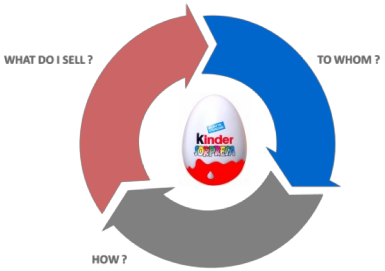
2 - A POSSIBLE APPROACH: The 3 Basic Questions



TO WHOM ?

Mothers purchase
Kids consume

2 - A POSSIBLE APPROACH: The 3 Basic Questions



HOW ?

+

+

=

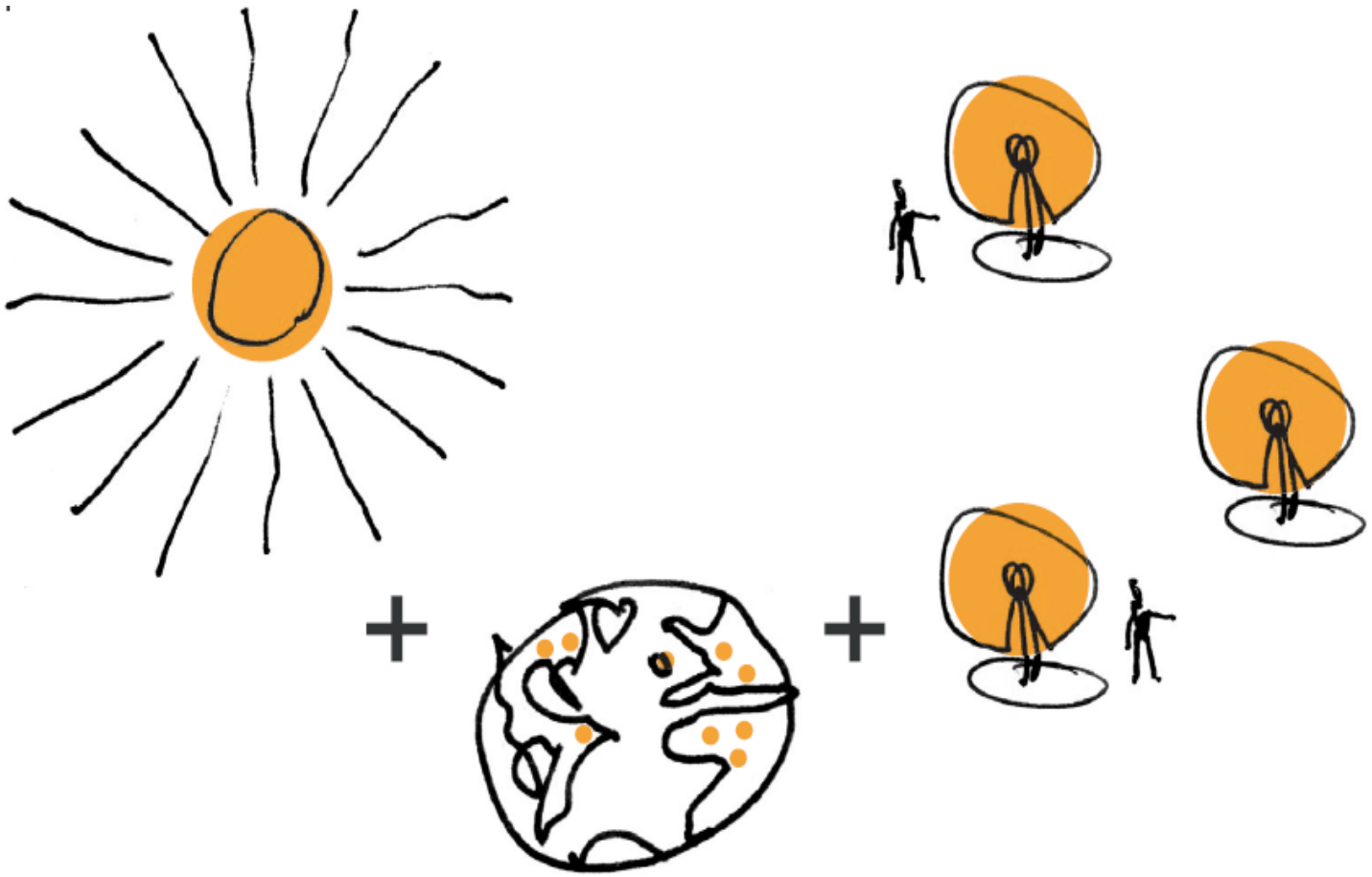
Reward | Convenience | Health reassurance

Kids cry → Mothers buy
… fathers too!

DISCUSSION ITEMS

1. Positioning the issue
2. A Methodology
3. The Dish Stirling experience
4. The MGT case
5. Key take aways
6. Q&A

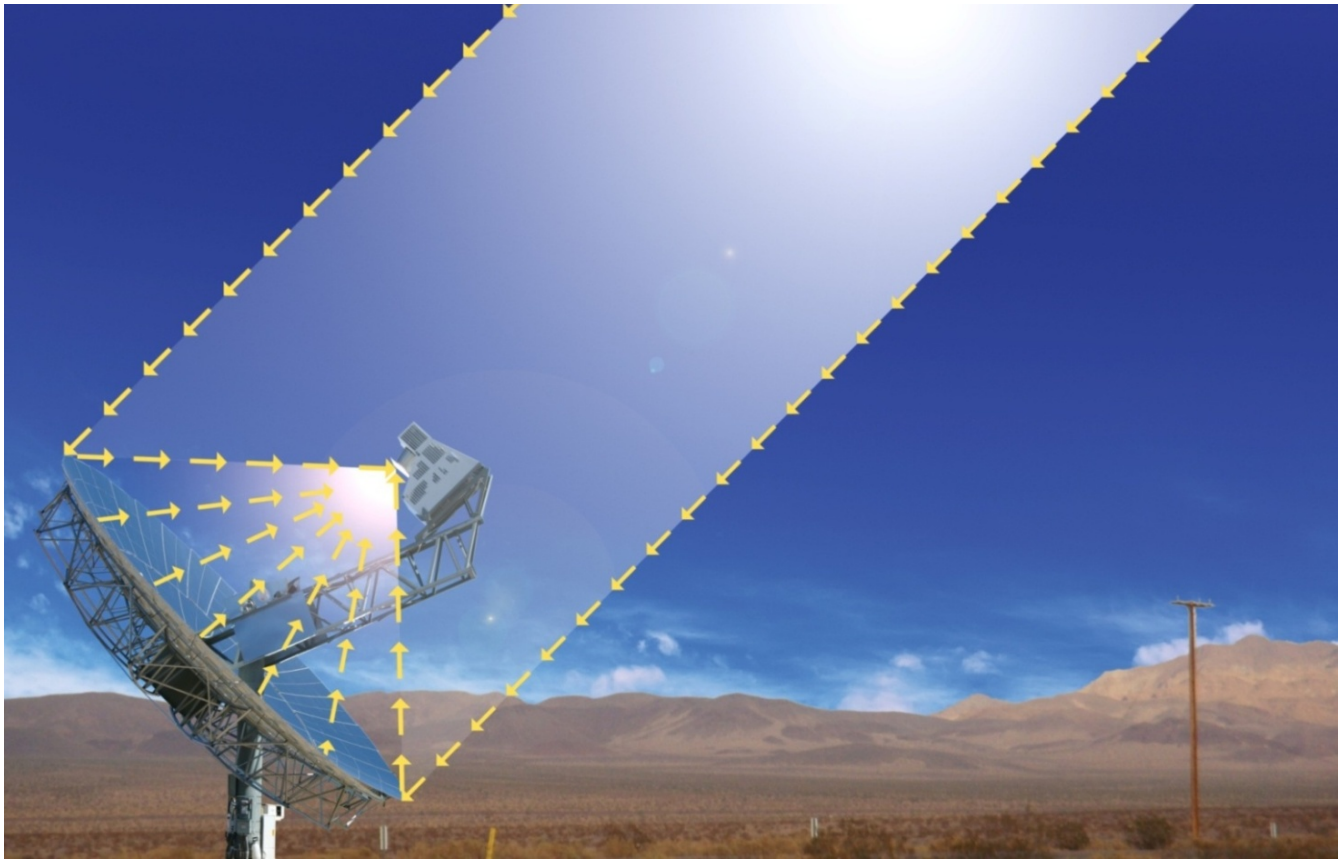
3 – THE DISH STIRLING EXAMPLE – The Vision ?



…produce and consume energy locally

…from a clean and inexhaustible source

3 – THE DISH STIRLING EXAMPLE



Sunlight is focused onto a highly efficient Stirling engine which converts thermal energy into electricity (and warm water)

3 – THE DISH STIRLING EXAMPLE - 1KWe + 3 KWt - Suppliers

innova TECHNOLOGY SOLUTIONS

R&D → Mktg. & Sales → Supply chain Production → Installation & Post Sales

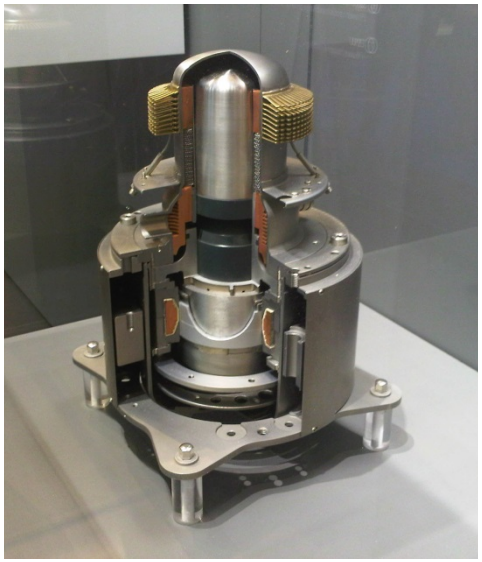
5%

microgen engine corporation

UNIVERSITÀ DELLA CALABRIA

faini telecommunication systems

a member of the KATHREIN-Group



Click here for animation

3 – THE DISH STIRLING EXAMPLE – Clients/channels

PUBLIC SECTOR

PRIVATE COMPANIES (medium–large)

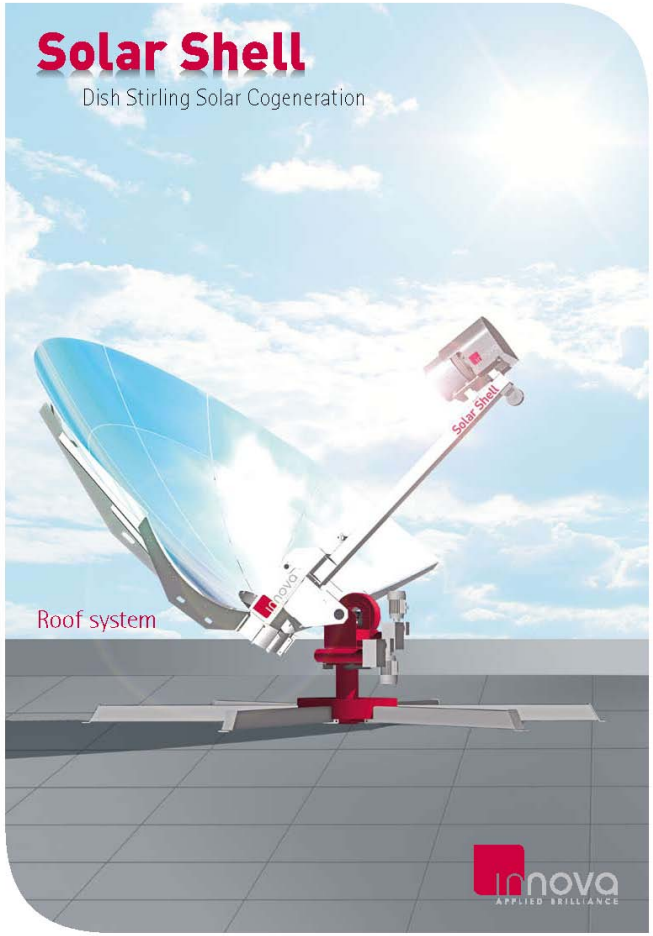
PRIVATE COMPANIES (small)

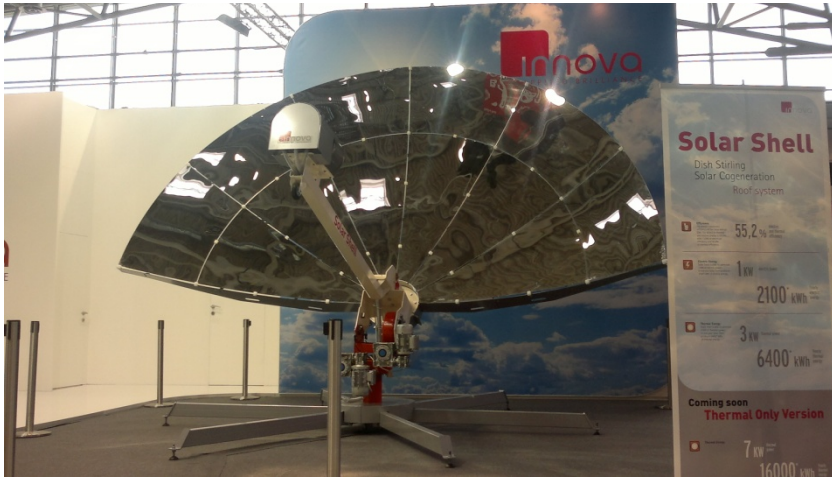
DEALERS, DISTRIBUTORS, AND UTILITY COMPANIES

3 – THE DISH STIRLING EXAMPLE – 1kWe + 3 kWt – Ground system

Trinum generates electricity (1kWe) and thermal energy (3 kWt).
The system consists of a parabolic dish (10 m²<), that tracks the sun and reflects the rays concentrating them on the head of a Stirling engine.
Trinum produces ca. 2100 Kwe and 6400 Kwt p.a...*

3 – THE DISH STIRLING EXAMPLE - 1KWe + 3 KWt – Roof system





3 – THE DISH STIRLING EXAMPLE – Key features

- More energy per square meter (minimal land disturbance , low water usage)
- Modular and scalable from 1KW to 25 kW and, eventually, Giga size
- Better energy (high quality, constant and high in peak hours when PV underperform)
- From – 18°to +50°
- Higher efficiency: 31% Peak ; >22% annual average (higher than any other CSP)
- Cost per kW/h perspectically on par with pv when critical mass production achieved
- High reliability. 90% of parts come from automotive industry. No inverter
- L.C.A.* substantially better than PV > 30 years through maintanance program, no need of disposal. Extendable life cycle via components replacements over time
- Local content potential. Various parts and services can be sourced locally

LIFE CYCLE ASSESSMENT ANALYSIS OF A SOLAR CONCENTRATION PLANT FOR THE MICRO- CHP
M. Cucumo, V. Ferraro*, V. Marinelli*, S. Cucumo**, L. Grieco*
*Department of Mechanical Engineering - University of Calabria - 87030 Arcavacata di Rende (CS), Italy
Ph (0984) 494616 - Fax (0984) 494673 - e-mail: @ m.cucumo unical.it

Too small and expensive !

→ Reduce cost /KWh

If you do it, do it big!

3 – THE DISH STIRLING EXAMPLE – The move to 25 KW

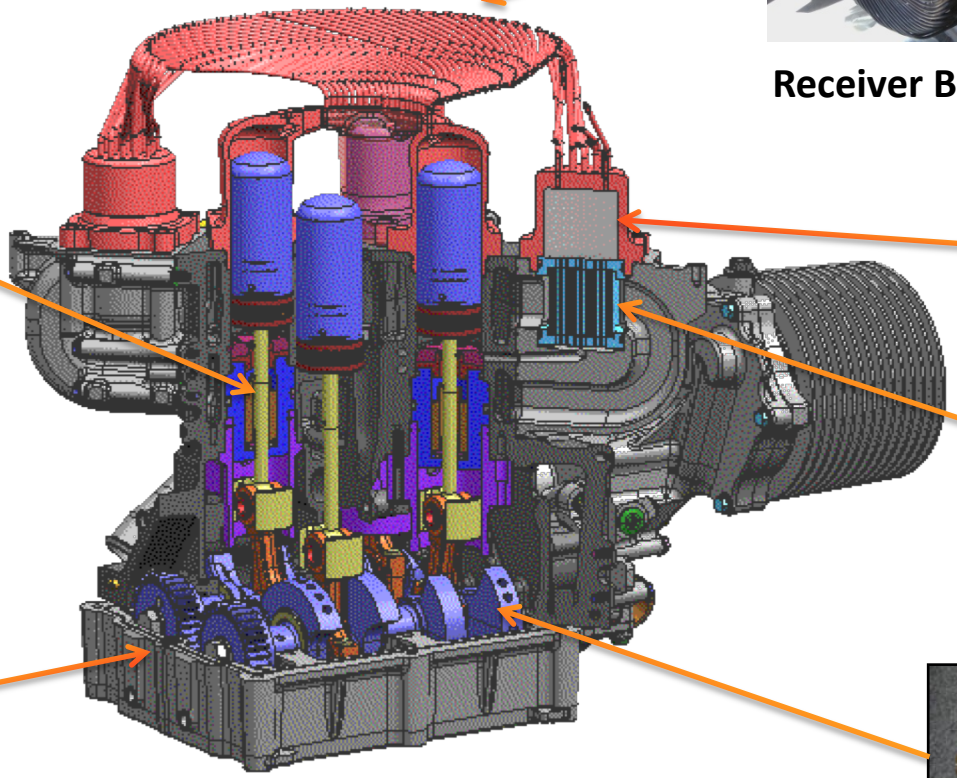
The next big thing ?

3 – THE DISH STIRLING EXAMPLE – The move to 25 KW

Piston Rod

Receiver Body

Heat exchanger



Cooler

Cylinder Block

Crankshaft

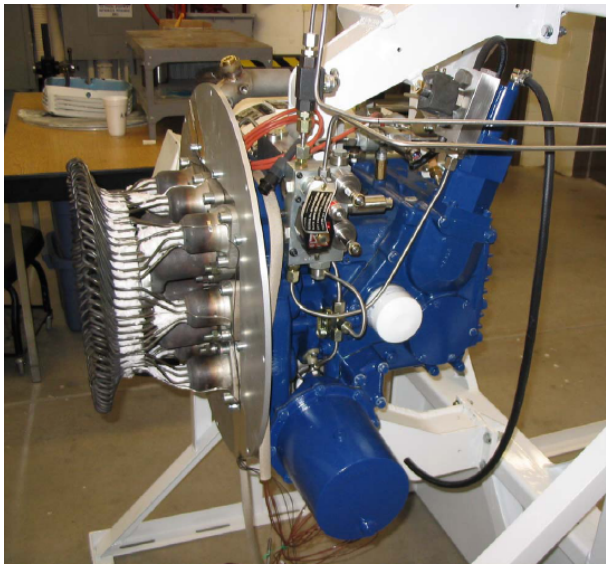
Predominantly Standard Engine Components in Stirling Engine Application

3 – THE DISH STIRLING EXAMPLE – The move to 25 KW

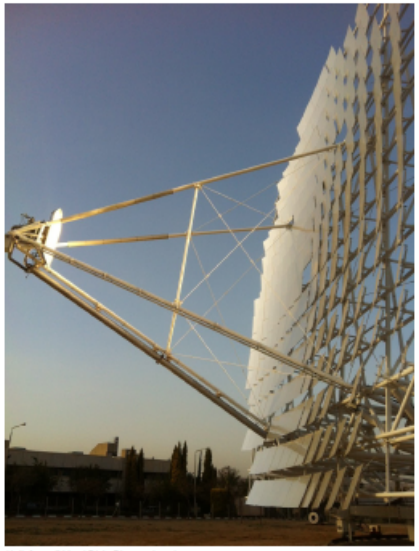
SunNUTS
something new under the sun

WIGP
systems

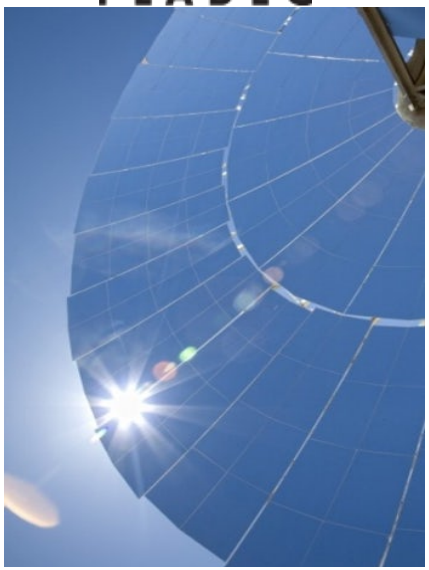
McLaren
Performance Technologies



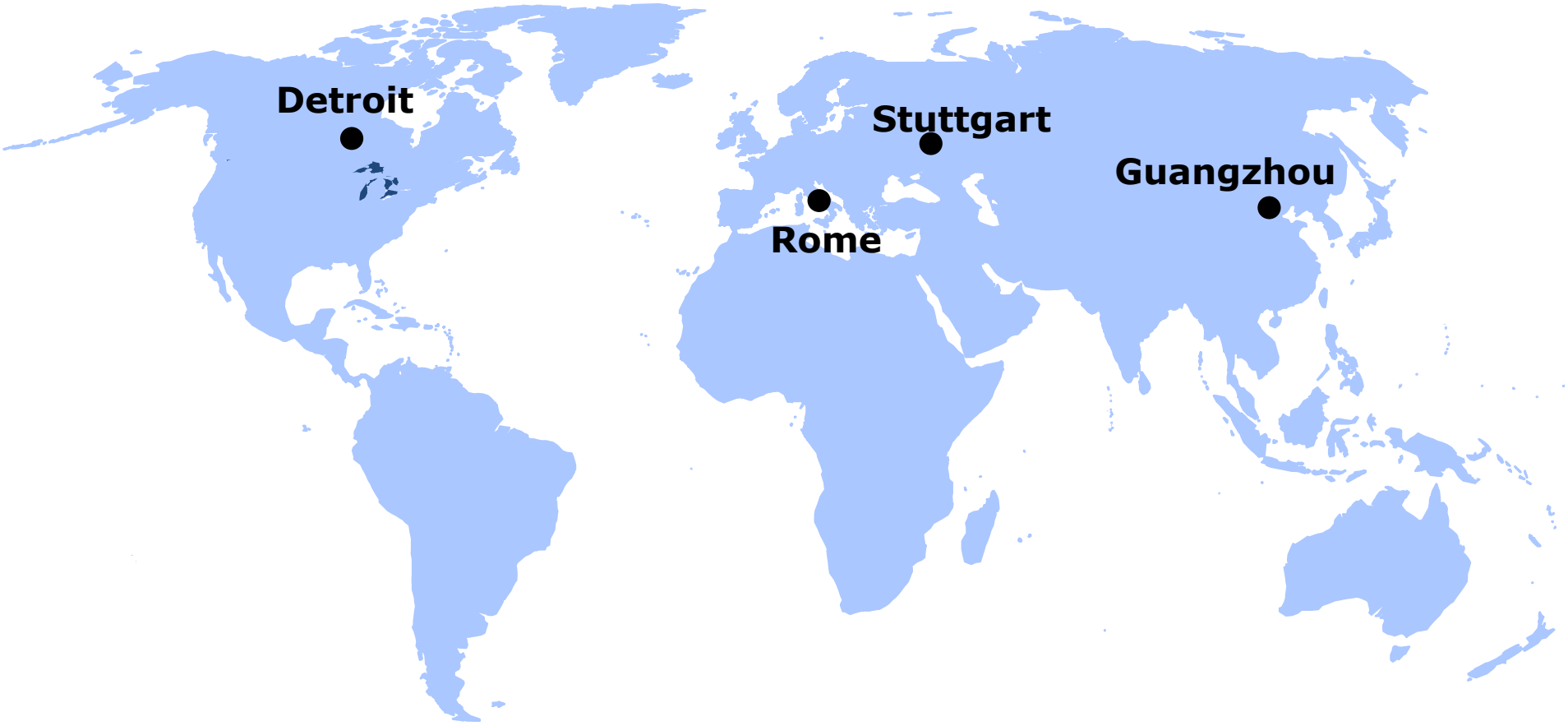
schlaich bergermann
und partner



FLABEG



3 – THE DISH STIRLING EXAMPLE – Addtional complication



3 – THE DISH STIRLING EXAMPLE – Lessons Learnt ?

LACK OF FOCUS	Too many apps → not enough customer /channel/sales force focus
NEEDS SUN	Energy storage for overnight consumption
NEEDS SPACE	Land occupation minimal, operation area large
INSTALLATION COST	€ /kW and €/kWh needs to make sense
DIFFCULT TO EXPLAIN	Stirling, temperatures, helium , hydrogen…?
DOES NOT CREATE MANY JOBS	Local job content limited
WATER AND ELECTRICITY DO NOT FIT	Not enough heat & not in desired proportions
NO MAJOR INDUSTRIAL SPONSOR	Failed mega demo → credibility → invsts → cost
LACK OF FOCUS and VICINITY	Geographical & cultural differences, little alignment
PV *explosion*	Unbeatable on €/kWh and flexibility

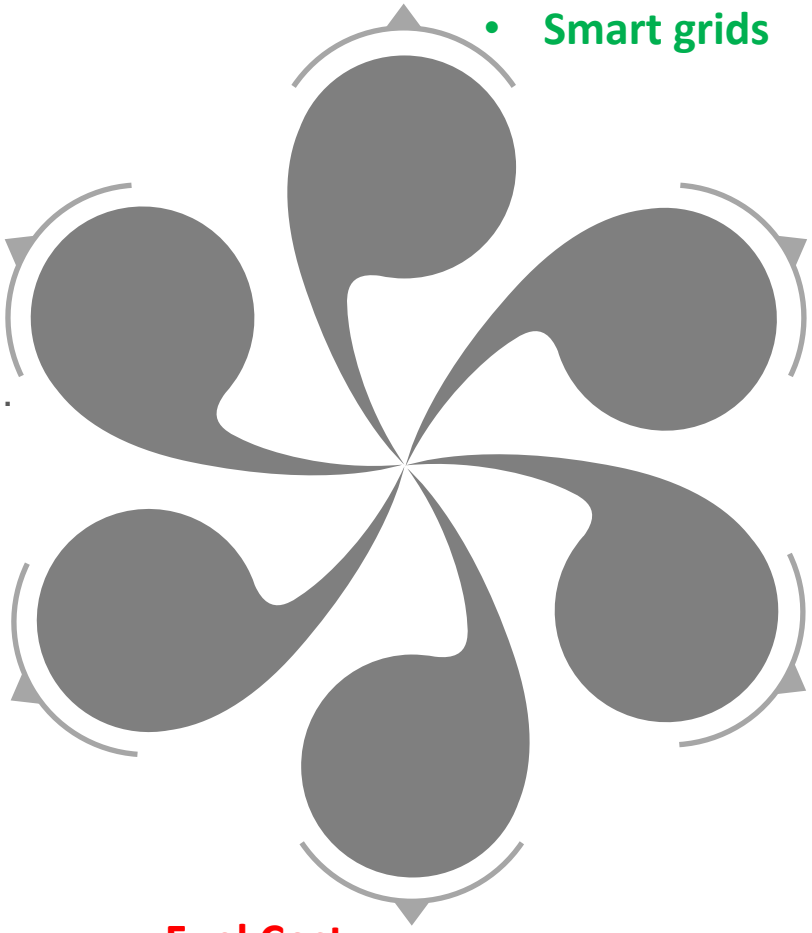
DISCUSSION ITEMS

1. Positioning the issue
2. A Methodology
3. The Dish Stirling experience
4. The MGT case
5. Key take aways
6. Q&A

4 – THE MGT CASE - is there a case?

- Distributed power generation
- Smart grids

- Institutional awareness
- Trade resistance
- Customers readiness
- Users acceptance



- Power autonomy
- Cogeneration

- Overcapacity
- Investments
- Industrial/fin. partner
- Suppliers eco-system

- Light
- Silent
- Reliable
- Maintenance

- Fuel Cost
- Fuel availability
- Lack of Product standardization → costs

4 – THE MGT CASE – Size matters

- **Large scale seems to be difficult at least in Europe**

- **Can we turn it into something different ?**

The only vacuum with balls.

Why use a fixed vacuum? All other upright vacuums have fixed wheels, preventing them from going where you need them to. The Dyson Ball pivots, going exactly where you want it to. WIth our incredible bagless Root-cyclone technology, you'll pick up more dirt than you thought was there.

dyson

4 – THE MGT CASE – Turning home appliances into a sexy profile symbol
The cyclonic vacuum technology !!!!

4 – THE MGT CASE – my initial feeling:
Efficient large domestic & small business use 5 to 25 kWe

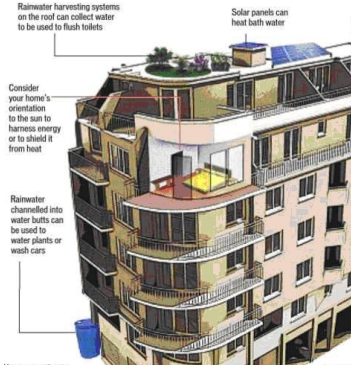
PHASE 3

PHASE 2

PHASE 1

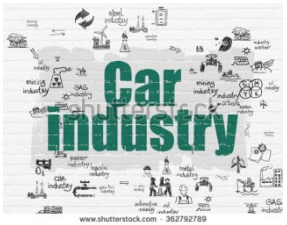
Agricultural activities

Mid to large Green buildings



Metropolitan recharge stations

4 – THE MGT CASE – why Metropolitan recharge stations ?



EUROPEAN
INVESTMENT
FUND

Rich & advanced Municipalities with traffic & pollution problem
Eg. Milano, london, Munich

Whether you go with the car industry or directly as a consortium (?) there needs to be commitment and representatives empowerement

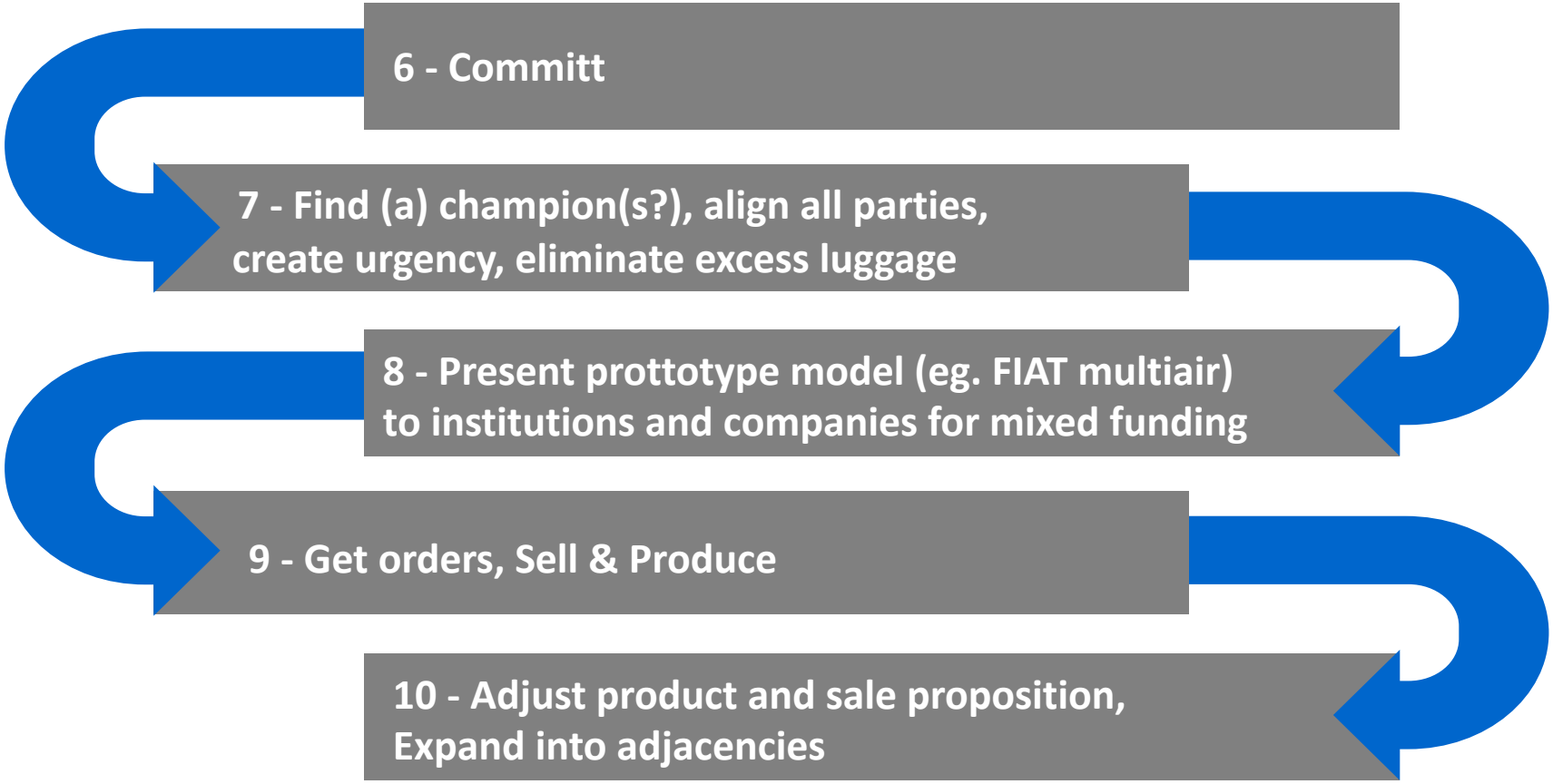
4 – THE MGT CASE – Model ?

DISCUSSION ITEMS

1. Positioning the issue
2. A Methodology
3. The Dish Stirling experience
4. The MGT case
5. Key take aways
6. Q&A

5 – 10 KEY TAKE AWAYS

5 – 10 KEY TAKE AWAYS



Thanks