

SOLAR ENERGY AND PERSPECTIVES OF EXIT FROM CRISIS

HELIOTRON INSTITUTE
SOLAR ENERGY SYSTEMS RESEARCH &
DEVELOPMENT

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1. PRESENTATION OF THE PATHOLOGY OF DE-INDUSTRIALIZATION CRISIS

1.A. NEGATIV IMPLICATIONS

- SIX YEARS OF CRISIS WITH LIMITED IF NON-EXISTENT INVESTMENTS**
- RESTRICTED IF NON-EXISTENT BANK SUPPORT FOR THE ENTERPRISES**
- CAPITAL CONTROL SENDING AWAY PERSPECTIVE INVESTORS**
- NEGATIV IMPLICATION OF CAPITAL CONTROL FOR THE ENTERPRISES**

1.B. SOME POSITIVE SIGNS

- **COMPETITIVE INDUSTRIAL PROFILE DUE TO DEDUCTIONS IN SALARIES**
- **TOURISM HAS BEEN BENEFITED FROM THE NEGATIVE SAFETY IN NEIGHBORS**
- **NEW OPPORTUNITIES FOR THE EXPLOITATION OF SOLAR ENERGY FOR EU**

2. GREEK MANUFACTURING / TOURISTIC INDUSTRY AND SOLAR ENERGY

2.A. GREEK MANUFACTURING

- GREEK MANUFACTURING PROFILE HAS BEEN MORE COMPETITIVE
- HOWEVER EVEN THIS POSITIVE PROFILE HAS NOT BEEN EXPLOITED

2.B. TOURISTIC INDUSTRY

- TOURISTIC INDUSTRY HAS BEEN SUCCESSFUL DOUBLING WITHIN 3 YEARS
- NEW INVESTMENTS HAVE BEEN ANNOUNCED AND MUST BE UTILIZED
- THE REST ECONOMY MUST TAKE ADVANTAGE AND COOPERATE
- TAKE ADVANTAGE OF THE EXPLOITATION OF SOLAR ENERGY (SEE BELOW)

2.C. SOLAR ENERGY

- SOLAR ENERGY AND ESPECIALLY PV CAN BE SPECIALLY BENEFITED WITH NET METERING
- THE NEW LAW ABOUT ECONIC NET METERING CAN BOOST PV IN BUILDINGS
- THIS CAN BE COMBINED WITH PARALLEL EXPLOITATION OF THE THERMAL PV
- NET METERING CAN BE EXPLOITED TO MAKE HOTELS ENERGY AUTARK
- HOTELS WITH THE THERMAL PV CAN EXPAND TOUTIST SAIZON BY 2 MONTHS
- GEOTHERMAL OR SEA WATER HEAT PUMPS CAN ALSO PROVIDE AIR –
CONDITIONING AND HOT WATER

GW UTILITY PV AT SOUTHERN EUROPE



3. SOLAR ENERGY AND RURAL PRODUCTION AND TOURISM

3.A. SOLAR ENERGY AND RURAL PRODUCTION (GREEN HOUSES)

- PV ENERGY CAN BE HYBRIDIZED PROVIDING BOTH ELECTRICITY AND H. W.
- RURAL PRODUCTION CAN COMBINE GREEN HOUSES WITH HYDROPONY & PV
- THERMAL PV HEATING GREEN HOUSES CAN CUT PRODUCT COST BY > 20-30 %

3.B. SOLAR ENERGY AND TOURISM (HOTEL UNITS)

- HOTELS CAN THIS WAY EXTEND THE TOURISTIC SAIZON BY AT LEAST 2 MONTHS
- THE COMPETITIVITY OF THE GREEK HOTELS CAN BE SUBSTANTIALY INCREASED
- HOTELS CAN THIS WAY CREATE AND ADVERTIZE A PROFITABLE SOLAR PROFILE

4. SOLAR ENERGY AGAINST CRISIS / WANTED COMPETITIVE CHARACTERISTICS

- SOUTHERN GREECE IS IN THE SAME PARALLEL WITH ALGERIA SAME INSOLATION
- COMPETITIVE ADVANTAGE FOR FEEDING CENTRAL EU WITH GW PV ELECTRICITY
- FRANCE AND GERMANY DEACTIVATE ABOUT 37.000MW OF NUCLEAR TILL 2022
- THIS IS EQUIVALENT WITH $5 \times 37.000 = 185.000$ MW PV EQUIVALENT CAPACITY
- IN PARALLEL EU WILL DEACTIVATE 69.000MW OF COAL POWER PLANTS BY 2024
- THIS IS EQUIVALENT WITH $4 \times 69.000 = 276.000$ MW PV EQUIVALENT ELECTRICITY
- FROM A TOTAL OF 416.000MW PV/WIND WILL SHARE THE DEMAND BY 60-40%
- SOUTHERN EU STATES ARE EXPECTED TO SHARE THIS BUSINESS OPPORTUNITY

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- **GREECE HAS DECISIVE ADVANTAGE AGAINST ITALY SPAIN AND FRANCE FOR PV**
- **IN ITALY LAND IS VERY EXPENSIVE IN SUITABLE LOCATIONS SOUTHERN NEAPLES**
- **SPAIN HAS NO INTERCONNECTION OVER PYRINAEAN WITH EDF WITHIN FRANCE**
- **FRANCE IS MORE NORTHERN AND HAS THE PROBLEM EXPENSIVE LAND AS ITALY**

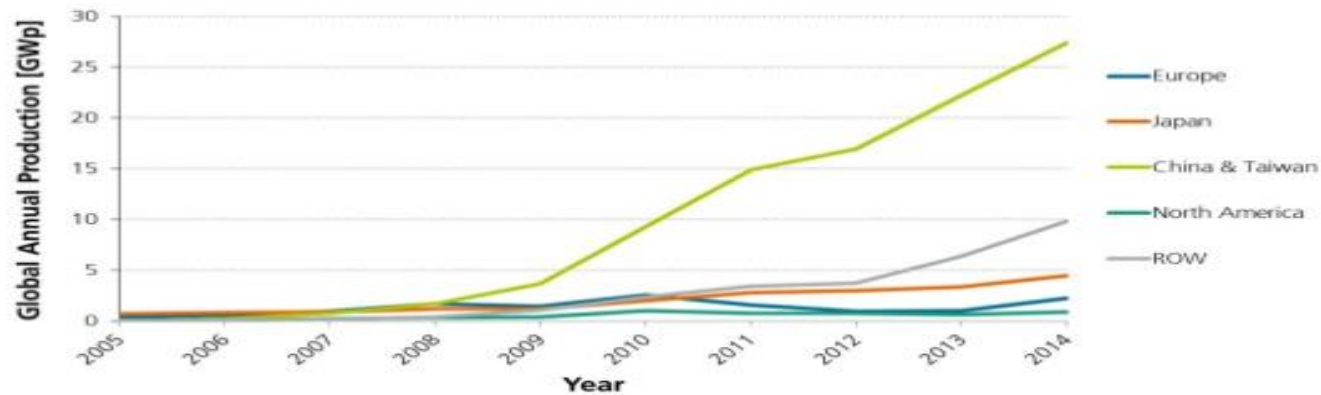
5. PERSPECTIVES OF SOLAR ENERGY / CREATION OF WORKING POSITIONS /

FAVORABLE BUSINESS OPPORTUNITY

- GREECE COULD REACTIVATE PROJECT LIKE HELIOS OF 10GW EXTEND TO >100GW
- A BUSINESS OPPORTUNITY OF 1,4 TRILLION EURO DURING THE NEXT 8-10 YEARS
- THE LAND REQUIRED AMOUNTS TO 50x60KM AND IS AVAILABLE ON ARID AREAS
- ANNUAL INCOME IS ESTIMATED IN EXCESS OF 6,0 BILLION EURO PV ELECTRICITY
- WITH THE INNOVATIVE PV TECHNOLOGY PV HEAT $5 \times P_{PV}$ CAN BE UTILIZED
- PV HEAT CAN BE COUPLED WITH 10 STREMAS HYDROPONY GREEN HOUSES/MW
- NET INCOME FROM EACH STREMA TOMATO HYDROPONY EXCEEDS 30.000 EURO

PV INDUSTRY BY REGION

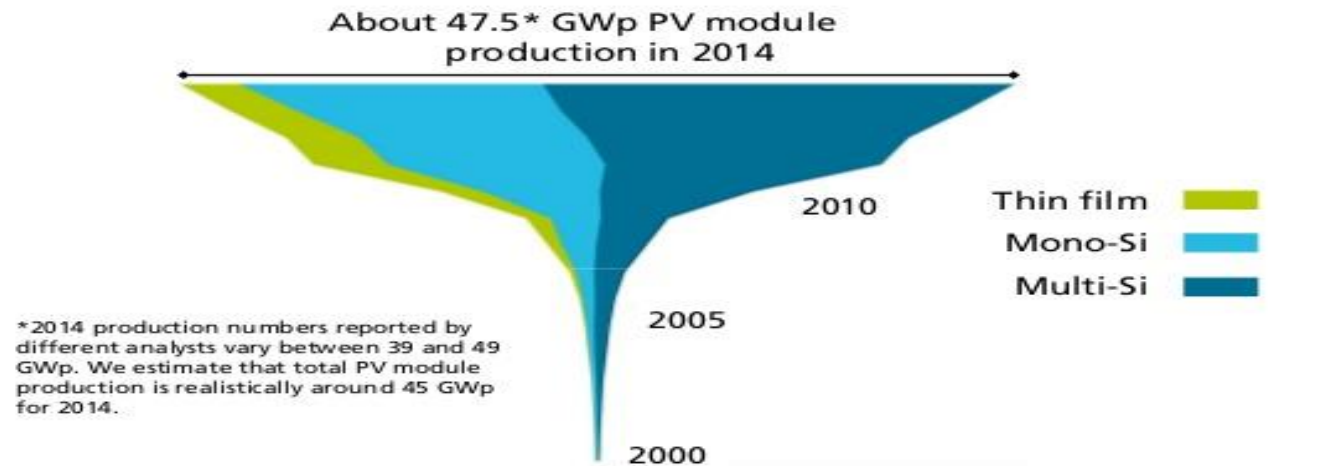
PV Industry Production by Region (2005-2014)
Global Annual Production



Data: Navigant Consulting and Paula Mirns. Graph: PSE AG 2015

PV INDUSTRY EVOLUTION 2000-2014

Annual PV Production by Technology Worldwide (in GWp)



- THIS IS 300.000 EURO NET INCOME FOR EACH MW OF 3-SUN PV EXPLOITATION
- THIS IS 5 TIMES THE INCOME FROM SELLING THE PV ELECTRICITY TO EUROPEANS
- THE LAND REQUIRED AMOUNTS TO 50x30KM AND IS AVAILABLE IN ARID AREAS
- HYDROPONY NEEDS 1/10 THE WATER OF OPEN AGRICULTURE AND ROCK SOIL
- THE PROJECT WILL CREATE DIR/IND WORKING PLACES IN EXCESS OF 1,0 MILLION
- COMBINED NET ANNUAL INCOME FROM THE SOLAR / AGRICULTURAL > 36 BIL €
- GREEK STATE EXPECTED TO CREATE A MINISTRY FOR EXPLOITATION OF THE SUN

6. THE UN COP21 AGREEMENT IN PARIS ON CLIMATE CHANGE REDUCTION OF CO2 EMISSIONS 2030/2050 - SOLAR ENERGY

- THE UN COP21 AGREEMENT MEANS FOR EU MORE THAN 1.000 GW PV TILL 2030
- GREECE CAN BE THE RECIPIENT OF A BIG STAKE OF THIS COLOSSAL INVESTMENT
- THE FIGURES TILL 2050 ARE DOUBLE THE ABOVE NUMBERS AND MAYBE TRIPPLE
- DUE TO ELECTRIFICATION OF THE MEANS OF TRANSPORTATION.
- GREECE CAN ORGANIZE THE EXPLOITATION OF THE SUN FOR EU

7. WARNING CLIMATE CHANGE INDICATIONS FROM NEW DATA

UNKNOWN UP NOW, ACCELERATE USE OF SOLAR ENERGY

- NEW WARNING CLIMATE CHANGE INDICATIONS FROM NEW DATA
- THE GULF STREAM VELOCITY HAS BEEN REDUCED BY MORE THAN 25%
- HURRICANES OF RATE 5 BACK TO BACK IN THE CARRIBEAN AND SOUTH US STATES
- WORLD WIDE WORRING SIGNALS ACCELERATE USE OF SOLAR ENERGY

Warning Facts I

Oceans Cooling Stream Velocity is reduced from 6.0 to 4.5 Miles/Hour. Climate Change is here! Too Late ? Why build-up of floating fresh water in Arctic as big as Lake Victoria could spell trouble for Britain and not only



Warning Facts II

- Last year's Arctic Ocean's ice thickness was minimal : 0.5 -1,5m
- In December 2015, middle of the 6-month Polar Night, in North Pole the temperature instead of minus 40 was several degrees over zero !
- First time ever in the history such difference, much earlier than foreseen.
- In previous years, the thickness of the polar ice reached up several meters above sea level and another 8-fold meters below the surface
- This ice consisted the stored cooling energy with which the gigantic Thermo - Haline Stream cooling the Pacific, Indian and Atlantic Oceans was cooled
- This year, maybe there will not exist enough ice storage for cooling the whole of the Thermo - Haline Stream for cooling the Oceans in order to avoid the Planet overheating.

Warning Facts II

- Oceans will overheat, maybe not in a year, they can store heat for a few years, but then they will burst out in form of Hyper Cyclones in order to be cooled, as in “The Day After Tomorrow” based on a US Army Study.
- Time to react before the Climate Change be irreversible is very short Maybe 15-20 years (some research institutes give even shorter time)
- Innovative PV Technology can achieve the UN Scenario to eliminate CO2 emissions instead of 35 years (till 2050) in only 15-20 years.
- Such a 15-20 years time gain can be the factor that will tip the scale to salvation from the Nightmare of Climate Change and by the way with a fantastic business profit for the Utilities, Industry and the Society

Consequences of the Haline Stream Interruption



“The Day After Tomorrow”, just a movie scenario for now, based on a Study as above financed by the American Army

8. CHANGE TO RENEWABLE ENERGY USE AND SPECIALLY IN SOLAR ENERGY AND MORE SPECIFICALLY IN PV

- WORLD HAS DOUBLED ITS INSTALLED PV CAPACITY EVERY 2YEARS LAST 10YEARS (SEE SLIDE 12 ABOVE)
- ESPECIALLY CHINA HAS REACHED THEIR TARGET OF 110 GW OF 2020 THIS YEAR, MUCH EARLIER THAN FORESEEN
- THE NEW CHINESE TARGET FOR 2020 HAS BEEN SET AT 200GW (MOST PROBABLY THEY WILL SURPASS 240GW)
- CHINA CLOSED LAST YEAR ABOUT 2500 COAL MINES AND SLOWED DOWN COAL FIRING

**9. THE DEVELOPMENT IN THE PV INVESTMENTS ALTHOUGH PARTICULARLY HIGH,
IT LACKS BEHIND AT A SCALE 1/10**

- TOTAL INSTALLED CAPACITY OF END 2016 SURPASSED 300GW OF PV CAPACITY**
- THE ADDED WORLDWIDE PV CAPACITY IN 2015, 16 AND 2017 WAS ABOUT 25%**
- ALTHOUGH HIGH IT HAS LOST THE MOMENTUM OF THE LAST 10 YEARS OF 41%**
- ANNUAL INCREASE OF 41% MEANS DOUBLING INSTALLED CAPACITY EACH 2YRS**
- IN ORDER TO MEET THE TARGETS OF COP21 FOR 2030 AND 2050 41% IS A MUST**
- ANNUAL INVESTMENTS OF 350 BILLION EURO LACK BEHIND AT A SCALE 1/10**

COMBINED GW PV AND WIND PROJECTS



CONCLUSIONS

10. WE HAVE TODAY A TOTAL OF 300GW, BUT WE NEED TO REACH 12.000GW BY 2030 AND 30-40.000GW BY 2050

11. GREECE CAN REALIZE PART FROM THE 160,000MW OF DESERTEK IN EUROPEAN TERRITORY INSTEAD OF NORTH AFRICA

12. FIRST STEP CAN BE THE 10,000MW OF THE "NEW HELIOS" PROJECT ELABORATED BY GERMAN COMPANIES

13. A PROJECT WITH A BUDGET OF 14BILLION € FOR ELECTRICITY PRODUCTION IN GREECE AND TRANSMISSION BY SUBMARINE CABLE TO ITALY

14. IT MAY COMBINE AND EXPLOITATION OF THE PV HEAT IN GREENHOUSES / HOTELS AS GIVEN ABOVE

15. POTENTIAL OF COMBINATION OF 10GW PV WITH 100,000 STREMAS OF GREENHOUSES

16. TURNOVER OF 10GW PV: 1,0 BILLION € / YEAR, TURNOVER OF 100,000 GREENHOUSE 6,0 BILLION € / YEAR

17. DIRECT WORKING POSITIONS IN THE PHASE OF CONSTRUCTION / OPERATION: 100.000 / 10GW, 1,0 MILLION PER 100GW AS ABOVE

THANK YOU FOR YOUR ATTENTION