



# **CALFULA**

## **Solar Energy** in Northern Chile at **Grid Parity** (or better)

September 2014

# Calfula: a Team of professional entrepreneurs ...

**FROWEIN & SPILKER**  
Business Development

## Frowein & Spilker Business Development Group

- An experienced Investment and Business Development firm
- More than US\$ 300 mio invested over 20 years
- Based in Hamburg, Germany
- **Managing partner** in charge of project development, finance, administration, legal
- [www.frowein-spilker.com](http://www.frowein-spilker.com)

**eren**

## Eren Groupe S.A.

- Equity Sponsor to Calfula Projects
- Based in Luxemburg
- Developer, Power Generator and Investor
- Focused on Renewable Energy Projects
- Total assets € 650 mio
- **Financial partner** providing equity capital to the projects
- [www.eren-groupe.com/](http://www.eren-groupe.com/)



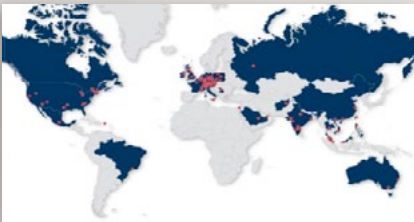
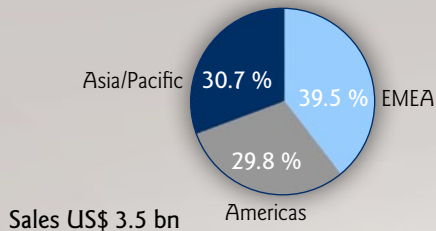
# ...and a strong technology partner



M+W GROUP



Over 7000 highly skilled and experienced employees



Global presence



EHS are core value

## M+W Group:

the leading global engineering and project execution company

- more than 8,000 employees worldwide
- offices and representations in 29 countries
- more than 300 large turnkey projects successfully completed
- US\$ 3.5 bn sales worldwide
- world class EHS records and awards
- focus on high-tech energy & environmental solutions, production facilities, mission critical infrastructure
- Headquarter in Stuttgart, Germany
- [www.mwgroup.net](http://www.mwgroup.net)

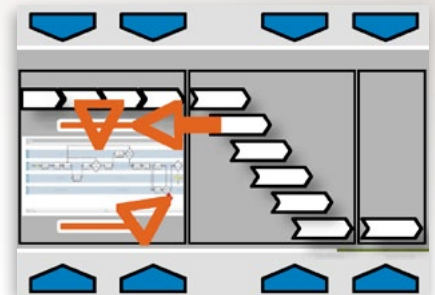
## M+W Power Generation:

proven track record in renewable power plant EPC


- more than 10 GWp PV Fab capacity realized since 2000
- more than 20 PV power plant installations completed since 2009
- installed base 400 MWp worldwide
- large scale CSP Concentrating Solar Power, Waste-to-Energy, Biomass, natural gas
- proven capabilities to manage complex projects
- integrated solutions focussed on customer value



More than 20 PV plant project references



Complex project management capabilities for integrated EPC solutions



# CALFULA: idea and objectives

- CALFULA is incorporated in Chile (CALFULA Chile SpA) with a local office and staff.
- The idea is to design, finance, build and operate Photovoltaic (PV) plants in Northern Chile against Power Purchase Agreements from local industrial offtakers at Grid Parity – or better.
- Because: PV is now ready for commercial use – if the conditions are right.  
And: Northern Chile is the best location worldwide for commercial use of PV.
- The first objective is to install up to 200 MWp, beginning with 3–6 MWp, larger projects subsequently.
- The long term objective is to develop CALFULA into a major supplier of ERNC\* in Chile.  
And beyond.



\*ERNC = Energías Renovables  
No Convencionables,  
i.e. Solar, Wind, Biomass.  
Does not include Hydro.



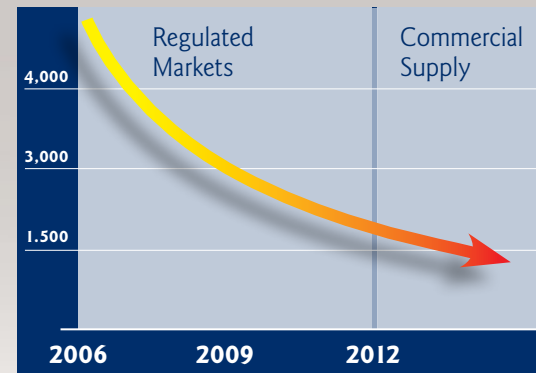
# PV is now ready for commercial use – if the conditions are right

- Heavy governmental stimulus (i.e. in Europe) has induced strong growth of PV installations in the past years
- Economies of scale have substantially driven down the cost of installation – the key cost driver in PV

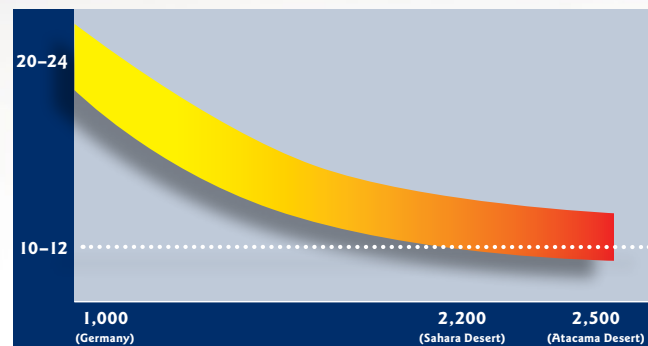
**Installed Capacity Photovoltaics**  
MWp



**Installation Cost**  
\$/KWp



**Cost of Electricity**  
\$/cent/kWh



Global radiation in kWh/m²/a

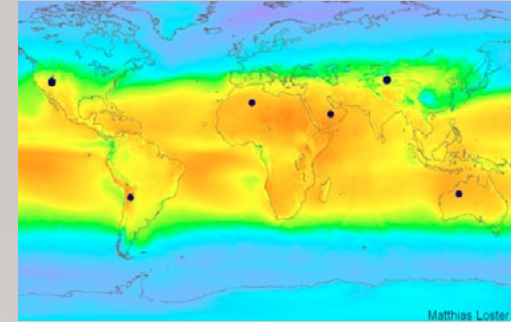
Grid Parity

- **Grid Parity is possible now where radiation is highest**
- PV is now a proven technology, reliable, environmental-safe, modular, easy and fast to install

# Northern Chile is the best location worldwide for commercial PV



- Radiation in Atacama is up to 2,700 kWh/m<sup>2</sup>/a: among highest worldwide
- High altitude, low temperatures and clean air are additional advantages
- Industrial users, i.e. mining companies are right there
- Demand for electricity is high and growing (5–6% p.a.)
- Mainly from fossil sources means high cost, limited potential (for ecological reasons), dependence on imported gas, coal, diesel
- Supply partly unstable
- Grid prices high: 12–18 \$cent/kWh (highest in South-America) and increasing
- In mining: energy is up to 20% of total cost
- Stable political environment, market driven economy
- Quota for ERNC imposed: 5% today, 20% in 2020
- PV-rush started in 2012: projects with more than 4,000 MWp
- But: actual installed capacity is <200 MWp





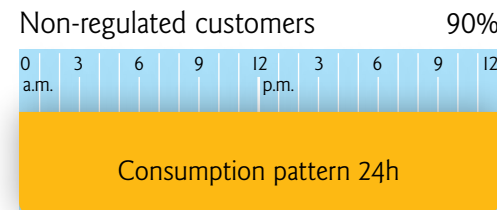
# The market: Electricity in Chile

## General Facts

- 4 Grids, not interconnected:  
SING – North, SIC – Central  
2 smaller in the south
- Total capacity installed: 17.3 GWp
- Demand growth: 5–6% p.a.  
= +20 GWp in 10 years
- Grid price: 12–18 US\$cent/kwh  
highest in South-America
- ERNC-requirement: 5% today,  
20% in 2020
- PV potential: 226 GWp (CER)  
actually installed: <200 MWp  
projects with more than 6,000 MWp  
projected with environmental authorization
- Feed-in obligation for powerplants  
<9 MWp
- Feed-in prices regulated by CDEC  
(governmental agency)

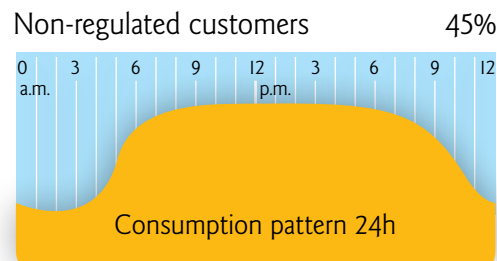
## SING – Sistema Interconectado del Norte Grande

- Owner: Transelec Chile S.A. (Canada), 100%
- Installed capacity: 3,600 MWp
  - Electroandina S.A. (E-CL, CL) 28%
  - E-CL (CL) 18%
  - AES Gener (AES Corp., USA) 16%
- Gas 58%
- Coal 32%
- Diesel 5%
- Oil 5%
- ERNC 0%



## SIC – Sistema Interconectado Central

- Owner: Transelec Chile S.A. (Canada), 98%
- Installed capacity: 11,800 MWp
  - Endesa Chile S.A. (Endesa, E / Enel, I) 34%
  - Colbun S.A. (Family Matte Larrain) 22%
  - AES Gener S.A. (AES Corp., USA) 18%
- Hydro 45%
- Gas 23%
- Diesel 17%
- Coal 12%
- ERNC 3%  
(Biomass 2%, Wind 1%)





# Our approach and proposal



## WE TARGET

- Industrial offtakers i.e. mining companies, foundries etc., also Energy providers, distributors
- In Northern Chile/Atacama, in SIC (3rd and 4th region) rather than SING (1st and 2nd region)
- Smaller projects to start and operate sooner – because no environmental audit is required for up to 3 MWp. But also larger projects when viable.

## WE PROVIDE

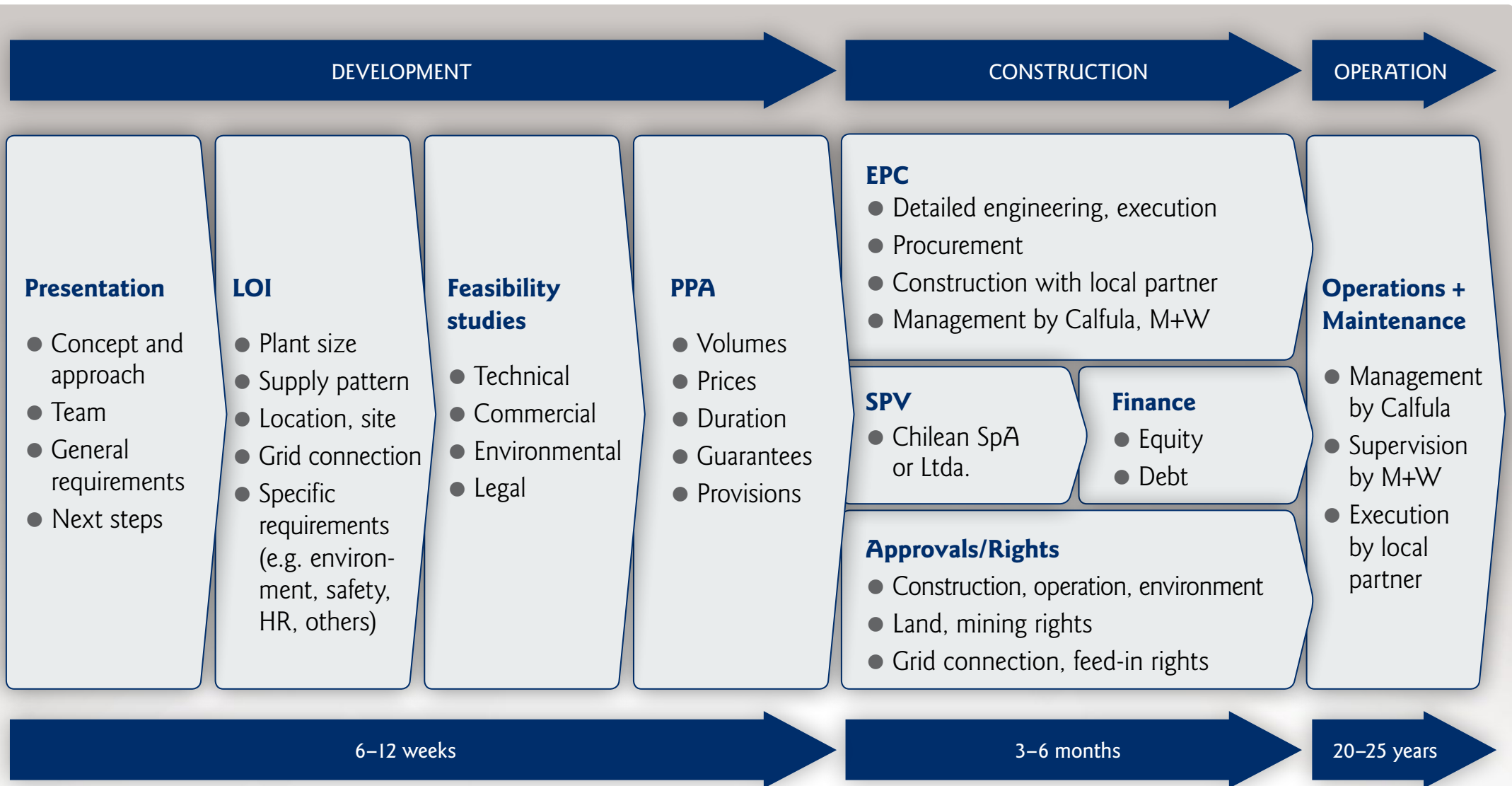
- Electricity at 10–14 US \$cent/kWh (depending on local conditions), heat at 8–12 US \$ cent/kwh
- Stable prices over PPA-lifetime (inflation-adjustment for O+M cost only)
- Stable and reliable supply during daylight hours
- German Engineering, European and Chilean Equity partner, International and Chilean banks
- Presence in Chile, local Operations & Maintenance
- Execution and responsibilities in the hand of a single supplier

## WE REQUEST (from offtakers)

- A formal (bankable) PPA (Power Purchase Agreement) for 10–20 years
- Evidence of good solvency or guarantees
- Local support for site selection, land rights, approvals from local/national authorities
- No capital contribution, no operational involvement



# The steps to go



# CALFULA: Business Structure Model

## FROWEIN & SPILKER Business Development

- Initiator
- Business development
- Commercial, Finance, Legal, Administration
- Based in Hamburg, Germany
- Robert Frowein, Dr. Moritz Spilker

## eren Eren Groupe S.A.

- Equity Sponsor to Calfula Projects
- Based in Luxemburg
- Developer, Power Generator and Investor
- Focused on Renewable Energy Projects
- Total assets € 650 mio

## Debt Provider

- Commercial Banks
- Development Banks (KfW/DEG)
- 70% of project finance

### Project finance

30%  
Equity

70%  
Debt

## CALFULA Chile SpA

Santiago, Chile

- Project Development
- Offtaker Due Diligence
- Set up SPV
- Edzard zu Knyphausen, Gerardo Montenegro

### Project Rights

- Contracts
- Finance
- Rights, permits
- Studies, audits
- Land rights

5%

95%

## Solar SPV

- Chilean Corporation, Plant related
- Construction of Plant (EPC)
- Operation and Maintenance of Plant (O+M)
- Production and supply of Energy

MWh

## Offtaker

### Potential advantages:

- Lower cost
- Stable and predictable pricing
- More independence from grid
- Compliance with ERNC requirements
- Clean energy footprint
- Gain experience with energy technologies of the future

### PPA

- Supply
- Duration
- Price
- Guarantees
- Provisions

### EPC Contract

- Engineering
- Procurement
- Construction
- Warranties

### O+M

- Operations
- Maintenance
- Local Subcontractor



M+W GROUP

- Global engineering and project execution company
- Sales US\$ 3bn, 9,000 employees
- More than 400MWp PV installed worldwide
- Based in Stuttgart, Germany
- M+W Gehrlicher, USA





# Contacts CALFULA



**Robert K. Frowein**  
r.frowein@calfula.com  
+49 172 4009997



**Dr. E. Moritz Spilker**  
m.spilker@calfula.com  
+49 172 6041562



**Edzard zu Knyphausen**  
e.knyphausen@calfula.cl  
+56 (9) 767 299 10



**Gerardo Montenegro Aznar**  
Gerardo.MontenegroAznar@mwgroup.net  
+56 (9) 96704475

## CALFULA GmbH

Grosse Bleichen 8  
20354 Hamburg  
Germany  
+49 40 3 00 39 97-0

## CALFULA Chile SpA

Alcántara 200  
Las Condes  
Santiago, Chile  
+56 2 2208 7452