EXPANDING THE MARKET FOR CONCENTRATING SOLAR POWER
Moving Opportunities Into Projects

MEXICAN PROJECT
INTEGRATED SOLAR COMBINED CYCLE SYSTEM

The Current Situation

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Comisión Federal de Electricidad

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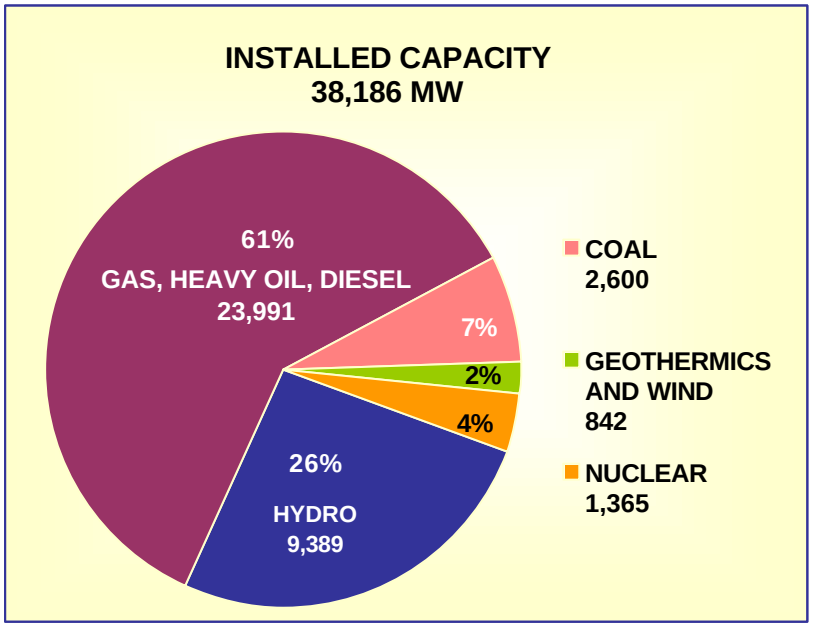
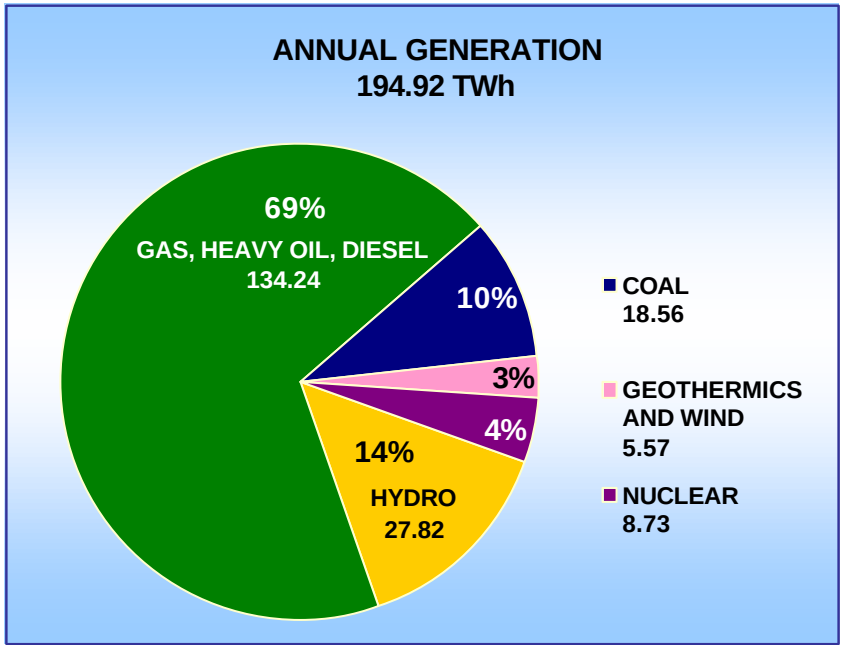
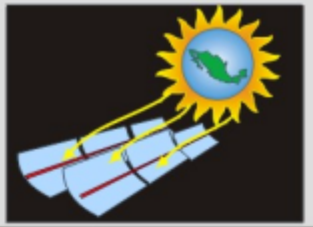
THE MEXICAN ELECTRIC SYSTEM - 2001



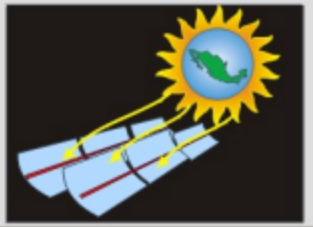


IMPORTANCE OF RENEWABLE ENERGY IN MÉXICO



- Mexican government recognizes the convenience of increasing RE participation to contribute to the sustainable development, fostering the following concepts:
  - Diversification of energy sources.
  - To reduce petroleum dependence.
  - To reduce impact on environment due to electricity generation.
- Solar energy is already playing an important role in matter of rural electrification: more than 50,000 PV systems are on operation.

BARRIERS TO THE RENEWABLE ENERGY DEVELOPMENT

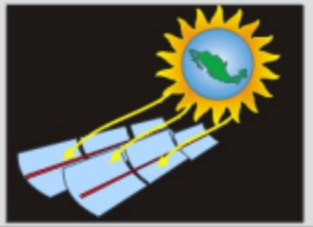


* Intermittent sources of energy, like solar, are not able to provide firm capacity at competitive costs on utility scale.

* CFE is forced by law to provide public service of electricity at least cost.

* Renewables are on disadvantage since compete with conventional energy sources on economic and financial terms.

MEXICAN POLICY ON RENEWABLE ENERGY

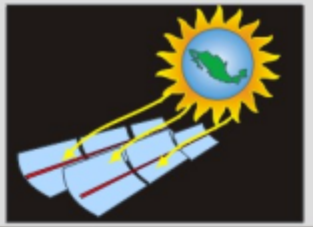


- **Mexico has not even a special policy on operation to support economically the renewable energy development, however some efforts are been made on that direction.**

- **The National Development Plan 2001-2006 declares the government interest in promoting renewable energy development. Social, private and public sectors are analyzing the viability of the following policies:**

  - To create a fund to partially support the renewable energy exploitation.
  - To implement a green market among the biggest consumers of electricity.
  - To participate with projects in programs derived from the Kyoto Protocol like the PCF and be part of the future market of carbon emissions.
  - To take opportunities of low cost financing and grants offered by development banks and international entities addressed to improve the environment and to promote the new clean technologies.

GEF GRANT FOR MEXICALI II POWER PLANT

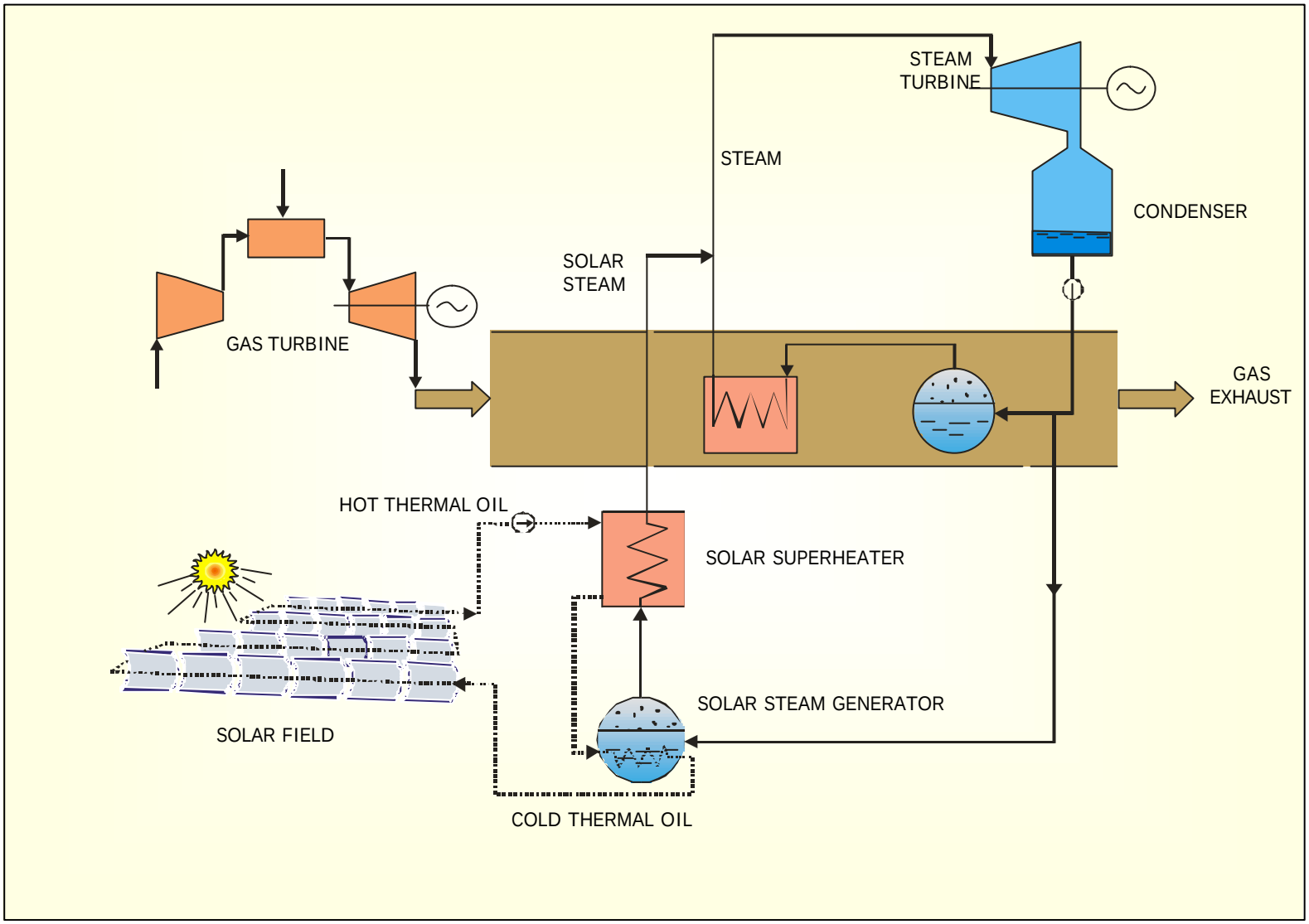


- GEF has displayed an strategy to promote the commercialization of solar parabolic through technology pursuing environmental targets.

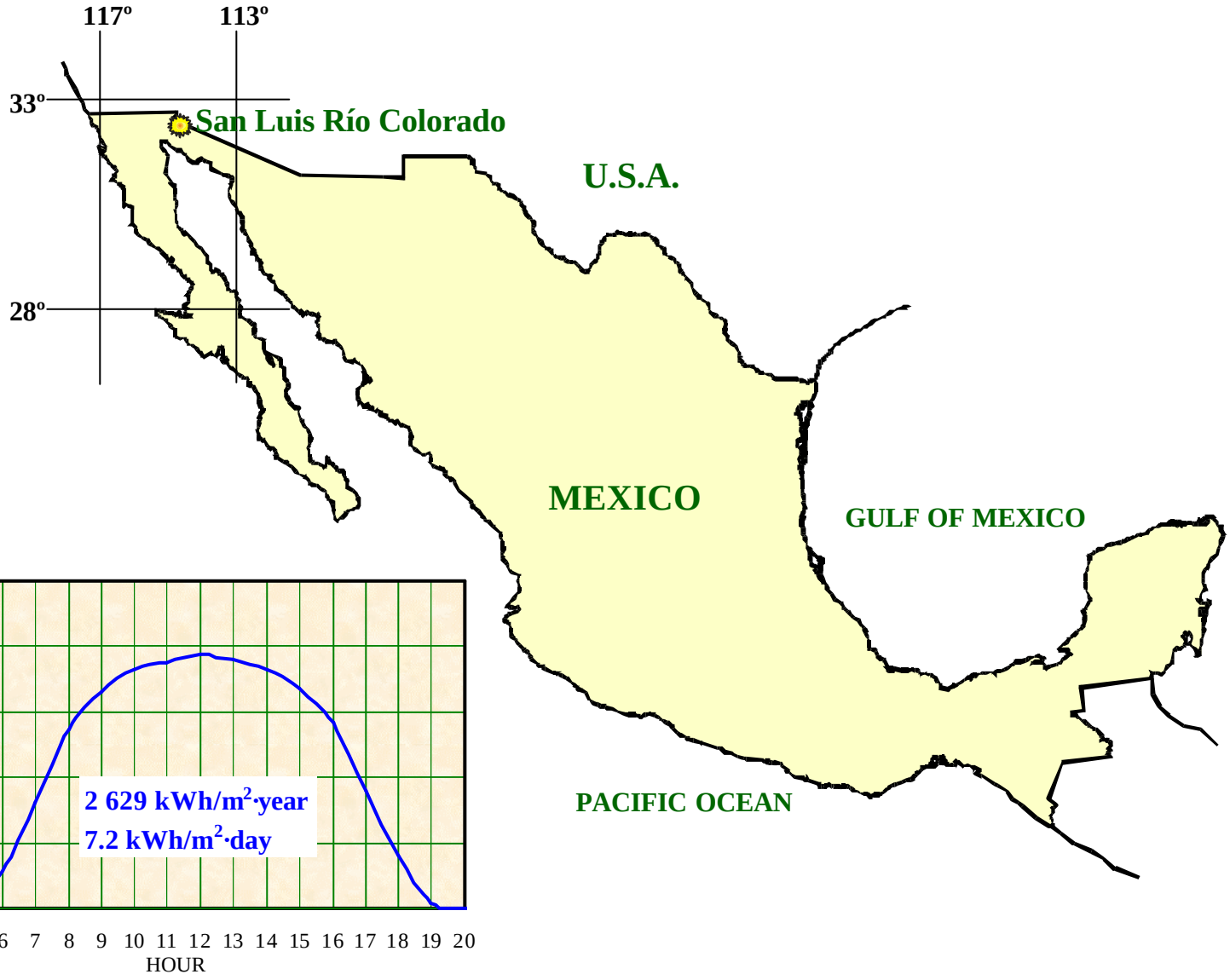
- México is candidate to receive a GEF grant in the amount of 49.35 MUSD to partially support the construction of an integrated solar combined cycle system.

- Grant is addressed to cover 100 % of the solar field investment, including their impact upon the power block.

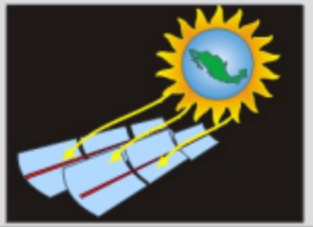
INTEGRATED SOLAR COMBINED CYCLE SYSTEM



LOCALIZATION OF THE SOLAR POWER PLANT



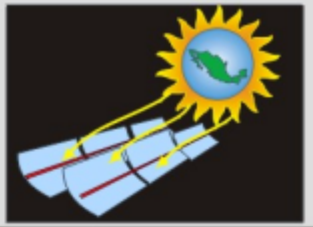
THE BIDDING PROCESS FOR THE MEXICALI II POWER PLANT



- The RFP was published on last March 14th, 2002.
- Reception and opening of proposals: September 5th.
- Winner decision: October 25th, 2002.
- Start of construction: May, 2003.
- Commercial operation: June, 2005.

- Bidders are free to offer a straight combined cycle or an Integrated Solar Combined Cycle System.
- Firm capacity of 220 MW with a minimum solar peak contribution of 25 MW is required.
- CFE and the IPP sign a 25 years PPA

BIDS EVALUATION

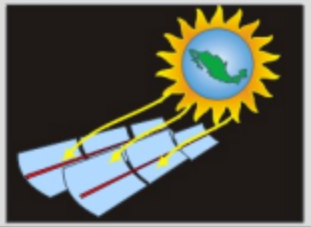


➔ The contract will be assigned to the bidder who offer the lower levelized energy cost (PNG):

$$\text{PNG [\$/kWh]} = \frac{(\text{CAPITAL} + \text{O\&M}_{\text{FIX}})_{\text{CC}} + \text{O\&M}_{\text{FIX-SOLAR}}}{\text{FIRM ENERGY}_{\text{CC + SOLAR}}} + \frac{(\text{FUEL} + \text{O\&M}_{\text{VAR}})_{\text{CC}} + \text{O\&M}_{\text{VAR-SOLAR}}}{\text{TOTAL ENERGY PRODUCTION}}$$

Bidders must fill one of the Forms 3.6.1 or 8.6.1 of the bidding documents with all capacity and energy charges, according the technology they choose. Capital charges due to the solar component will not be accepted.

CAPACITY PAYMENTS



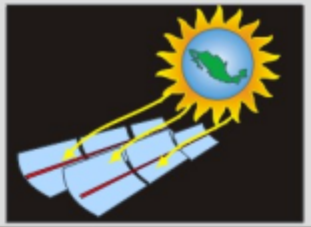
- Bidders must guaranty the power plant availability for each month of the PPA in their offers. Monthly availability must be equal or bigger than 0.9

- Bidders will also provide with their proposals the charges for capital and fix O&M that they want for each month of the PPA. Charges are expressed in USD/kWmonth

- During the plant operation, its availability will be evaluated every month. Capacity payments will be adjusted with a moving average of the last 12 months.

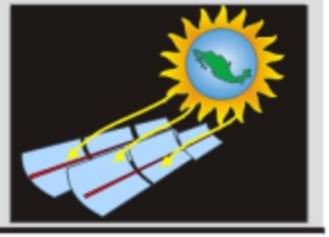
- For an ISCCS, this procedure will be applicable for the combined cycle component but not for the solar component.

ENERGY CHARGES



- Fuel charges
  - Fuel consumption will be based on guarantied heat rate, which will be calculated from a mathematical model every 5 minutes according the load, and measurements of weather conditions, including DNI, and others.
  - Fuel price will be taken from relevant publications that are mentioned in the bidding documents. For payment purposes it will be a pass through.
- Variable O&M includes water consumption and other consumables.
- For energy payments there will not be distinction between solar and CCGT components. Energy charges will multiply the total electricity delivered to the grid.

COMMITMENT OF SOLAR FIELD PERFORMANCE
(under analysis)

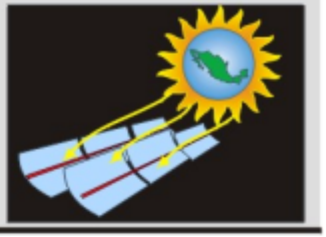


- CFE and GEF do not want the IPP to abandon the solar field.
- The solar field performance would be evaluated every year, in order to guarantee its appropriate operation.
- Deficient operation of solar field will be penalized as follows:

ANNUAL PENALTY [$] = (GSD - GSR) * CUP

- GSD = ANNUAL DESIGN SOLAR PRODUCTION, kWh
- GSR = ANNUAL REAL SOLAR PRODUCTION, kWh
- CUP = 0.012 USD/kWh

COMMITMENT OF SOLAR FIELD PERFORMANCE
(under analysis)

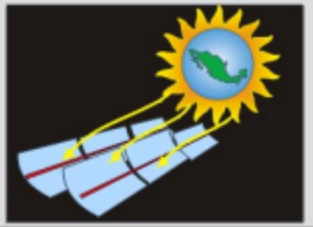


- **Real Solar Production (GSR) will be determined from field measurements of thermal load delivered by the solar field to the power cycle.**

- **Design Solar Production (GSD) will be determined at design conditions.**

- **Both, GSR and GSD, will be calculated through a mathematical model of the system, which is prepared by the IPP.**

FINAL COMMENTS
(1/2)



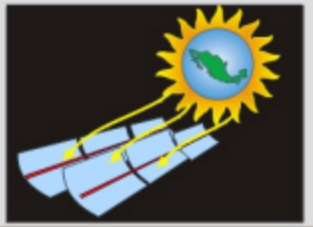
- To be successful the ISCCS should be capable of producing cheaper electricity than the straight CCGT.

  The IPP will only pay for the solar field O&M costs.

- The project must be efficient on a commercial context providing profits to the investors.

- In the ISCCS, solar electricity contributes to reduce fuel consumption. In the last 18 months, gas prices were in the range from 1.7 to 9.5 USD/MMBTU. Such scenario is favorable for the ISCCS.

FINAL COMMENTS
(2/2)



- CSP with storage energy systems should be tested to provide firm capacity and overcome technical barriers.
- Future green markets will contribute to expand the CSP industry.
- Solar Mexican project is the first experience of CSP on utility scale under competitive basis. The scheme published in the bidding documents allows the solar bidders to be competitive against the CCGT bidders.
- This project will set an important reference to predict the future market of the CSP technology. According the progress of the bidding process, we expect to have some conclusions by the next California CSP meeting.