SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

Belén Gallego, Founder & Director of CSP Today

Washington DC, ESMAP Meeting

7th Nov 2012

CSP today

IT MAKES SENSE TO THINK OF THE FUTURE

FROM WHY…

TO HOW?

TECHNOLOGY DOESN´T TELL THE WHOLE STORY

IT MAKES SENSE TO THINK OF THE FUTURE

"It will come as no surprise to hear that only a tiny fraction — less than 1 percent — of cars driving along American roads are fully electric. What might be more surprising is the fact that this wasn't always the case. In 1900, 34 percent of cars in New York, Boston and Chicago were powered by electric motors. Nearly half had steam engines. What happened? Why do we end up embracing one technology while another, better one struggles or fails?

The easiest assumption is that some powerful entity suppresses one technology and favors another, and so the wheel of progress slowly turns. But historians of science and business will tell you that this isn't the whole story. Instead, the culture we live in and the technologies we use are constantly shaping and being shaped by one another, and it's this messy and unpredictable process that determines winners and losers"

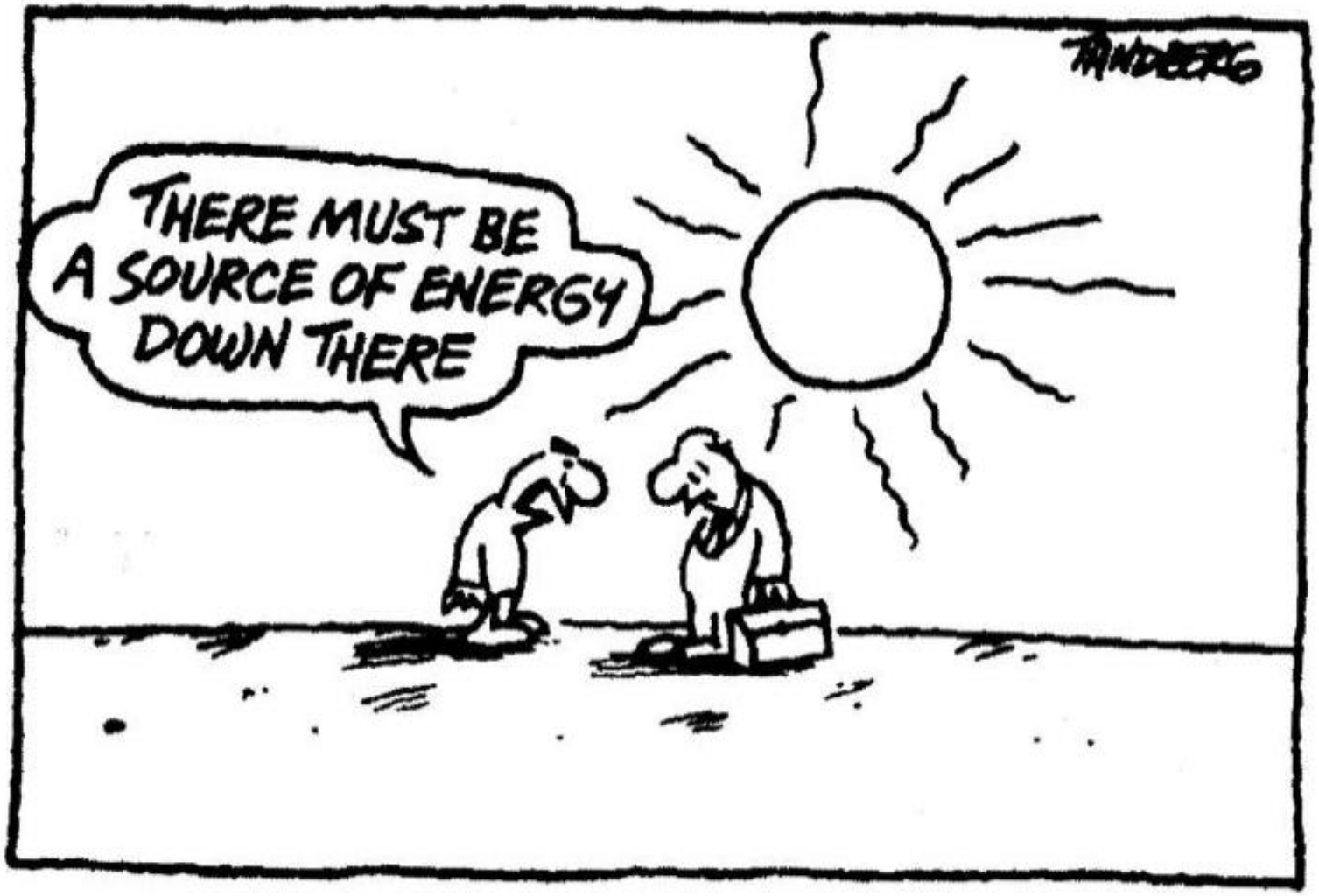
MAGGIE KOERTH-BAKER, New York Times. October 2, 2012

YOU ARE AN AGENT OF CHANGE…

LET´S EXPLORE HOW WE CAN SHAPE THE SOLAR FUTURE TOGETHER

CSP today

IT MAKES SENSE TO THINK OF THE FUTURE



THE CSP INDUSTRY TODAY

Source: CSP Today Global Tracker

THE CSP INDUSTRY TODAY

Plants in Operation and Construction Currently highly concentrated in the US and Spain

OPERATION		
Country	MW	Share
Spain	1682.4	71.5%
USA	571.16	24.2%
ROW	102.44	4.3%
Total	2356	

CONSTRUCTION		
Country	MW	Share
USA	1319	45%
Spain	583	20%
India	489	17%
China	206	7%
ROW	308	11%
Total	2905	

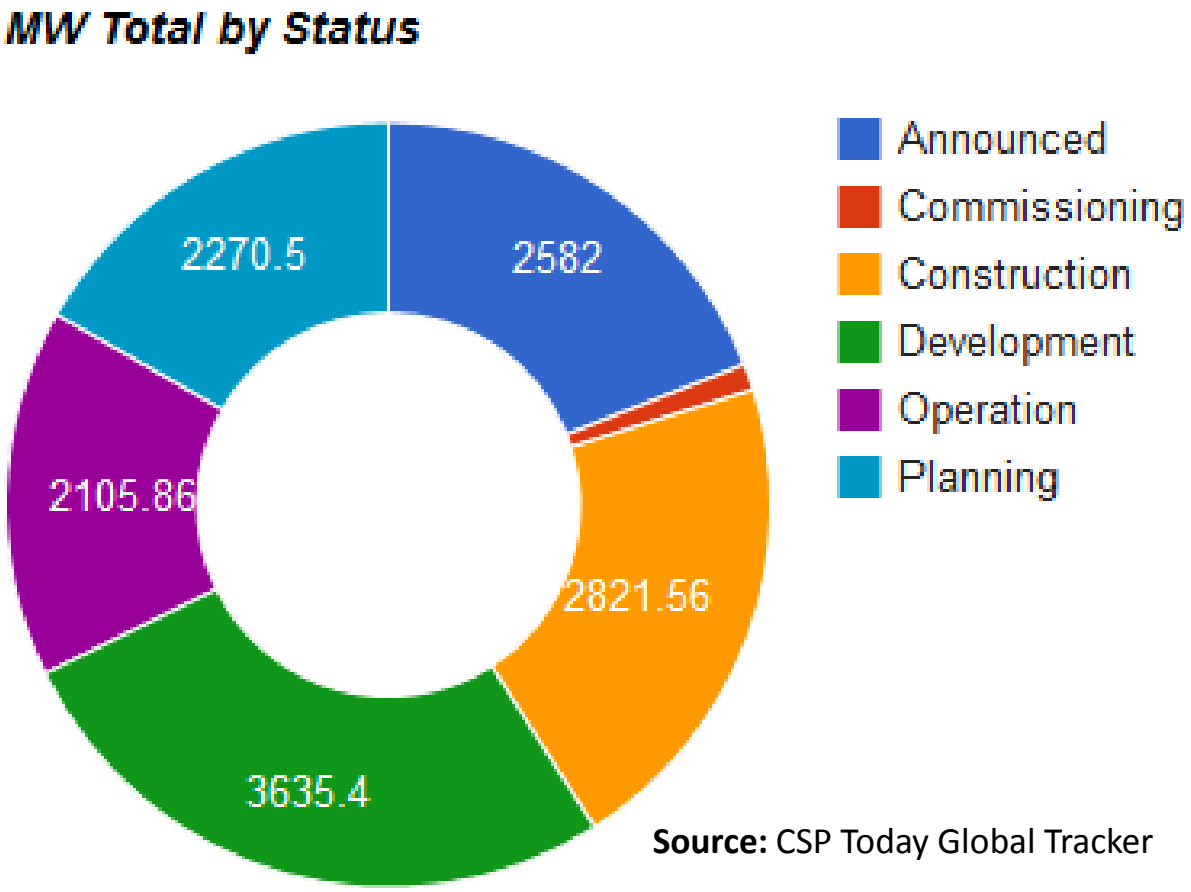
Plants in Development and Planning Increasing in Emerging Markets

DEVELOPMENT		
Country	**MW**	**Share**
USA	1755	54%
Israel	435	13%
South Africa	50	1.5%
Chile	365	11%
Morocco	285	8.75%
Australia	250	8%
ROW	8	0.25%
Spain	110	3.5%
Total	3258	

PLANNING		
Country	**MW**	**Share**
USA	1990*	55%
South Africa	545	15%
India	408	11%
Algeria	147	5%
Australia	197	5.5%
ROW	315	8.7%
Total	3602	

* 600 MW BrightSource Siberia Project – see details on Global Tracker

THE CSP INDUSTRY TODAY



Source: CSP Today Global Tracker

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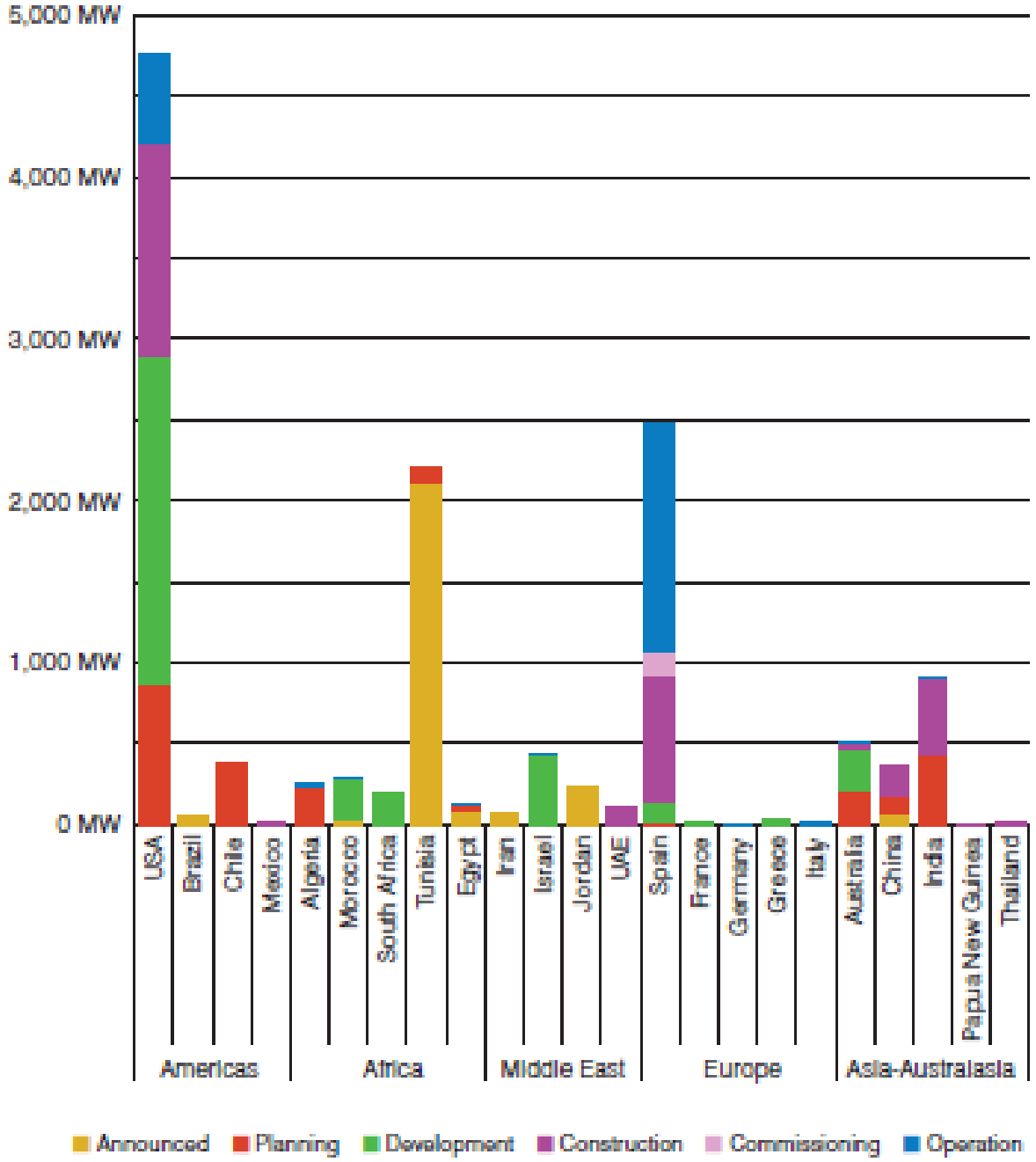
Announced Planning Development Construction Commissioning Operation

Global Overview of CSP Projects, September 2012



Source: CSP Today Quarterly Update, 3 September 2012

THE CSP INDUSTRY TODAY

CSP Industry Project Pipeline Overview
November 2012

	Planning	Development	Construction	Operation	Government Renewable Goals
Algeria	140	7	80	25	22 GW from renewables by 2030
Australia	197.5	250	47	13.3	41,000 GWh/year from renewables by 2020
Brazil	50	0	0	0	158,816 GWh of renewables by 2020
Chile	5	360	7	0	13 GW renewables by 2020
China	0	113.2	206	0	3 GW by 2020
Egypt	30	0	0	20	100 MW of CSP by 2020
France	0	12	1.3	1	0.5% of total energy consumption from CSP by 2020
Germany	0	0	0	1.5	35% of total energy consumption by 2020
Greece	0	38	0	0	50,485 GWh from renewables by 2020
India	408	0	439	6.56	20 GW of solar energy by 2022
Israel	0	435	0	6	10% of renewables by 2020
Italy	0	30	0	1	263,035.7 GWh of renewables in 2020
Jordan	225	0	0	0	10% renewables by 2020
Mexico	0	0	12	0	35% of total energy consumption in 2024
Morocco	20	285	0	20	2 GW of solar energy by 2020
South Africa	345	50	150	0	1200 MW of CSP by 2020 (may be subject to increase)
Spain	0	82	583	1682.4	TBC
Thailand	0	0	10	5	20% of renewable energy by 2020
Tunisia	2200*	0	0	0	TBC
Turkey	0	50	0	0	30% of renewables in 2023
UAE	0	0	0	100**	7% renewables by 2020
USA	1990	1755	1319	571.16	TBC

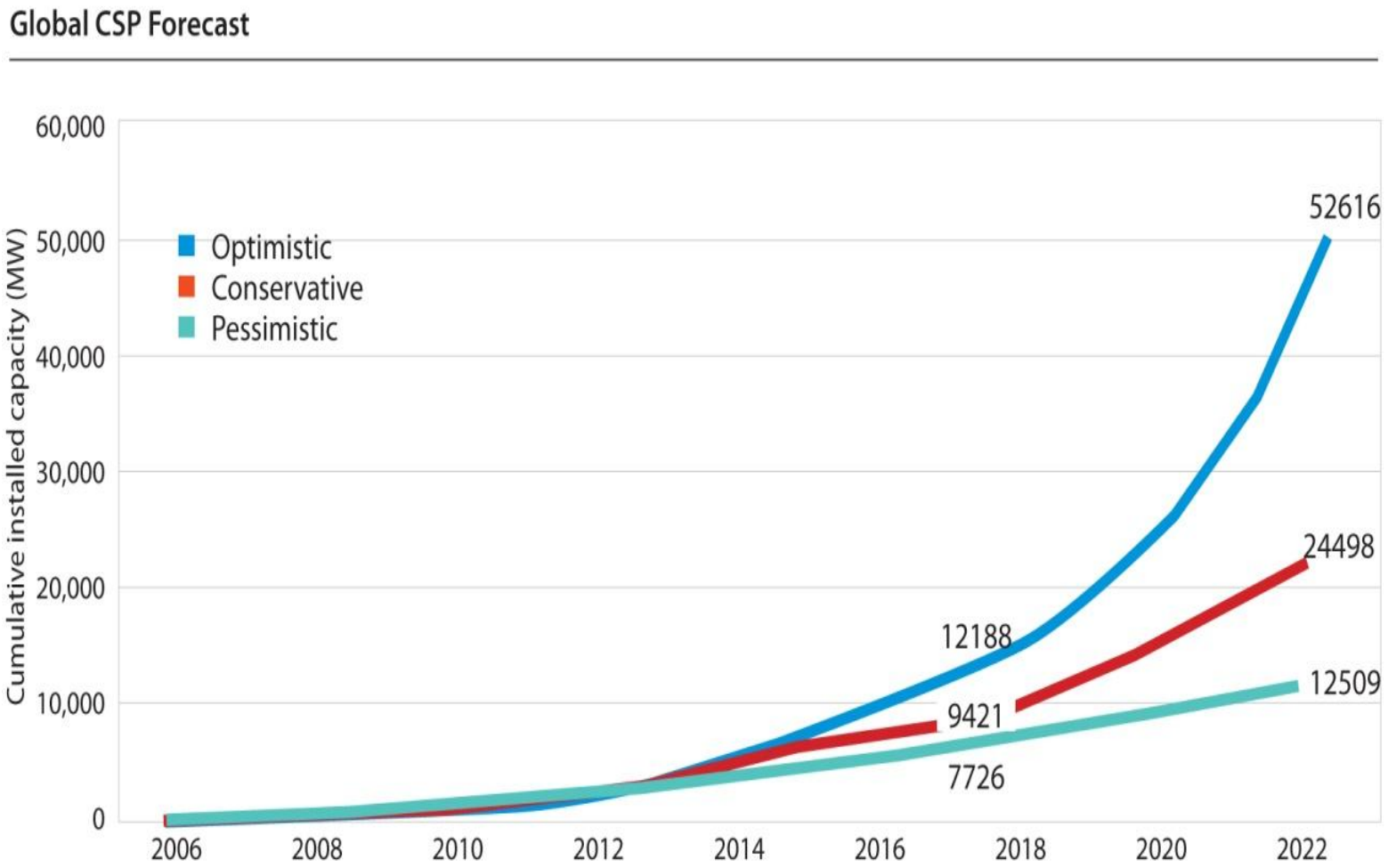
*This allocation includes the 2GW project being promoted by NürEnergy

** Currently commissioning, expected to be operating as of Dec 2012

Source: CSP Today Global Tracker

CSP INDUSTRY MARKET FORECAST AND OUTLOOK

Future CSP Growth



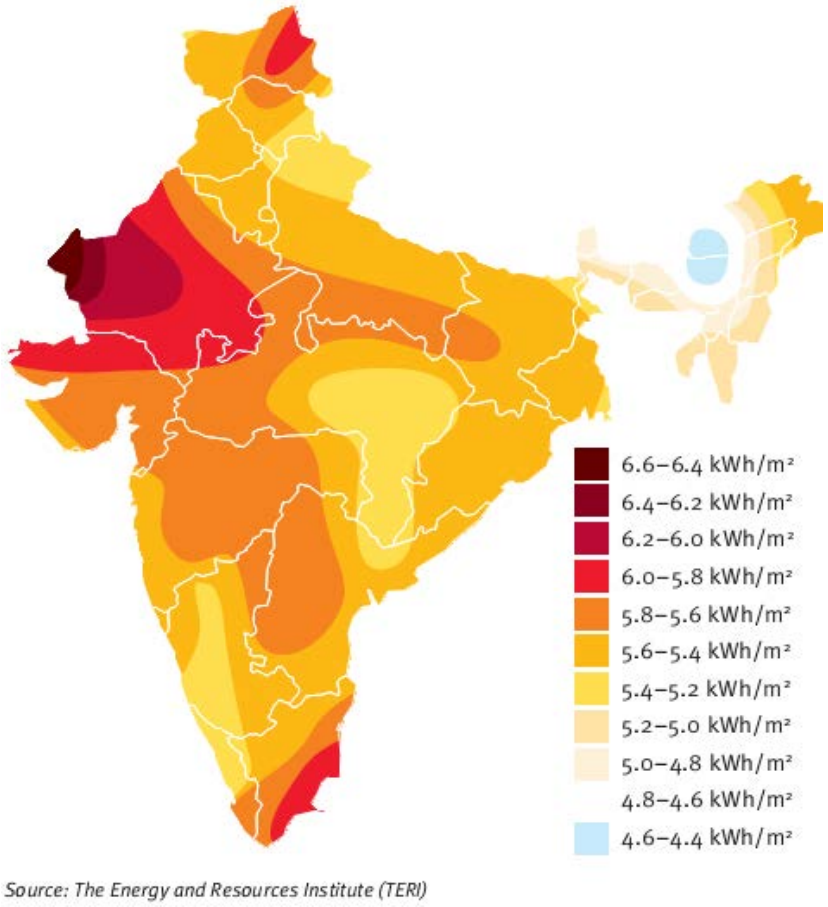
Source: CSP Markets Report 2012-2013

“This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us"

Western Union Internal memo
1876

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA



Source: The Energy and Resources Institute (TERI)

Solar Resource: 2,100 Kwh/m2/annum

Installed Power Capacity: 174 GW

Annual Electricity Consumption: 724TWh

Annual Electricity Demand in 2020: 2000 TWh

Electricity Mix (2011)
Coal: 56.4%
Gas: 9.1%
Nuclear: 2.37%
Hydro: 19.3%
Renewables: 12.1 %

Source: CSP Markets Report 2012-2013

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

REGULATORY FRAMEWORK

- In January 2010 the Ministry of New and Renewable Energy (MNRE) in collaboration with the Asian Development Bank (ADB) launched the Jawaharlal National Solar Mission (JNNSM) aiming for 20GW of solar power by 2020 (CSP and PV)
- Oversubscription to the 500MW of CSP offered as part of Phase 1 on JNNSM caused a reverse bidding process that resulted in very low tariffs. The projects have had difficulties to find financing and it is at present unclear what projects will be finalized on time
- The next Phase has been postponed and it is expected to be revealed in January 2013. The CSP allocation of the next Phase is not yet known
- Some states have set their own solar allocations including Rajasthan, Gujarat, Karnataka & Tamil Nadu

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

Current Tariffs for Allocated CSP and PV plants in India

Solar Program	Allocation	CSP Tariff	PPA Period
	MW	(Rs/ kWh)	
National Solar Mission	20,000	15.31	25 years
Rajasthan Solar Program	12,000	1.95	25 years
Gujarat Solar Energy Policy	935	12.32 14.0 7.0	25 years From the 1st – 12 years From 13 – 25 years
Maharashtra	-	15.24	25 years
Jharkhand	-	13.12	25 years
Madhya Pradesh	-	11.26	25 years
Karnataka	350	11.35	25 years

INDIA

GUJARAT STATE SOLAR POLICY

- Gujarat's potential for CSP with water availability stands at 345.71 GW. The current Gujarat Solar Energy 2009 policy was published in January 2009 and is valid until 2014.
- It originally set a target of 500 MW of solar power generating projects (PV and CSP) to be installed with a minimum of 5 MW per project. Given the interest of a large number of developers, the government subsequently allocated projects worth 935 MW for both CSP and PV.
- This is the only policy in India with a fixed FIT, and working on a first-come-first-serve basis. The tariff is set at INR 14/kWh for the first 12 years and INR 7/kWh for the next 13 years

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

RAJASTHAN STATE SOLAR POLICY

- Rajasthan published its Rajasthan Solar Energy Policy 2011 in April 2011. It targets 10 to 12 GW of solar power installed within the next 10 to 12 years
- The majority of this new capacity shall be installed under the JNNSM, although the state will also directly procure a maximum of 200 MW until 2013 (Phase 1) and an additional 400 MW from 2013 to 2017 (Phase 2) through a competitive bidding process
- The capacity will be equally distributed between CSP and PV. Requested project capacities range from 5 to 10 MW for PV and 5 to 50 MW for CSP

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

KARNATAKA STATE SOLAR POLICY

- Karnataka announced its solar policy in July 2011 which fixes an objective of 350 MW of projects by 2016
- The state has tendered 80 MW worth of bids. The size of individual projects is limited from 5 MW to 10 MW for CSP. The policy has no domestic content requirement
- The original capacity to be allocated in the first phase was 30 MW of CSP and 50 MW of solar PV, but as bids for only 20 MW (2x10 MW) of CSP capacity were received, the excess 10 MW was allocated to solar PV
- The CSP projects must be commissioned within 30 months of signing the PPA, while solar PV projects will be granted a period of 18 months for commissioning.

INDIA

TAMIL NADU STATE SOLAR POLICY

- The Tamil Nadu government has recently announced plans to set up solar parks in various districts under public and private structures to achieve 1,000 MW of installed solar capacity in the next five years
- This strategy is in line with the state government's Vision 2023 plan, which envisages solar power capacity additions of 5,000 MW over the next 11 years

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

LATEST DEVELOPMENTS

MNRE has announced a separate program for CSP hybrid demonstration plants. Ranging in size from 20-50 MW. The plants will each be located in a different states (Rajasthan, Gujarat, Tamil Nadu and Andhra Pradesh)
The government shall oversee the provision of land, water resources, grid connectivity, geo-technical reports, PPA distribution licenses and the environmental clearance

- CSP with hybrid cooling to reduce water consumption
- CSP with steam temperatures higher than 500ºC
- CSP plant with more than 10 hours of storage to achieve 24/7 operation
- CSP with 30% natural gas support

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

CHALLENGES FOR CSP DEVELOPMENT

- DNI measurements were overestimated and there is still not enough on-site historical DNI data
- India is a very price sensitive market. Low bids drove international competition out of the market
- Land acquisition is a complicated & expensive process
- Water acquisition is often complicated or impossible in the best solar areas
- Financial closure is a very complex issue and very expensive at Indian interest rates
- An on-going requirement for localization or “Indianization” may make it harder to purchase components in upcoming plants
- Developers are not allowed to use gas in the CSP plants

INDIA

OPPORTUNITIES FOR CSP DEVELOPMENT

- Indianization could push prices of components down sharply
- Hybridization may be a good solution for India as they face coal shortages and supply chain issues. As mentioned above, a new policy has been launched by the government recently
- Energy demand in India is currently not met and it will increase greatly as the country continues industrialization
- There is a big potential for “captive plants”
- There is great opportunity for further privatization of the power sector

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

INDIA

IDIOSYNCRASIES OF THE INDIAN MARKET

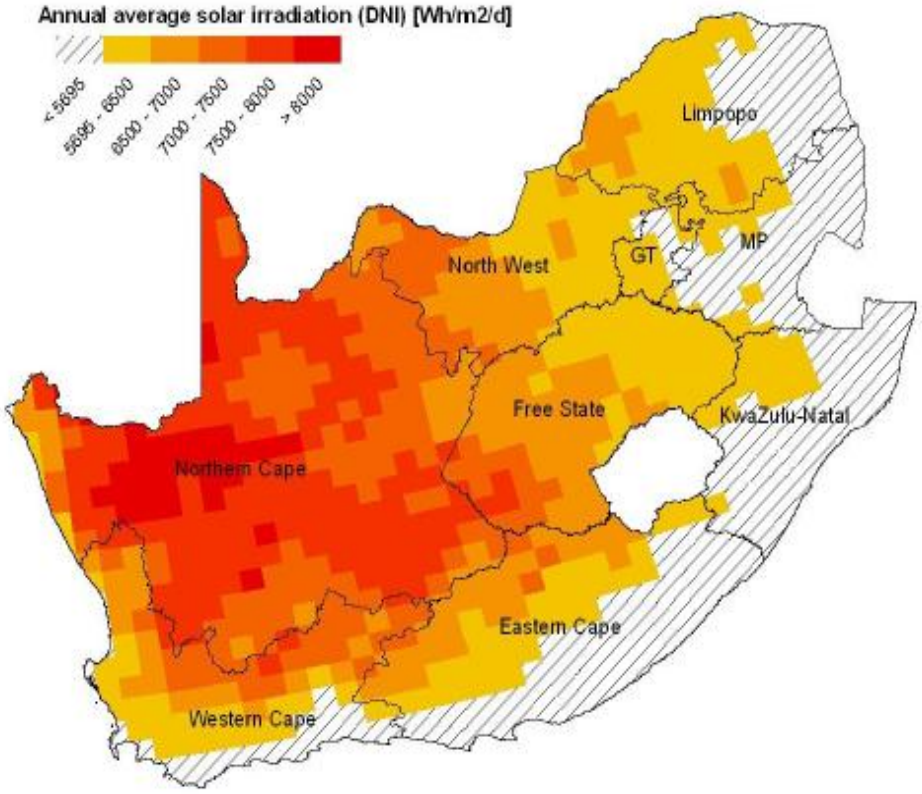
- CSP is forced to lower costs very aggressively from the word go
- It has the biggest Fresnel plants in the world in construction
- It has the potential to localize aggressively
- It has opened the market for new companies to the industry
- It has huge real potential for hybridization
- Highly modular / lower efficiency technology will be developed here

“No one will need more than 640 KB of memory for a personal computer”

Attributed to Bill Gates
1981

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

SOUTH AFRICA



Solar Resource: 2,800 Kwh/m2/annum

Installed Power Capacity: 44.1 GW

Annual Electricity Consumption: 240.5 TWh

Expected Annual Electricity Demand in 2020: 375 TWh

Electricity Mix (2011)
Coal: 84.5%
Gas: 4.8%
Nuclear: 3.8%
Hydro & Pumped Storage: 6.8%

Source: CSP Markets Report 2012-2013

SOUTH AFRICA

REGULATORY FRAMEWORK

- South Africa originally announced a REFIT program (Renewable Energy Feed in Tariffs)
- It changed to a REBID system in July 2011, encouraging competition with a ceiling of ZAR 2.85 per kW/h
- Bidders have to illustrate the social and economic impacts of their project
- In August 2011, the Minister of Energy announced the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) determining that 3,725 MW must be generated from renewable energy sources in order to ensure an uninterrupted supply of electricity
- The REIPPPP will include a total of five procurements rounds; the first two rounds took place in November 2011 and March 2012, and the next round is expected in May 2013.
- Only 200 MW was allocated to CSP in the first round

Source: CSP Today Global Tracker 2012

SOUTH AFRICA

LATEST DEVELOPMENTS

- On 6 November 2012 (yesterday!) Abengoa announced it had begun construction of the first two CSP plants in South Africa: Khi Solar (50 MW) and KaXu Solar (100 MW), whilst the 50 MW Bokpoort plant led by ACWA is expected to go into construction in March next year
- South Africa has moved to add an additional 3200 MW to its renewable capacity by 2020
- The planned 5 GW Solar Park in South Africa has moved location from near Upington to Siyathemba. The South Africa Department of Energy has re-opened applications for consultants to conduct the pre-feasibility study

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

CURRENT OVERVIEW OF REIPPP DELAYS IN SOUTH AFRICA

ROUND 1 DELAYS

- Bid submission date 4 November 2011
- Financial closure deadline ~~20th June 2012 | 9 to 20 July 2012~~ | ~~October 2012~~ | 5 November 2012

ROUND 2 DELAYS

- Bid submission date 5 March 2012
- Financial closure deadline ~~13 December 2012~~ | ~~11 - 22 Feb 2013~~ |March 18/28 2013

ROUND 3 DELAYS

- Bid submission date ~~20 Aug 2012~~ | ~~1 October 2012~~ | 7 May 2013
- Financial closure deadline ~~31 May 2013~~ | ~~1 to 12 Jul 2013~~ |TBC?

Source: CSP Today Global Tracker/CSP South Africa Guide

CSP today

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

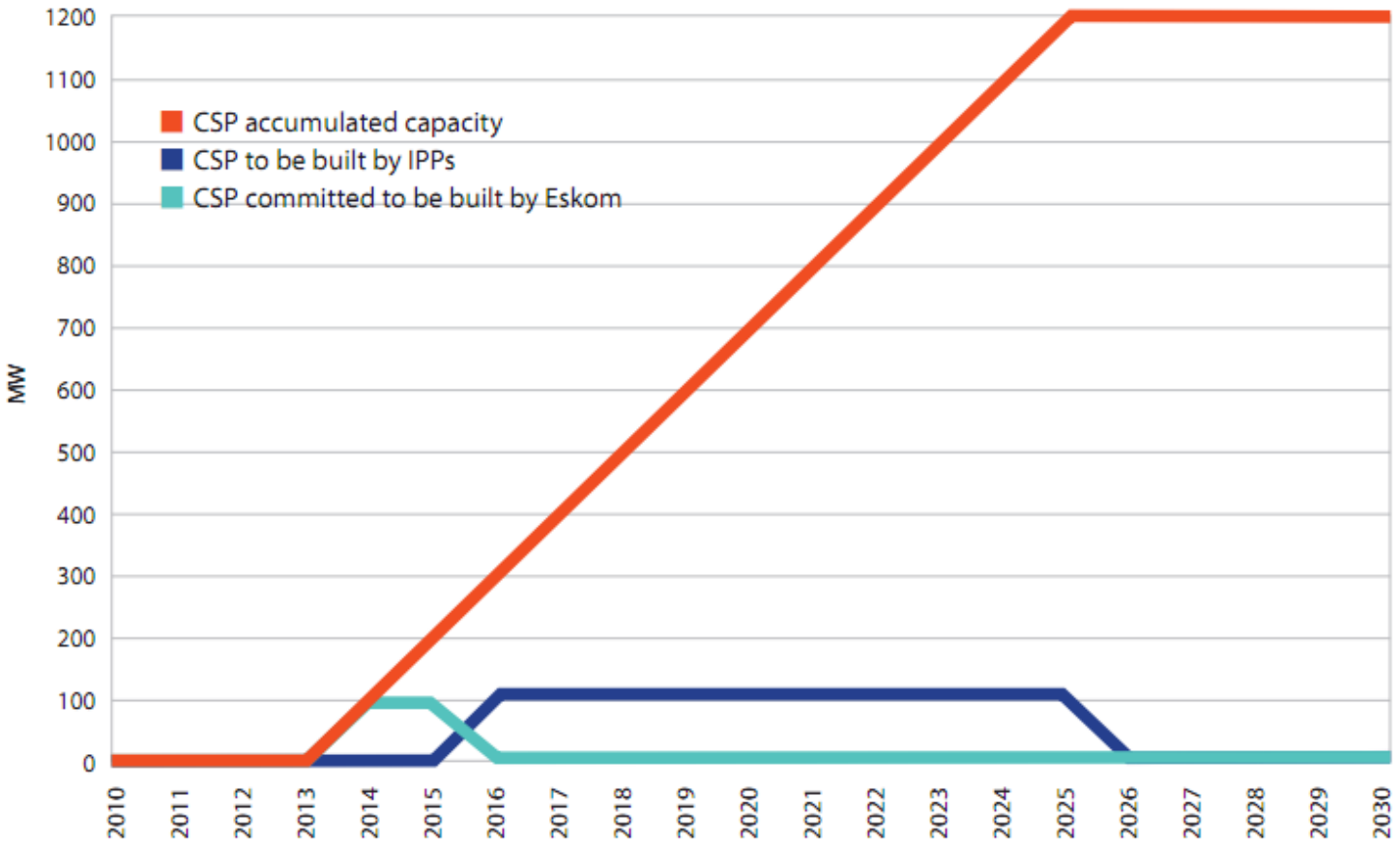
SOUTH AFRICA

Drivers	Barriers
Excellent solar resource (up to 2,900 kWh/m²/year)	Water availability
Land availability	No further allocation posted so far in REIPPPP
Low slopes (1% in places with high DNI)	Insufficient grid connectivity and capacity
Large automotive industry	Lengthy permitting process
Electricity export capability	Strict qualification criteria for REIPPPP
Specific commitment from government to CSP in the IRP	Fossil fuel lobby and competition
Good CSP + TES match to demand curve	CSP high capital cost cannot compete with cheap coal
High dependency on fossil fuels	Monopoly of Eskom
Large hybridization potential	Cap of only 1,200 MW of CSP by 2030 as per IRP
Planned increase in consumers' electricity tariff will make the mining industry look for other options such as solar energy	
200 MW of CSP soon to start construction and more than 1,000 MW announced by developers	
Huge appetite from lending institutions to finance renewable energy projects in South Africa	

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

SOUTH AFRICA

Figure 19: CSP MW Allocation According to IRP 2010-2030 [7]



Source: CSP Today Markets Report, 2012-2013

SOUTH AFRICA

IDIOSYNCRASIES OF THE SOUTH AFRICAN MARKET

- Dry cooling is very important for South Africa which adds complexity to the projects from the financial perspective
- Dispatchability is a key factor enabling integration with the grid
- There is potential for steam generation for mining processes
- High temperature/high efficiency technology will develop here
- The availability of local financing sources makes this market unique
- Eskom is a force of its own – and it will develop CSP

“I think there is a world market for maybe five computers”

Thomas Watson
Chairman of IBM
1943

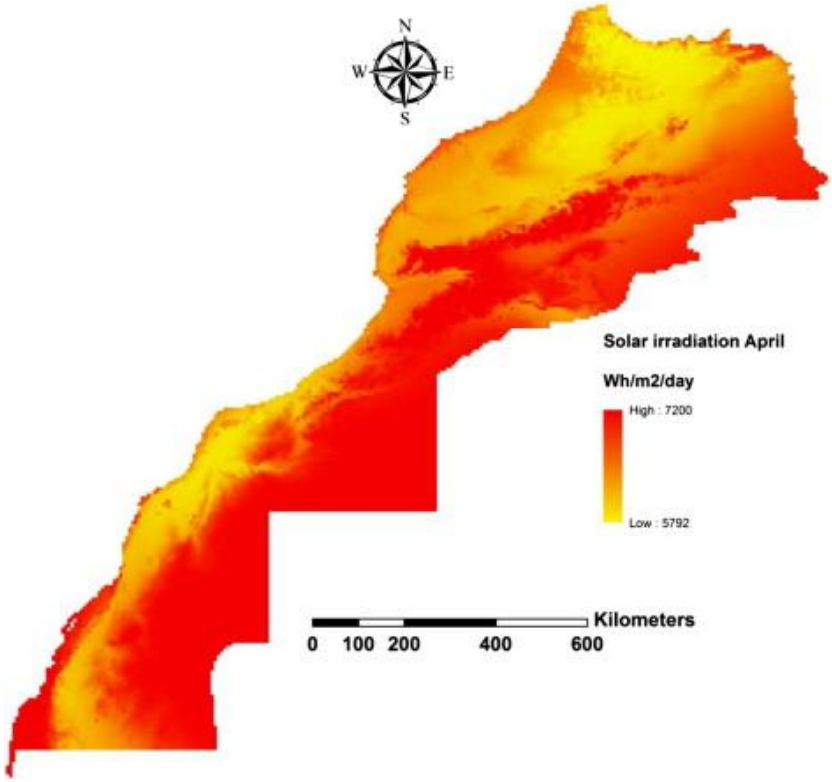
SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

GROWING FOCUS: MENA

- **SAUDI:** 25 GW of CSP by 2032
- **UAE:** Shams 1 in commissioning, due to move into operation in December 2012
- Scale-up initiatives by the World Bank and AfDB in Algeria, Egypt, Jordan, Morocco and Tunisia. Under the supervision of the Clean Technology Fund (CTF): goal to raise around USD 4.8 billion and deploy a 1GW generation capacity.

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

MOROCCO



Solar Resource: 2,500 kWh/m2/annum
Installed Power Capacity: 6.3 GW
Annual Electricity Consumption: 23.7 TWh
Expected Annual Electricity Demand in 2020: 46.6TWh

Electricity Mix (2011)
Coal: 41%
Gasoil: 17%
Electricity Imports: 15%
Hydro: 14%
Natural Gas: 11%

Source: CSP Markets Report 2012-2013

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

MOROCCO

REGULATORY FRAMEWORK

- The Moroccan government unveiled the Moroccan Solar Plan in November 2009 aiming at establishing 2,000 MW of solar power by 2020
- Five sites were selected for the development of solar power plants
- The Moroccan Agency for Solar Energy (MASEN) was created to roll out the Solar Plan and handle tenders for the five sites. Local utility, ONE, has a 25% shareholding in MASEN
- The tender process that MASEN has selected is an international public competitive bidding process where the bidder offers a lower tariff, which must fulfil the minimal technical specifications set by MASEN
- A PPA will be signed between the CSP developer and MASEN. Under this PPA, the bidder is responsible for designing, financing, building and operating and maintaining the plant on a long-term basis. Bidders assume financial closure risk with the potential consequences of not achieving financial closure by a fixed date, risking the loss of the development security and termination of the PPA

Source: CSP Markets Report 2012-2013

MOROCCO

LATEST DEVELOPMENTS

- Regarding the planned 500 MW Ouarzazate complex, the first bid has been allocated to the Ourzazate 160 MW PT plant to be developed by a consortium including ACWA, TSK, Acciona and Aries Ingeniería y Sistemas
- The next bidding round in Morocco is set to be announced before the end of the year. MASEN has indicated that Tower will be the technology of choice
- The government of Morocco has set a target of 42% of installed capacity from renewable energy sources by 2020 (this will represent around 6,000 MW)
- It has also proposed a distribution of 14% wind, 14% solar (no CSP-specific allocation) and 14% hydro
- Possibility to export renewable energy electricity using the national electricity grid and its interconnections

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

MOROCCO

Drivers	Barriers
Excellent solar resource	Weak grid in certain regions of high DNI
2,000 MW announced under Moroccan Solar Plan by 2020	Water scarcity
Land availability	Lack of related CSP industry
Increased electricity Demand (7% annually)	
Financing available from international financing institutions	
EU partnership to meet EU 20-20-20 targets	
Potential to export electricity to Europe via interconnect with Spain in the close future	
Available equity investors in the Moroccan market	

MOROCCO

IDIOSYNCRASIES OF THE MOROCCAN MARKET

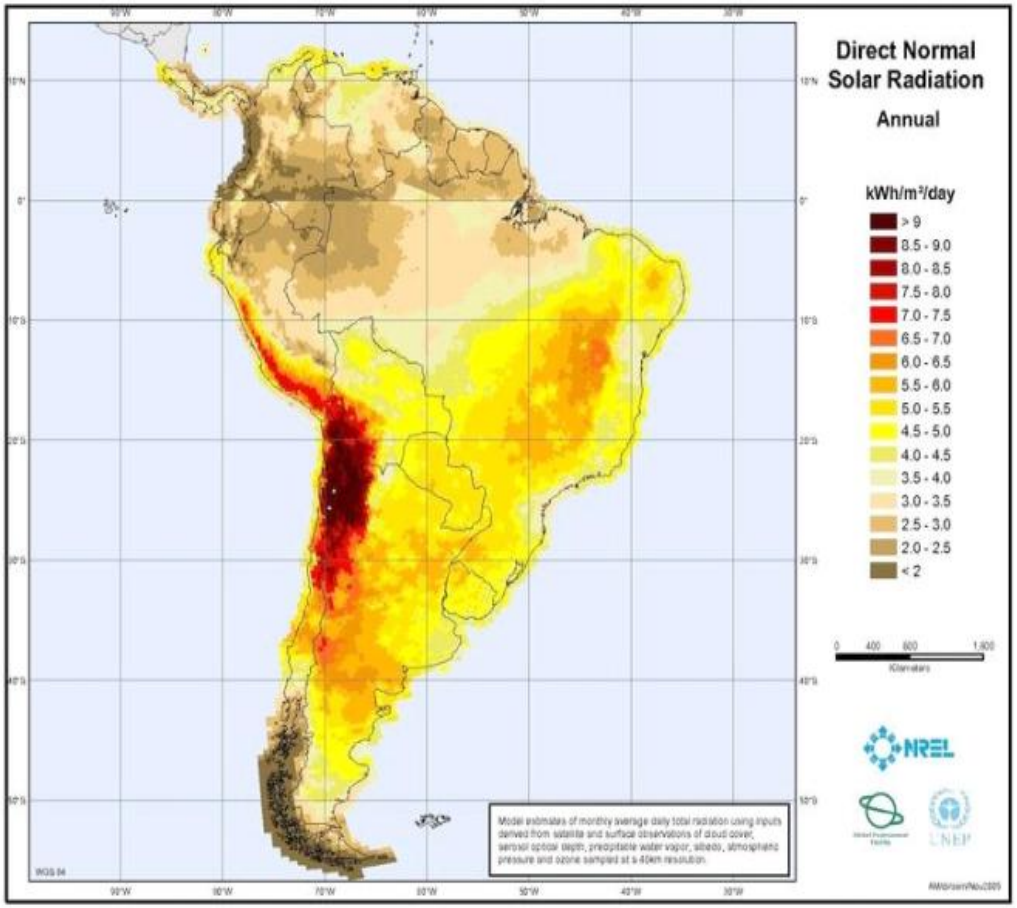
- Proximity to Europe makes it the perfect market for potential export of solar energy from a stable North African country
- Commitment from the Moroccan government and financial support from international agencies such as the African Development Bank
- It´s the first international move by ACWA to gain a position in the CSP industry which signals a possible opening of further MENA markets, starting with Saudi Arabia

"Radio has no future. Heavier-than-air flying machines are impossible. X-rays will prove to be a hoax."

William Thomson, British Scientist
1899

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

CHILE



Solar Resource: 3,300 Kwh/m2/annum
Installed Power Capacity: 17.6 GW
Annual Electricity Consumption: 60 TWh
Expected Annual Electricity Demand in 2020: 100 TWh

Energy Mix (2001)
Hydro: 38%
Natural Gas: 36%
Coal: 17%
Gas diesel/Oil: 7%
Biomass: 2%

Source: CSP Markets Report 2012-2013

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

CHILE

REGULATORY FRAMEWORK

- Free market – No regulatory framework so competition with fossil fuels is the norm
- The deployment of renewable energy power plants is now a priority for the Chilean government. A mandatory quota system requires that 5% of the electricity generated in the country must come from renewable energy sources, which will gradually increase to 10% by 2024
- The mining industry consumes an estimated 80% of northern Chile's electricity. The energy needs of the mining industry are expected to grow 5% annually in the coming years
- The potential in Chile for CSP plants has not being clearly determined on a large-scale, but it is estimated that the country could have a theoretical potential of up to 2,636 GW of CSP in the whole country (MINENERGIA and GIZ 2011)

Source: CSP Markets Report 2012-2013

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

CHILE

LATEST DEVELOPMENTS

- The government has been working with the IDB on a bidding process to build the first 50MW CSP plant in Chile to demonstrate the viability & reliability to future off-takers and speed market penetration
- However, the launch of the tender has been postponed several times and it is now expected to take place in November 2012
- The government is also working in a number of projects including opening a new research and innovation centre dedicated to analyzing CSP in Chilean conditions
- A CSP plant for steam generation for mining processes is currently under construction, and more are in negotiation
- GDF Suez has announced a 7MW Fresnel addition to an existing coal plant although the project appears to be currently on hold

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

CHILE

Drivers	Barriers
Best solar resource on earth	No regulatory framework for CSP yet
High dependence on fuel imports	Grid capacity limited
Energy demand growth	Water scarcity
High electricity prices	No bank experience financing large-scale CSP projects in Chile
Growth of the mining sector	
Renewable energy obligations	
Main supplier of thermal storage salts	
CSP coupling with desalination plants	
Hybrid CSP option with the mining industry	
Volatility of electricity prices	

Source: CSP Today Markets Report, 2012-2013

SPECIFICS OF WORLDWIDE CSP EMERGING MARKETS

CHILE

IDIOSYNCRASIES OF THE CHILEAN MARKET

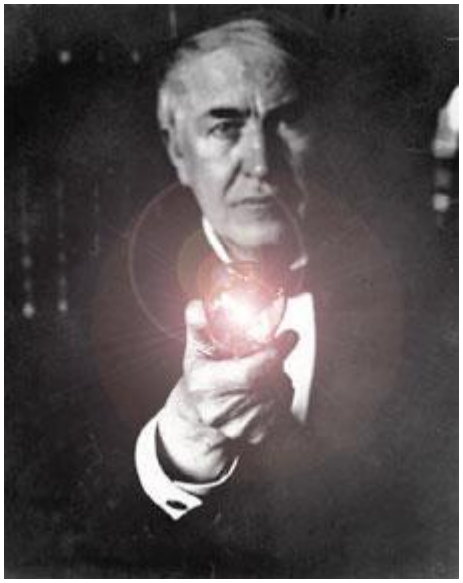
- Since the mining industry works 24/7, Northern Chile has the perfect situation for CSP as CSP unlike PV has storage which promotes better grid integration. Storage is key to success in Chile
- This market is completely different due to its free market government policy. This means that CSP has to compete with fossil fuel generation
- Also the process to develop a plant is complex as the client (mining company) negotiates the PPA directly with the developer. Mining companies tend to be a risk adverse and require extra due diligence, higher safety and security standards
- There is very little water in the Atacama desert and overcoming this is going to take some innovative strategies, as well as dry cooling technology
- Chile requires extra due diligence due to the high potential of seismic movements, which in turn increases the price of a project
- There is great potential for CSP steam generation and desalination

OTHER EXCITING MARKETS

- Saudi Arabia
- Jordan
- Algeria
- China
- Tunisia
- … (More to come!)

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that“

Thomas Edison, 1931



Thank you for listening

Questions?

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