EuPD Research

Concentrated Solar Thermal Power (CSP) – Now and in the Future

Exclusive Management Summary for Survey Participants

EuPD Research
Bonn, December 2008

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A. Background

The principles of concentrated solar thermal power (CSP) conversion have been known for more than a century; its commercial growth and exploitation occuring since the 1980s. However, in the 1990s, annual installa-tion remained static. Only in the last few years has the industry again gained momentum : several projects are planned and others are in construction. The U.S. is still one of the most important markets in this area but new opportunities are opening up for CSP in other regions, such as Europe, Asia, North Africa, Australia, Mexico and Brazil. In Europe for example this has occured with the introduction of attractive feed-in tariffs (FITs) for plant operators, such as in Spain and Italy. Furthermore, a rising demand for clean energy and the interest of financial investors in undertaking sustainable investments is promoting the development of solar thermal power generation.

In order to give an overview of the global CSP market EuPD Research decided to carry out a survey – taking into account the points of view of all relevant stakeholders such as manufacturers, project developers, energy suppliers, investors, government bodies and other experts.

The available report is an exclusive preliminary summary of the results for the participants of the survey. On the following pages you will find an overview about:

- the survey sample,
- the value chain and its market players,
- insight in the EuPD Research country market rating,
- the main hindrances and drivers of the global CSP market according to the survey participants,
- the participant's assessments of the importance of communication channels,
- an overview of reasons stated for choosing a CSP technology,
  and attitudes towards renewable energy technologies as stated by survey participants from the financial sector and governmental bodies

B. Research Design

The analysis is based on a broad primary quantitative survey among 110 worldwide market players such as research institutes, manufacturers, project developers, investors/creditors, EPCs, lobby groups and electric utilities.

Key Data of the Survey

- Completion of 39 interviews
- Field time: September - October 2008

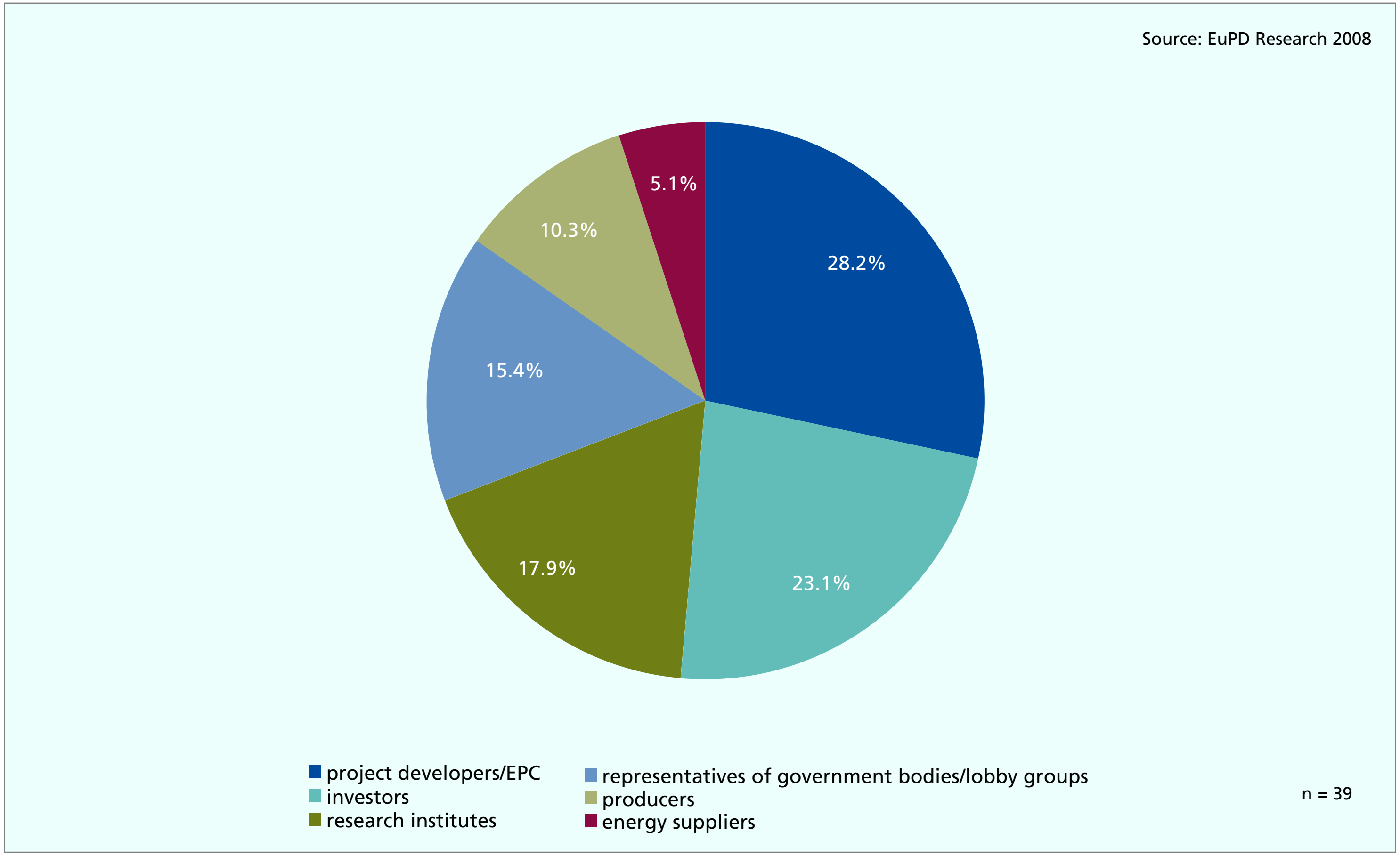
Method

Partly-standardized telephone interviews via CATI

Questionnaire design

- The interviews were based on separate questionnaires for each target group.
- Some of the questions were posed to all participants, and other questions were asked more specifically to a certain group.

B. Sample Composition

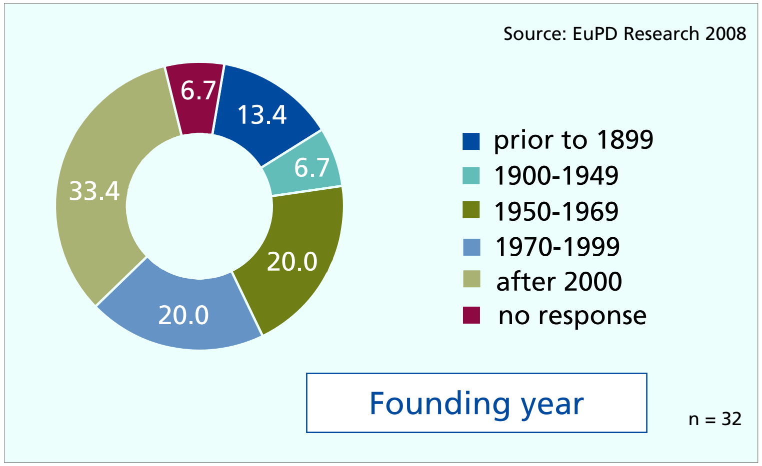


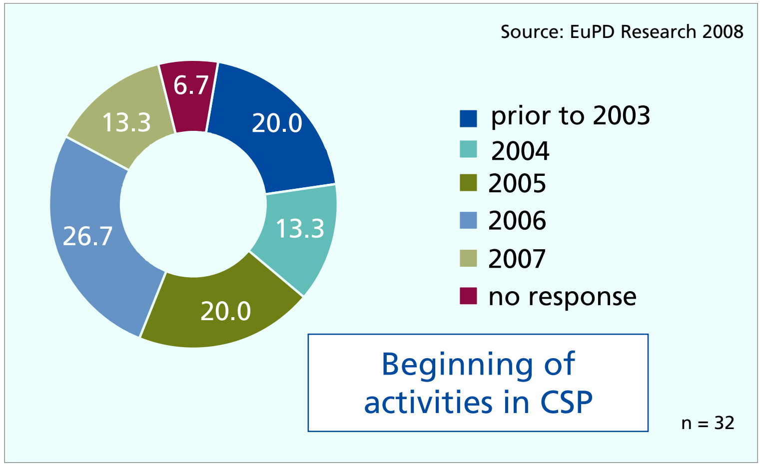
The chart on the left illustrates the composition of the survey sample.

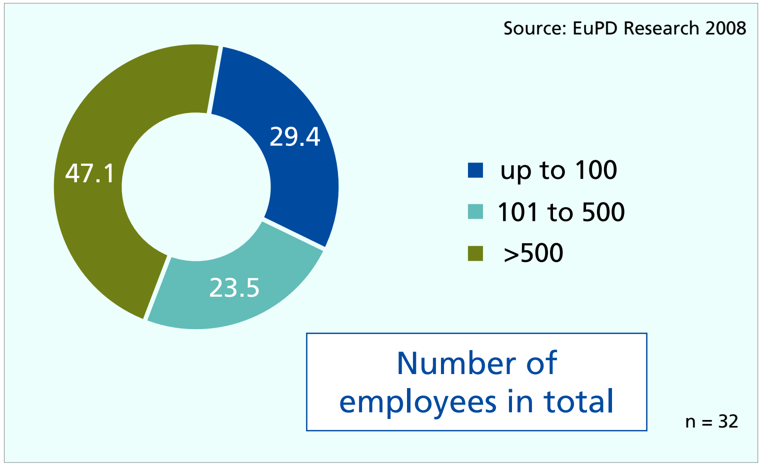
The group with the highest share are project developers and EPC companies which make up 28.2%.

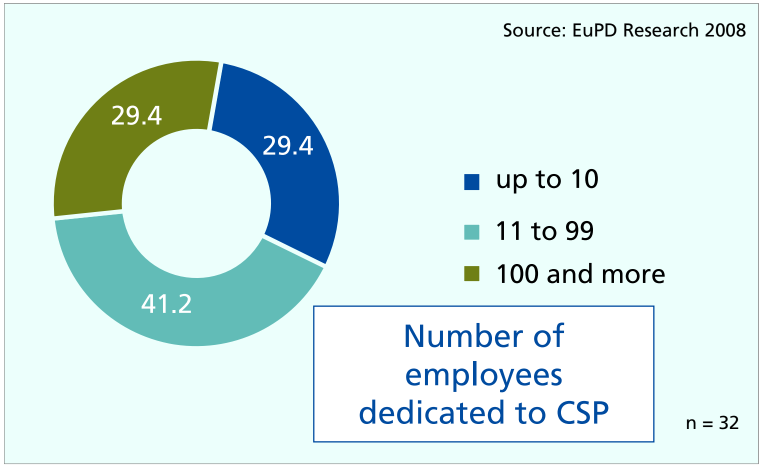
The second largest group is made up of investors (23.1%) followed by research institutes with 17.9%.

B. Sample: Further Key Figures



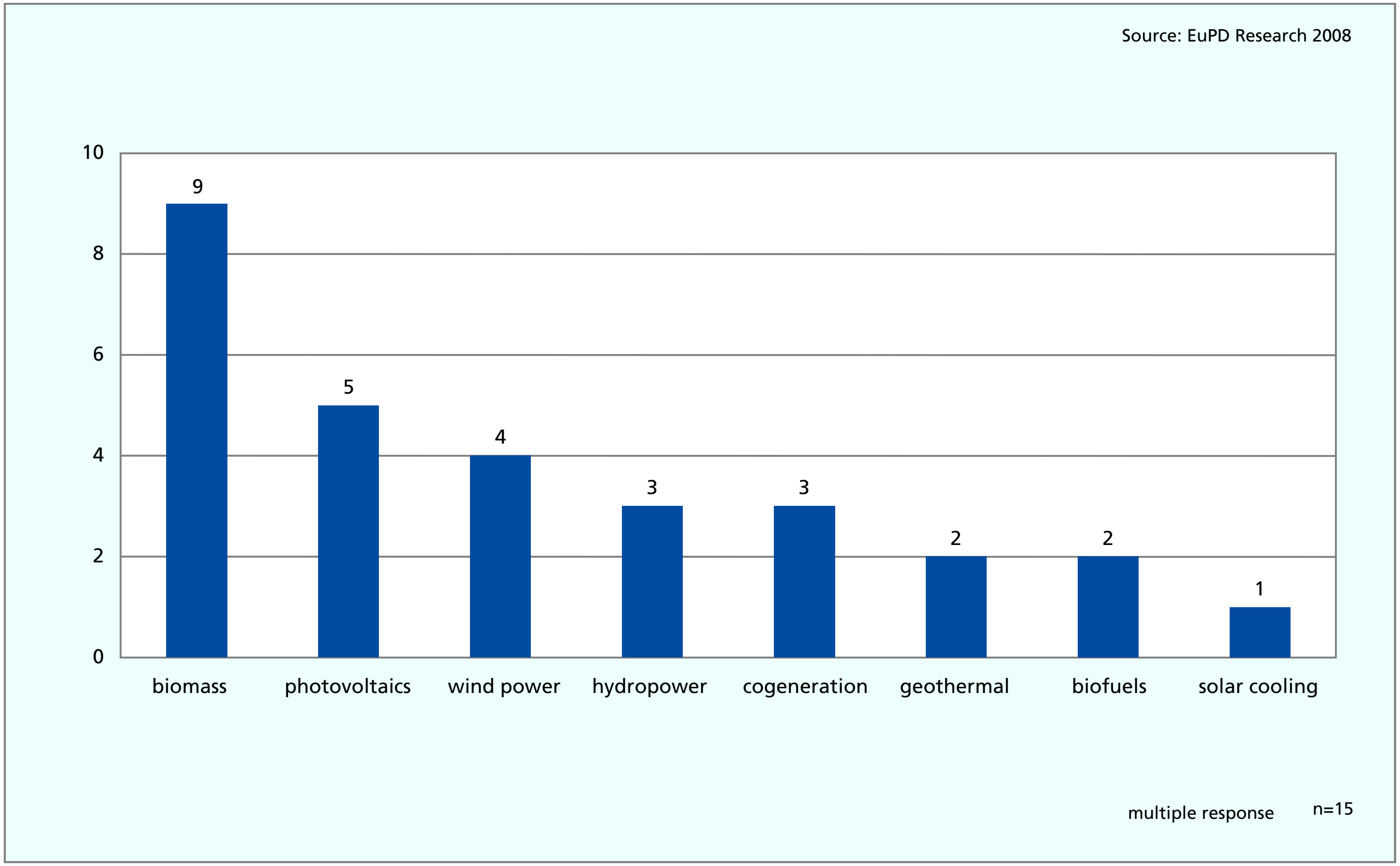






B. Sample: Further RES Activities of Competitors and Manufacturers

In which other renewable energy fields is your company active?



9 manufacturers and project developers are active in the field of biomass as well as CSP.

5 deal with PV plants, while 4 are active in the production and development of wind power plants.

Hydropower and cogeneration are fields of renewable energies where 3 of the surveyed component manufacturers and project developers are engaged.

c. CSP Value Chain

R&D
- CIEMAT/PSA
- CNRS
- CERTH
- DLR
- DOE
- Fraunhofer ISE
- IDAE
- IEA Solar Paces
- INETI
- NREL
- PSI
- SANDIA
- Weizmann Institute

Manu-facturers
- 3M
- Alstom
- Balcke-Dürr
- Dèfi Systémes
- Flabeg
- GE
- GEA Ibérica
- Guardian
- Kraftanlagen München
- MAN Turbo
- Novatec Biosol
- Rioglass
- Saint-Gobain
- Schott Solar
- Siemens
- Solel
- SPX Cooling
- Thermodyn

Project developers
- Abengoa
- Acciona
- ACS
- Albiasa Solar
- Aries
- Ausra
- Brightsource
- Enerstar
- esolar
- Iberdrola
- Ibereólica Solar
- Novatec Biosol
- SES
- Skyfuel
- Solar Millennium
- SolarReserve
- Torresol
- Valoriza

Investors/ Creditors
- ADB
- Banc Sabadell
- Banesto
- Caja Madrid
- Calyon
- CAM
- Cofides
- Commerzbank
- EIB
- Fidelity
- ING
- JBIC
- KfW IPEX
- Lupus Alpha
- Masdar
- Natixis
- Piraeus Bank
- Santander
- SI Capital
- Société Generale
- Swisscanto
- Ubibanca
- UBS
- Union Invest
- West LB
- World Bank/GEF

EPC
- Abener
- Acciona
- Aries
- Astrom
- Babcock Montajes
- Cobra
- Duro Felguera
- Elecnor
- Fichtner
- Flagsol
- FPL Energy
- Iberese
- Iberinco
- Isolux
- Kraftanlagen München
- MAN Solar Millennium
- M+W Zander
- sbp
- Sener

Operators/IPP
- Abengoa
- Acciona
- ACS
- Aries
- Enerstar
- FPL Energy
- Iberdrola
- Ibereólica Solar
- Masdar
- Solar Millennium
- Valoriza
- Sener

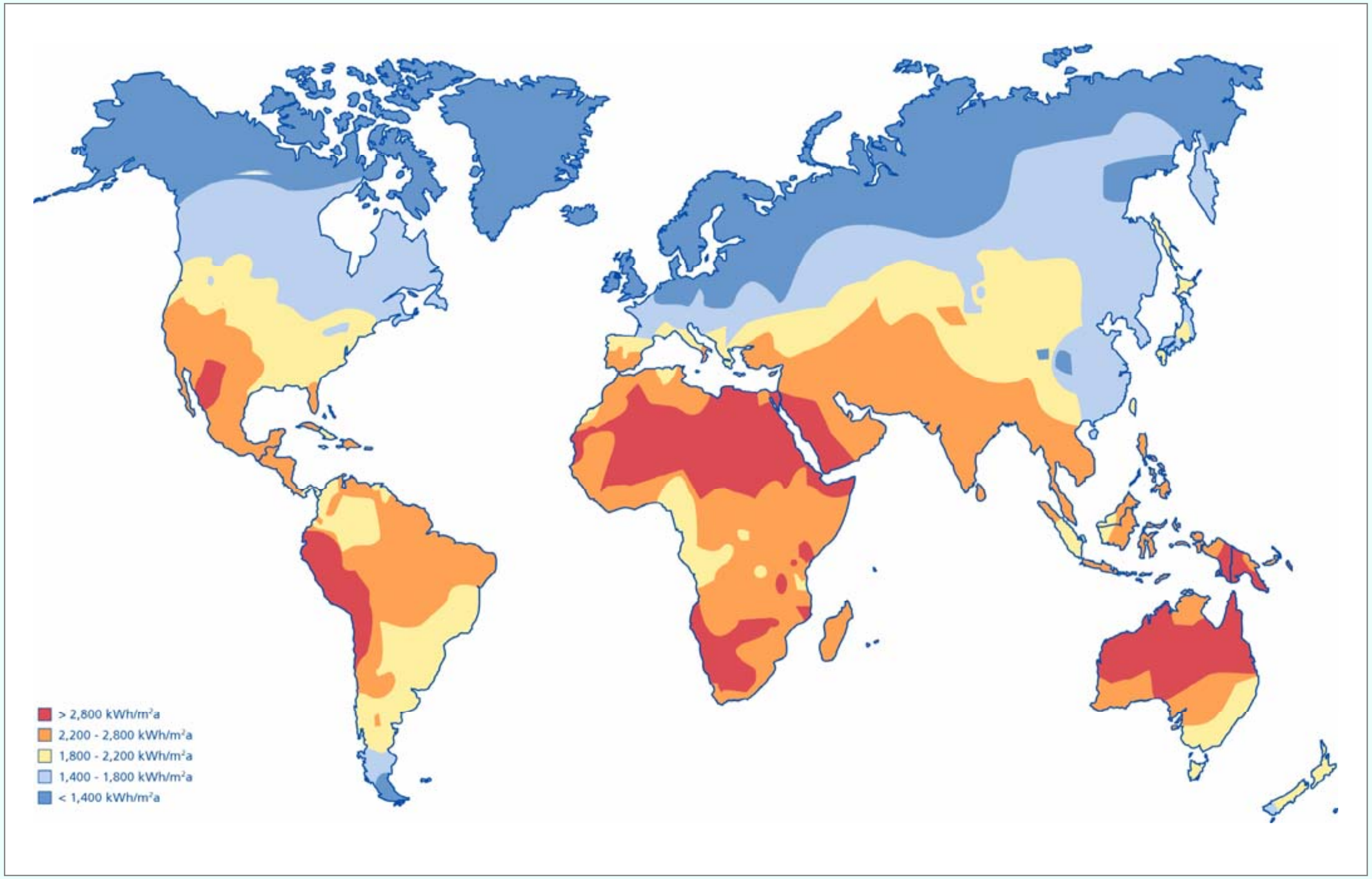
Utilities
- APS
- Endesa
- Iberdrola
- NEAL
- Nevada Solar
- ONE
- Sierra Pacific

Legend:
- Glass/Mirrors
- Receivers
- Collectors
- Turbines
- Cooling equip.
- Others

- Engineering/ consulting
- Just engineering
- Just construction

D. General Market Conditions: Global Solar Radiation

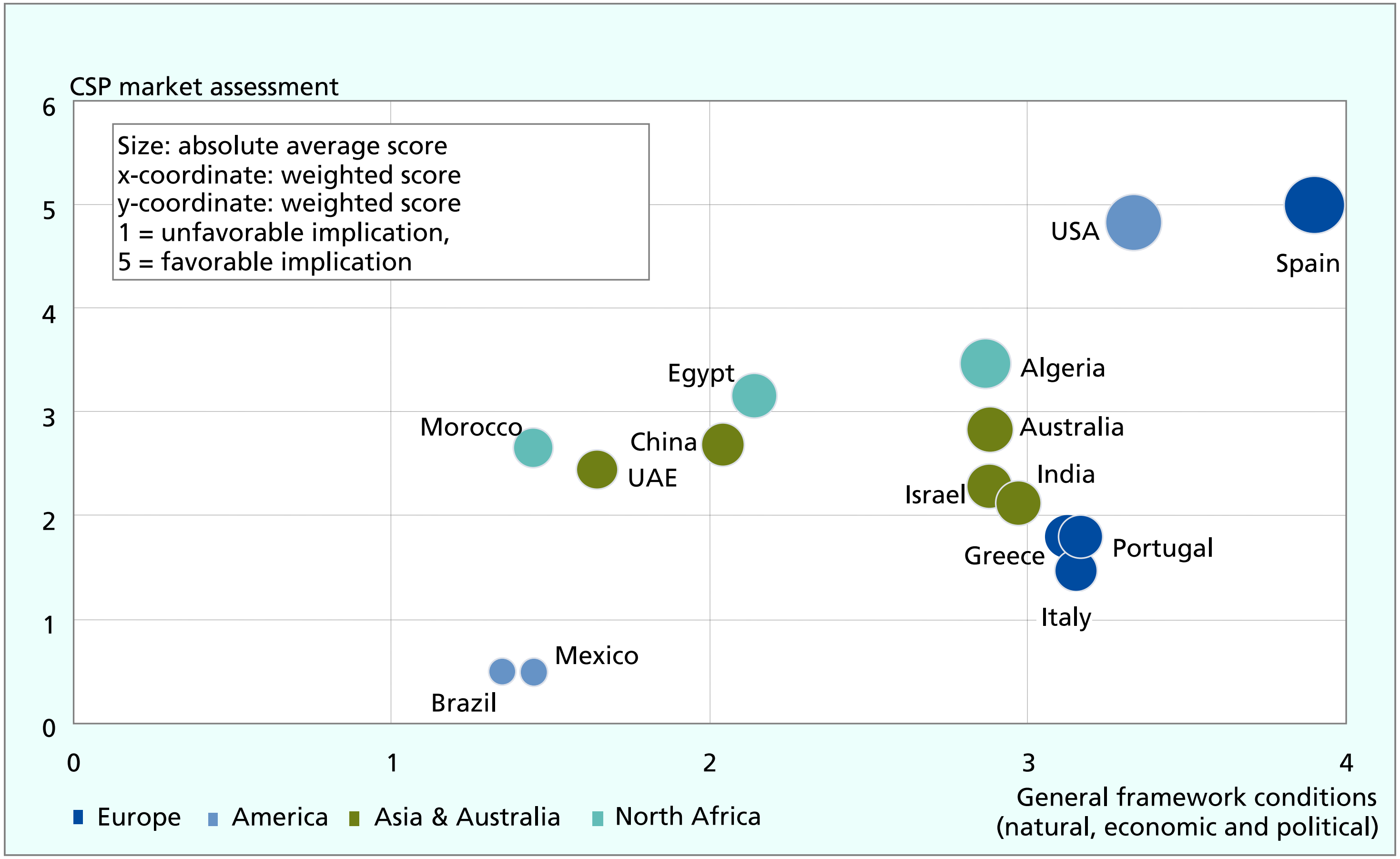
Source: EuPD Research 2008



Not every country is suitable for solar thermal systems as direct, strong sunshine is required.

As can be seen from the map, the best areas for CSP are North Africa and Australia, as well as parts of the US, South America and Asia. The southern parts of Spain and Italy, along with Portugal and Greece are the only parts of Europe where CSP makes sense.

D. General Market Conditions: CSP Market Rating Results

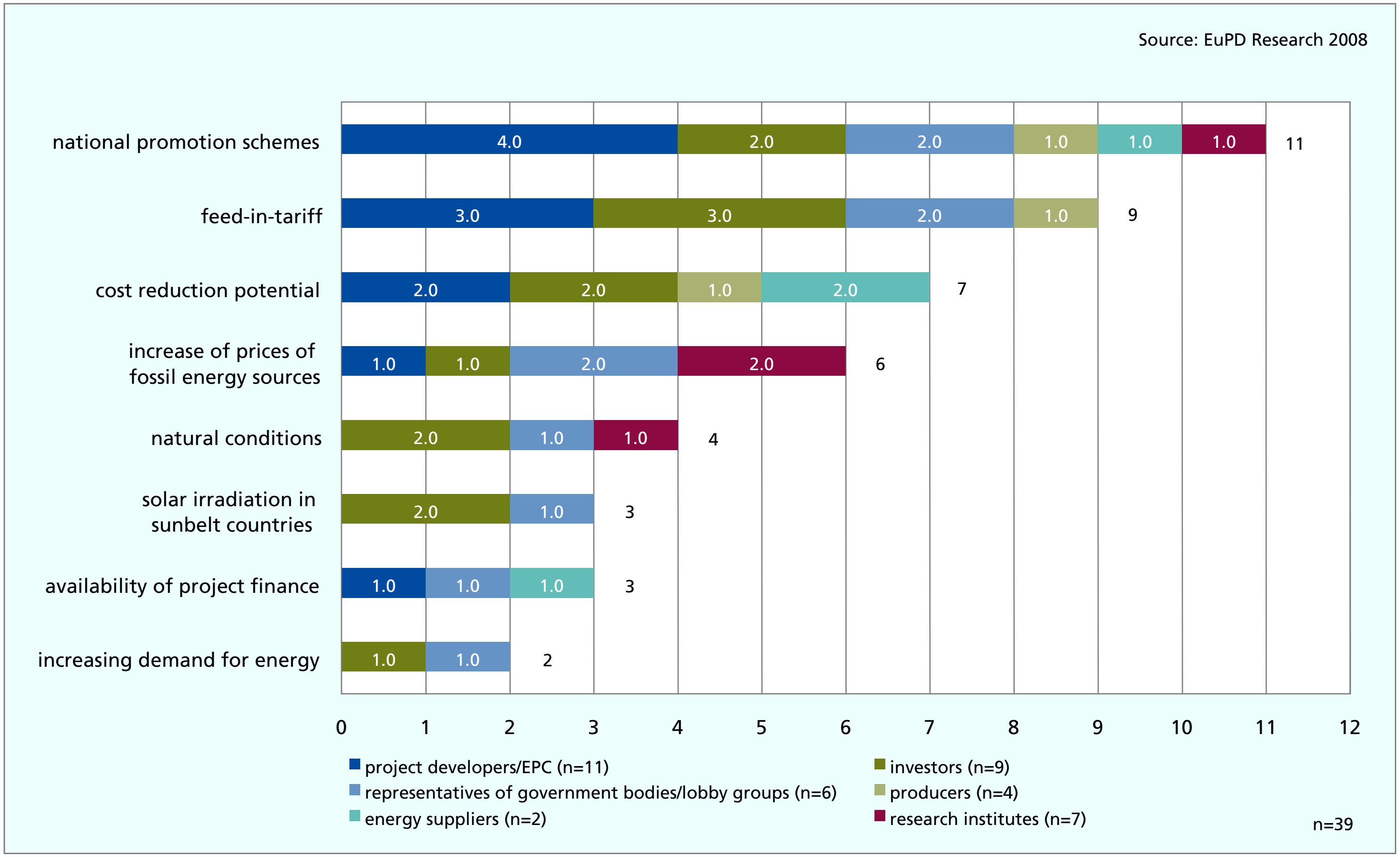


The two-dimensional display of the EuPD Research national market ranking results shows the correlation of general framework conditions (natural, economic and political) and CSP market assessment. All factors and the respective criteria are weighted according to their importance.

It is not surprising that Spain and the USA spearhead the rankings. The other European countries have good frame-work conditions but their CSP market assessment is not very high. North Africa has a strong presence but Moroccan frame-work conditions are not very good.

D. General Market Conditions: Main Drivers

What do you think are the main drivers for CSP markets (unaided)?

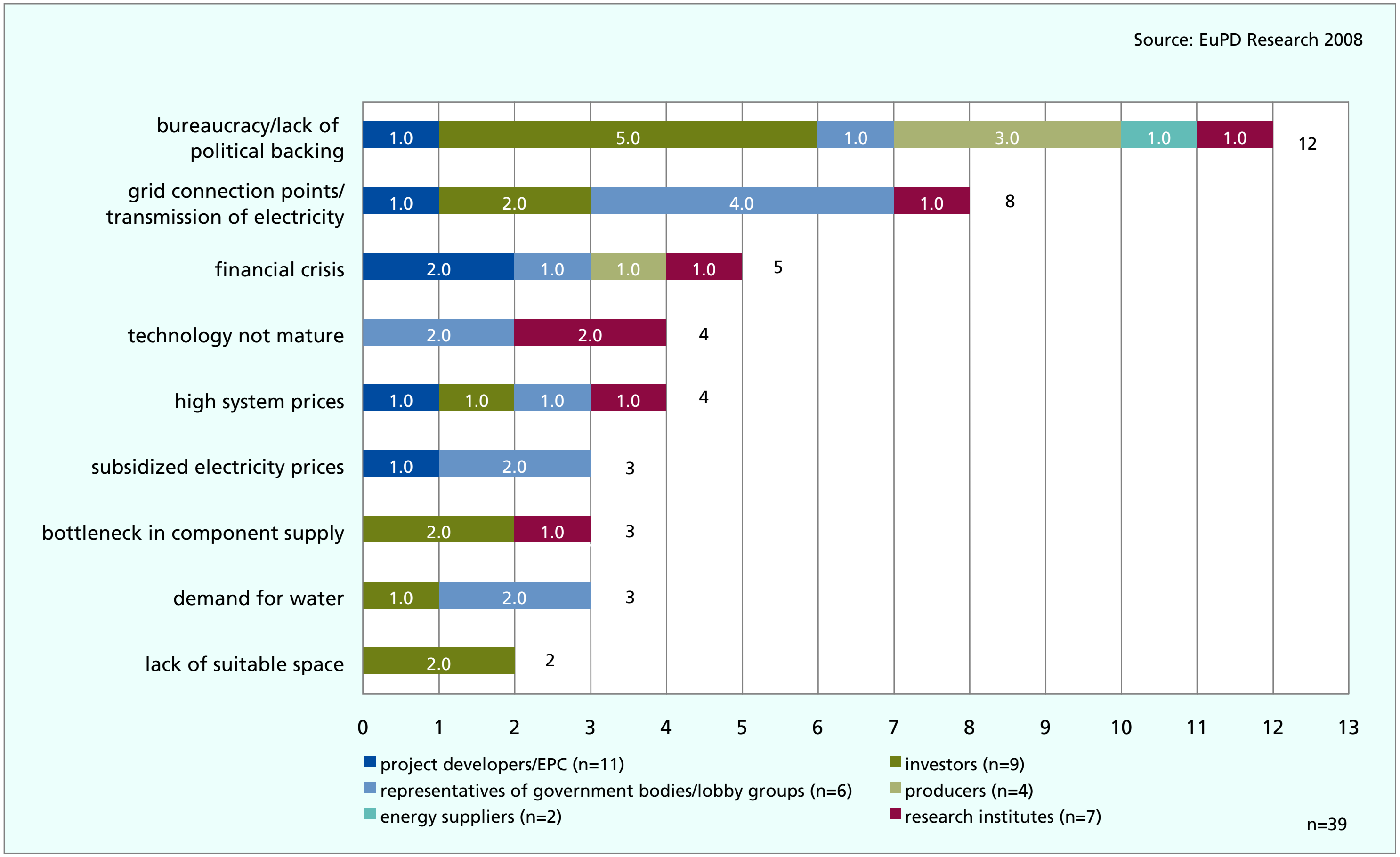


As can be seen from the graph, the national promotion schemes in place are considered to be the most important market drivers by the competitors and the majority of survey participants overall. This is a similar response to the second most common answer: the feed-in tariff.

It is thus clear that the overwhelming majority of participants rely on political promotion schemes.

D. General Market Conditions: Main Hindrances

What do you think are the main hindrances for CSP markets?

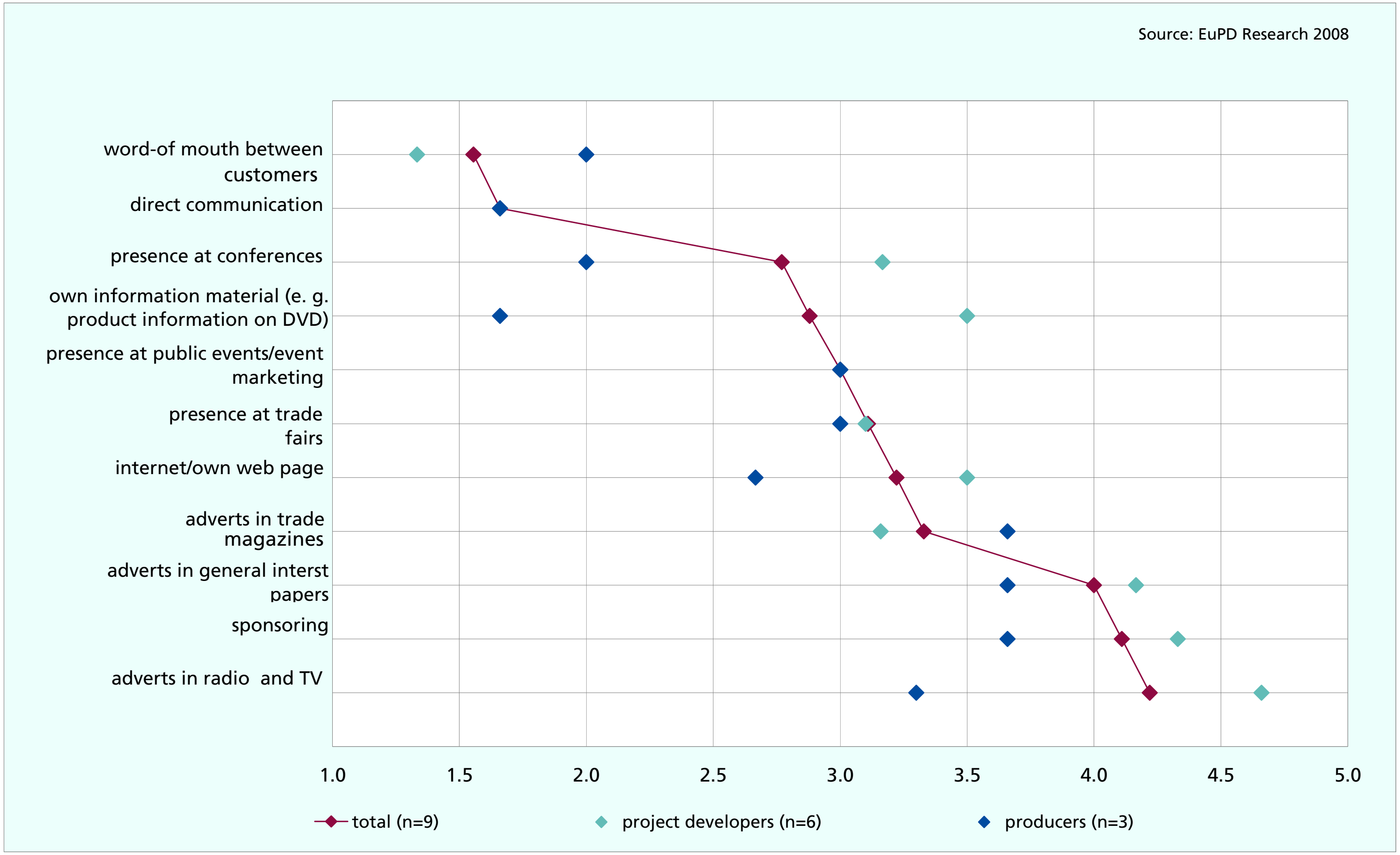


Bureaucracy was named as the main hindrance by 12 participants in total. Even in the countries where a feed-in tariff is in place, this can cause major problems.

Grid connection and transmission issues were also seen as hindrances, particularly by government bodies and lobby groups.

E. Important Communication Channels in the Field of CSP

Please evaluate the following communication instruments with regard to their importance for the acquisition of new customers in the field of CSP, where 1 is "very important" and 5 is "not important at all".

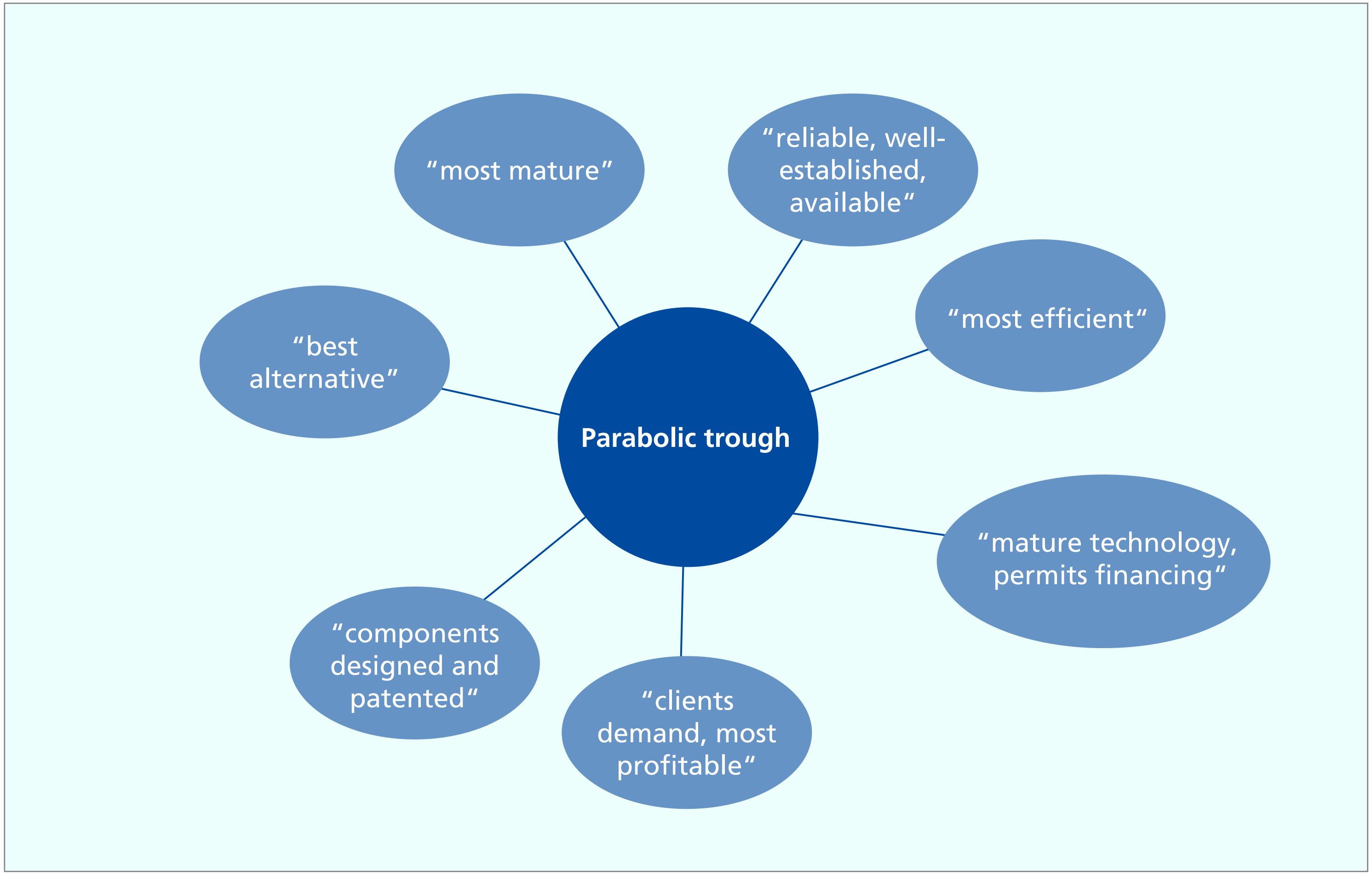


The most important communication instrument for the acquisition of new customers in the field of CSP is word-of-mouth communication between customers. Project developers in particular expressed this opinion.

The highest differences occur in regard to the importance of information material: whereas producers attach high importance to this instrument, project developers do not share this opinion.

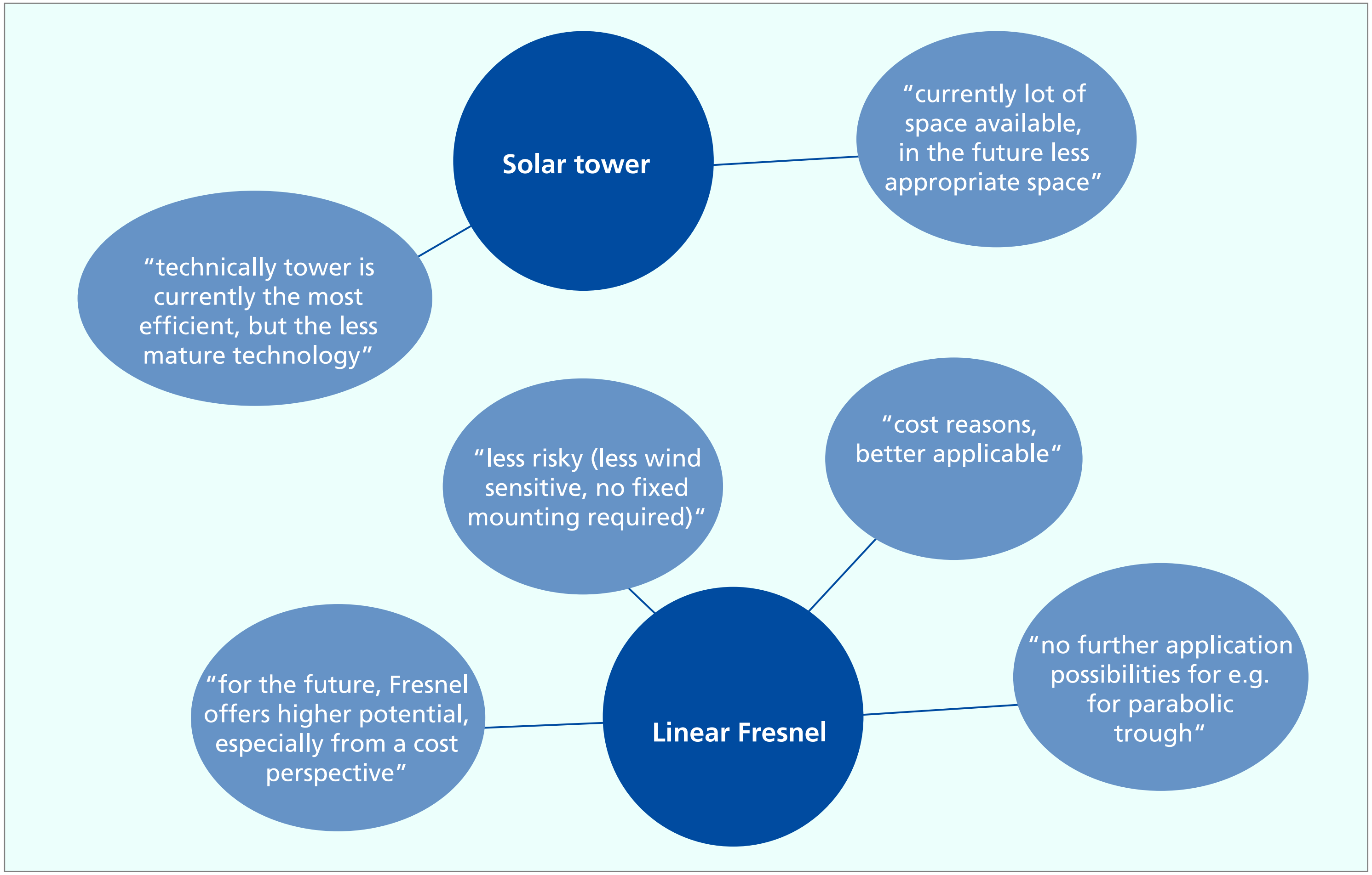
F. Stated Reasons for Choosing a CSP Technology – Parabolic Trough

What were the reasons why you chose these CSP technologies?



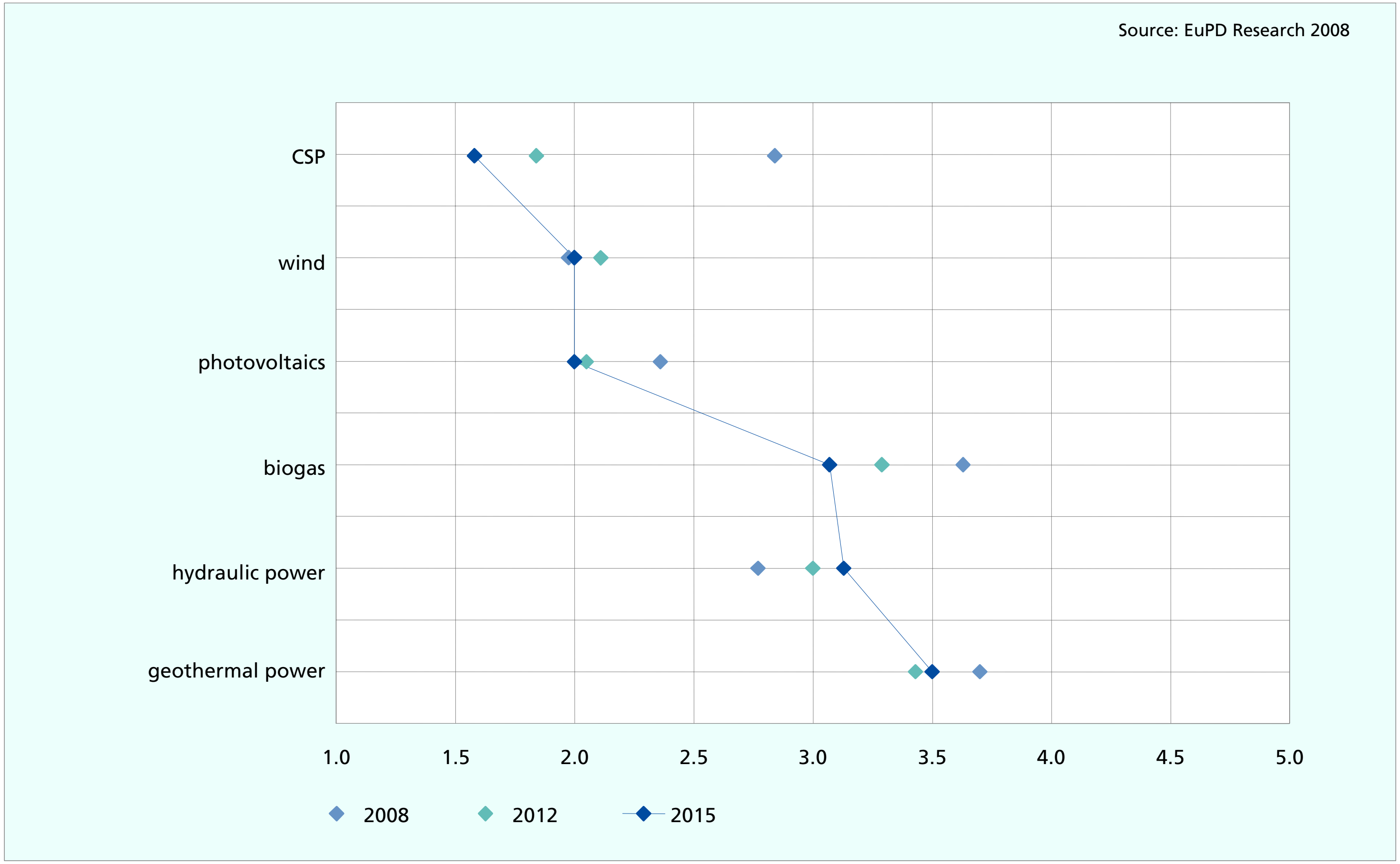
F. Stated Reasons for Choosing a CSP Technology – Solar Tower and Linear Fresnel

What were the reasons why you chose these CSP technologies?



G. Attitudes Towards Renewable Energy Technologies

On a scale from 1 (high significance) to 5 (low significance): How would you estimate the following sources of renewable energy according to their significance today, 2012 and in the year 2015?



For the survey participants from the finance sector and governmental bodies, CSP is of average importance at the moment. Wind, PV and hydraulic power are more significant.

But this is expected to change: whereas the importance of wind and hydropower is expected to remain the same or decrease slightly, CSP will gain more importance.

PV and biogas are also expected to become more significant.

Conclusion

- The largest group of survey participants is made up of project developers and EPC companies followed by investors and creditors. More than a third of the surveyed companies were founded after 2000. 1 in 5 of the participants entered the CSP business before the year 2003; 40% in 2006 or later. Besides CSP, 60% of the project developers and manufacturers are active in the field of biomass and one third in the photovoltaics sector.
- Although there are many markets of interest for CSP in terms of solar radiation, not all of them are in the right position to grow at present. The European countries have a great advantage in that they all have feed-in-tariffs. Spain can be seen as top market at the moment due to a good promotion scheme and huge CSP project pipeline.
- The US is in many ways the CSP forerunner, although there was little movement during the 1990s. With the extension of the ITC promotion scheme, stable framework conditions for the CSP market have been created. Algeria , India and Israel are making their first steps in the right direction with the implementation of feed-in-tariffs, but the promotion schemes are very restricted. Although no feed-in tariff is implemented in Australia, the country is also a very attractive market, due to the strong economic situation and the very good natural conditions.
- According to the research sample, national promotion schemes, feed-in tariffs and the cost reduction potential are seen as the most important market drivers. Bureaucratic hurdles, the availability of grid connection points and the current financial crisis are seen as the main hindrances.

Conclusion

- Word-of mouth between customers and direct communication are the channels crucial for the acquisition of new customers according to the survey participants. Adverts and sponsoring activities are of minor importance. This can be understood as unmistakable signs of a B2B market.

- In comparison to other renewable energy technologies such as wind, photovoltaic and hydro power, CSP is currently less significant from the point of view of the survey participants from the finance sector and governmental bodies. But in the future more significance is attached to CSP while that of hydro and wind power is expected to decrease slightly or remain constant.

Editorial

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