INNOVATIVE HELIOSTATS
1. The innovation process

2. Where are we right now?

3. Some examples of innovative heliostats

4. Some *personal* recommendation for *innovative persons*

5. The very last citation
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Shall we divide the innovation process in some phases?

**Ph.A)** Pure creation (invention) \(\rightarrow\) Conceptually not reducible

**Ph.B)** Introduce *not evident* modifications to improve the original invention \(\rightarrow\) Technically there is a great potential of evolution

**Ph.C)** Manufacture, test and evaluation of a prototype

**Ph.D)** Introduce the *final product* in a productive market
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Where are we right now?

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Innovation process status report

Ph.B) Not evident modifications to improve the original Invention →
Very simple T-shape support structure (pedestal + torque tube). Large mirror area is possible by using facets. Canting is necessary. Drives integrated in a Horizontal mounting. Not sophisticated local control. Wiring for both power and communications.

Ph.C) Manufacturing, test and evaluation of a prototype → Many of them from different countries.

Ph.D) Introduce the final product in a productive market → Yes
Some examples of innovative heliostats

Innovation process status report

**Ph.B**) Not evident modifications to improve the original Invention →
High quality 3D spatial support structure. Large mirror area is possible by using stretched membranes. Canting is not necessary. Focal distance variable. Decentralized drives. 2 local controls (heliostat + membranes). Wiring for both power and communications.

**Ph.C**) Manufacturing, test and evaluation of a prototype → Yes, ASM-150 at PSA

**Ph.D**) Introduce the final product in a productive market → Not yet
Innovation process status report

**Ph.B)** Not evident modifications to improve the original Invention
Intelligent local control. No-wiring for both power (PV cell) and communications (radio).

**Ph.C)** Manufacturing, test and evaluation of a prototype
Yes, PCHA heliostat field at PSA

**Ph.D)** Introduce the final product in a *productive market*
Not yet

Some examples of innovative heliostats

Stand-alone
(PSA)
Some examples of innovative heliostats

**Innovation process status report**

**Ph.B) Not evident modifications to improve the original Invention →**
Intelligent local control. Cylindrical optics. New pseudo-horizontal mounting design. As a result, at focal plane there is a linear flux distribution on target, very stable from sun rise to sun set. Nice fitting with elongated receiver (i.e. cylindrical shape).

**Ph.C) Manufacturing of a prototype → Yes (PSA-ABENGOA). Test and evaluation → Not yet**

**Ph.D) Introduce the final product in a productive market → Not yet**

Line Focus Heliostat (PSA)
Some examples of innovative heliostats

Innovation process status report

Ph.B) Not evident modifications to improve the original Invention → Pentagon shaped Concentrator (47.5 m²). The nearly circular concentrator minimizes shading and blocking. The pentagonal shape and the appropriate size offers very low astigmatism optics. Slope drive and intelligent control systems.

Ph.C) Manufacturing of a prototype → Yes. Test and evaluation → Yes (PSA, CSP)

Ph.D) Introduce the final product in a productive market → Not yet
Some examples of innovative heliostats

Innovation process status report

Ph.B) Not evident modifications to improve the original Invention →
Costs saving potentials made possible by employing small sized heliostats in contrary to the trend of using larger heliostats. New driving mechanism using a cable system, it has quasi no backlash and works with high efficiency. Automated calibration system based on computer vision to relax the requirements on the quality of the physical setup (the actual mirror orientation is optimized).

Ph.C) Manufacturing of a prototype → Yes. Test and evaluation → Pending (PSA)

Ph.D) Introduce the final product in a productive market → Not yet
Some examples of innovative heliostats

**Innovation process status report**

**Ph.B)** Not evident modifications to improve the original Invention → Facets are not optical systems. Facet is universal for the whole heliostat field. Optimal heliostat focal length. Canting is not necessary. Heliostat is modular, serial manufacturing, easy step-by-step mounting and set-up procedure, not technician or precision instruments required, easy facets replacement in case of corrosion or breaking, simple package and shipping.

**Ph.C)** Manufacturing of a prototype → Yes (size 9 m², ≈40 m² pending)
Test and evaluation (size 40 m²) → Pending (PSA)

**Ph.D)** Introduce the final product in a productive market → Not yet
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Some personal recommendations for innovative persons

What is the hardest thing in the world? To think
(R. W. Emerson)

• Be non-conformist with the establishment
• Use the “critical” and “lateral” thinking
• Think by yourself for a while before starting urgently with the bibliographic search
• Turn your PC off and go to the blackboard
• Delete from time to time completely the blackboard and re-boot your brain
• Nobody understand me or... I do not understand myself?
• Surround yourself with more creative and intelligent people than you
• Be persistent, but also enough humble to say “I’m really wrong”
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• *In the cosmic scale, only the fantastic has a chance of being true*  
* (Theilard de Chardin)

• We should also think in something *fantastic* in Solar Energy, and make it true.

Thanks, good bye and good luck