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EUROPEAN SOLAR THERMAL
POWER INDUSTRY ASSOCIATION



FICHTNER SOLAR GmbH
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WORLD SOLAR POWER

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Technical Due Diligence of CSP Plants for Project Finance

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Professional career of Georg Brakmann

- 1999 - ... Fichtner Solar GmbH (Stuttgart)**
Co-Founder, Managing Director and Partner
Engineering for Solar Power Plants
- 1998 - ... ESTIA (Europe)**
Co-Founder and President
Lobbying for CSP
- 1987 - 1999 Fichtner (Stuttgart)**
Marketing and Engineering for Solar- and for Conventional Power Plants
- 1975 - 1986 Westinghouse Nuclear (Brussels)**
Marketing and Engineering for Nuclear Power Plants
- 1973 - 1975 IBM (Germany)**
Software Development
- 1971 - 1973 Institute for Nuclear Safety (Köln)**
Safety Assessment of Nuclear Reactors
- 1969 - 1971 Space Research Institute (Montreal)**
Development of Launch Vehicles for Satellites
- 1966 - 1968 Montreal Engineering Ltd. (Montreal)**
Engineering for Power Plants
- 1966 - 1971 McGill University (Montreal)**
Master of Engineering (Aerospace Engineering)
- 1963 - 1966 University of Essen (Germany)**
Diplom-Ingenieur (Mechanical Engineering)



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Project Finance is Risk Management

No risk, no fun

- **Risk:**

Does the project generate enough revenues to repay the loan?

- **Fun:**

Interest rate above base rate depends on the assessed risk.



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Risk of the Lenders

- Technology
- Suppliers
- EPC - Contract
- O&M - Contract
- Solar Resource
- Infrastructure
- Performance Model
- Financial Model





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Technology

- **Technology Risk is mitigated by proven design or tested equipment.**



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Suppliers

- **Risk due to Suppliers is mitigated by their references, experience and financial strength.**





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EPC - Contract

- Performance guarantees (solar / fossil)
- Guarantee tests
- Tolerances and accuracy of measurements
- LDs (Liquidated Damages) for deficiencies in performance and time for completion
- Limit of LDs
- Rejection criteria
- Warranty and degradation
- Payment conditions
- Transfer of ownership



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O&M - Contract

- Warranties for availability
- Performance warranties / degradation
- Spare parts management
- O&M budget



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Solar Resource

- Basis and accuracy of historic irradiation data
- Assessment of future irradiation data
- 50%, 75% and 95% probability of future long term average irradiation
- Low irradiation has a more severe effect in earlier years of the project than it has in later years



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Infrastructure, Permits & Licenses

- Space constraints
- Geotechnical review
- Access roads
- Flood protection
- Availability of fossil fuel
- Water (short and long term availability)
- Transmission facility
- Local support / opposition to the Project





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Performance Model

- **EPC - Contractor guarantees electricity generation as function of solar - meteo conditions.**
- **Annual electricity generation capability must be verified by Independent Engineer according to:**
 - Contractor's guarantees, including allowance for tolerance and accuracy of measurements
 - different solar irradiation scenarios
 - legal limitation on use of fossil fuel
 - expected availability / equipment degradation



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Financial Model

- **Low probability scenarios must still result in sufficient revenues to repay loan incl. interest.**



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Conclusion

**Project Financing of CSP Plants does not represent an undue risk to Lenders, if:
The Projects are managed and verified by competent Developers, Contractors and Engineering Companies.**

