

# Applicability of SAM to model CSP power plants as parts of smelters in the Atacama Desert, Chile

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# Important

- For evaluating a 300 MWe CSP plant with TES it is necessary:
  - To know if SAM is really applicable to Chilean conditions and
  - To show the detailed cost calculations of LCOE in Excel



# Investments

- When SAM is run for United States locations the default investment costs reflect in-depth studies carried out on behalf of N.R.E.L.
- These values are not applicable to plants to be built in Chile about 200 kilometers East of the coast at elevations exceeding 2,000 meters above sea level.



# Business Case

- The general case which should be analyzed is not specifically included in SAM's list of options.
- Instead, the plant should:
  - be considered as part of an existing copper smelter
  - pay no sales taxes because of this
  - have a useful life of 40 years and its initial cost amortized in this period
  - incorporate a 2% real discount rate, equal to the net return of the government's overseas investments
  - be air-cooled
  - resistant to the action of SO<sub>2</sub> present in the air surrounding the CSP plant
  - protected from major damages in case of strong earth quakes
  - designed using historically significant meteorological records and realistic DNI values for its location.



# DNI and other meteorological data

- Hourly datasets for ten years for the locations of major importance in the Atacama Desert are not part of SAM.
- They can be had from private sources at a cost, without assurance of their quality by N.R.E.L.
- The usefulness of SAM would be enhanced if it includes the possibility of accessing these data.
- The UNDP has contributed to the collection of old data and put it online.
- Government agency “Comisión Nacional de Energía” is generating this type of data at three weather stations located in Northern Chile.



# Operation and Maintenance Costs

- The values included in SAM reflect the situation in California and neighboring states and thus are not valid for CSP plants located in the Atacama Desert of Northern Chile.
- If details of the figures given for these values were made available separately, they might be adapted to Chilean locations.



# Levelized Cost of Electricity (LCOE)

- The value of LCOE should be calculated and shown as an Excel spreadsheet, in which each parameter should be backed by a credible reference.
- The cost of imported equipment should include its f.o.b. value, transportation costs to the plant premises and local erection costs for a site located at -22.31667 LATITUDE -68.93333 LONGITUDE and 2,850 m.a.s.l. ALTITUDE



# Author's Resume

## PATRICIO CASTRO

### EDUCATION

- Master of Chemical Engineering, University of Virginia, Charlottesville, VA, USA, 1958
- Chemical Engineer, Universidad Técnica Federico Santa María, Valparaíso, Chile, 1956

### EXPERIENCE

- UNIDO expert and consultant in ten countries in the field of chemical economics, ending in 2006 with a seven year stint at the Sultanate of Oman
- United Nations Industrial Development Organization (UNIDO) adviser on chemical and petrochemical projects to JUNAC (Junta del Acuerdo de Cartagena), Lima, Perú, 1982
- Sales Representative at large for Battelle and Garrett Research and Development (Occidental Petroleum subsidiary), 1974
- Research Fellow, Battelle Memorial Institute, Columbus, OH, 1973
- Vice President for Development, Sociedad Química y Minera de Chile (SQM), 1972
- Professor of Diffusional Operations, Universidad Técnica del Estado, Santiago, Chile, 1968
- Head of Chemical and Fertilizer Plant Projects, Corporación de Fomento de la Producción (CORFO), Santiago, Chile, 1968
- Smelter Foreman and Assistant Test Engineer, Chile Exploration Company (Anaconda subsidiary), Chuquicamata, Chile, Copper Sulphide Plant Smelter, 1961



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