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The Clean Energy Sector in Japan

An Analysis on Investment and Industrial Cooperation Opportunities for EU SMEs

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Executive Summary

While the EU and Japan are at the forefront of the deployment of clean technologies, there is still an unexplored potential in terms of experience sharing, technological cooperation, and mutual investment in this area. The similarities in geographical, environmental, political, and economic structures make Japan an ideal market for green technologies in which European companies can succeed. For Japan, there is a clear benefit to learn from the EU experience in technologies and solutions to accommodate large quantities of clean energy sources into its energy market.

The Japanese market only started to move after the Fukushima disaster in 2011 and there is a chance for foreign players to be part of the game. However, Japan is in a luxurious position as it is able to choose from the best approaches worldwide. Therefore, it is essential to present these solutions in Japan and show the Japanese players in this market that Europe is here and engaged.

This report outlines the current status of EU-Japan cooperation on clean energy and how business could fit into these activities. Cooperation takes place through the EU-Japan Energy Dialogue, Science and Technology Agreement and seminars organised by stakeholders in Japan. However, a comprehensive focus on clean energy is missing and could be accommodated by the forthcoming Free Trade Agreement (FTA)/Economic Partnership Agreement (EPA) and Strategic Partnership Agreement (SPA).

This report further reports on the conditions for clean energy in Japan for EU companies. The main obstacles, funding and cooperation opportunities are subsequently set out. While several issues underpin the growth of clean energy, they are not being seen as insurmountable. Japanese policy-makers are aware of the necessity to remove the obstacles withholding growth in order for Japan to attain a higher share of renewable energy in the energy mix and increase energy efficiency. It was also found that the business conditions in this sector are not remarkably different from other sectors in Japan.

To draw a clear picture of the status of EU Small and Medium-sized Enterprises (SMEs) on this market, SMEs active on the clean energy market in Japan were identified and a selection of them interviewed in order to listen to their experiences and demands. 61 companies were found of which 31 have representations and nine have a local office in Japan. Success factors for SMEs on the Japanese market include hiring of a local expert who has a track record in the specific field the company is getting into. In addition, a

prior connection to Japanese clients and international experience were also found to be correlating factors. These companies would like to receive more market information, trade fair participation of the EU that could facilitate their participation, activities to showcase their company on the Japanese market and information for access to Japanese funds.

Opportunities for SMEs can be found in most sectors of the clean energy market from all types of renewable energy to smarts grids and energy efficiency related technologies. Through interviews and literature review, wind and bio energy have been identified as having the most potential for European companies.

Finally, a number of conclusions and recommendations for policy makers are given that could encourage investment and technological cooperation in this field. The main actions the EU can take to promote European companies in Japan are:

- Organising activities focused on a specific technology or service.
- Include clean energy in the upcoming EU-Japan FTA/EPA.
- Include clean energy in the upcoming EU-Japan SPA.
- Trade fair participation.
- EU business missions for SMEs within a specific theme.
- Expand the information service for EU companies interested in Japan.

List of Abbreviations

BEV	Battery Electric Vehicles
CAPEX	Capital expenditures
CHP	Combined Heat and Power
EPA	Economic Partnership Agreement
EPCO	Electric Power Company
ETP	Executive Training Programme
EV	Electric Vehicles
FIT	Feed-in Tariff
FTA	Free Trade Agreement
GW	Gigawatt
IEC	International Electrotechnical Commission
IPP	Independent Power Producer
JETRO	Japan External Trade Organisation
JV	Joint-Venture
JWPA	Japanese Wind Power Association
kL	kiloliter
kW	Kilowatt
METI	Ministry of Economy, Trade and Industry, Japan
MW	Megawatt
NEDO	New Energy and Industrial Technology Development Organization
OCCTO	Organisation for Cross-regional Coordination of Transmission Operators
ORC	Organic Rankine Cycle
PHEV	Plug-in Hybrid electric Vehicles
PJ	Petajoule
PV	Photovoltaic
R&D	Research and development
RPS	Renewable Portfolio Standard
SME	Small and Medium-sized Enterprise
SPA	Strategic Partnership Agreement
SPC	Special Purpose Companies
SWH	Solar Water Heating
TEPCO	Tokyo Electric Power Company
TPP	Trans-Pacific Partnership
TTIP	Transatlantic Trade and Investment Partnership
TW	Terawatt

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1 Introduction

The EU and Japan have traditionally been at the forefront of promoting clean energy and developing clean energy technologies. The EU has set ambitious targets on renewable energy, emission reductions and energy efficiency in the 2020 framework and will continue these efforts towards 2030 and 2050. Japan has dominated solar photovoltaic (PV) development in the past. It started the Sunshine Programme to introduce solar power after the oil shocks in the 1970s and was the first country to reach 1 GW of installed solar capacity in 2004 thanks to the first subsidy programme started in 1994 for residential solar panels. These developments were partly responsible for establishing major Japanese solar PV manufacturers and a thriving solar industry[1].

The slowdown of solar PV deployment in the mid-2000s is said to be partly the result of Japan's energy plan in 2002 which sought to expand nuclear power to 30% by 2011[2]. However, the events following the Great East Japan Earthquake and Fukushima Daiichi nuclear disaster in 2011 have shifted Japan's energy policy towards less reliance on nuclear power[3]. This has accelerated a trend towards cleaner energy sources that was already ongoing before 2011. With the Feed-in Tariff (FIT) that was enacted in 2012, the Japanese renewable energy market is expected to grow significantly in the years ahead.

The Japanese market related to global warming mitigation, such as energy saving and renewable energy, is estimated to experience a substantial increase of 53% from JPY 32 trillion[4] in 2005 to JPY 49 trillion in 2015 according to statistics from the Ministry of Economy, Trade and Industry[5]. As the Japanese energy market will further liberalize, the FIT and additional support from the government for green energies will enable the creation of attractive business models and further growth.

[1] Foster, Robert, Majid Ghassemi, and Alma Cota. 2010. *Solar Energy: Renewable Energy and the Environment*. Energy and the Environment Series. CRC Press, Taylor and Francis Group.

[2] Colville, Finlay. 2013. "Recharged Japan Solar PV Industry Hits 10 GW of Installed Capacity." Solarbuzz. September 11.http://www.solarbuzz.com/resources/articles-and-presentations/recharged-japan-solar-pv-industry-hits-10-gw-of-installed-capacity.

[3] At the time of writing, it is unclear to which extent nuclear power will resurface. However, it is clear there is a strong trend towards the expansion of renewable energy that is likely to continue.

[4] 1 trillion = 1.000.000 million

[5] JETRO. "Attractive Sectors." http://www.jetro.go.jp/uk/Invest_in_Japan/Attractive_Sectors/

While the EU and Japan are at the forefront of the deployment of clean technologies, there is still an unexplored potential in terms of experience sharing, technological cooperation, and mutual investment in this area. The similarities in geographical, environmental, political, and economic structures make Japan an ideal market for green technologies in which European companies can succeed. For Japan, there is a clear benefit to learn from the EU experience in technologies and solutions to accommodate large quantities of clean energy sources into the energy market.

The EU can contribute in enhancing the basic conditions for European companies in Japan. In particular Small and Medium-sized Enterprises (SMEs) need extra support as Japan has additional obstacles when compared to other markets, such as the business culture, language and geographical distance. In the global clean energy market, technology SMEs are flourishing and invest in new markets and business fields to maintain their leading international position. The EU can help them to achieve these goals in Japan.

This report aims to outline the current status of EU-Japan cooperation on clean energy with regards to how business could fit into this cooperation. It further reports on the conditions for clean energy in Japan for EU companies. The main obstacles, funding and cooperation opportunities are subsequently set out. The final chapter looks into the specific opportunities for EU SMEs that were identified through interviews as having potential. Finally, a number of conclusions and recommendations for policy makers are given that could encourage investment and technological cooperation in this field.

Methodology

The main questions on which this report attempts to formulate an answer are: How can the EU improve conditions for EU SMEs on the Japanese clean energy market? What kinds of opportunities exist on the Japanese clean energy market for EU SMEs? How can they invest, cooperate and enter this market? And what are the obstacles and success factors?

Data was collected through literature review and interviews with experts from the Japanese government and related organisations, embassies of European countries, sector associations, consultants and EU companies. On the basis of these interviews, two segments of the clean energy market were selected and further explored.

To draw a clear picture of the status of EU SMEs on this market, SMEs active on the clean energy market in Japan were identified and a selection of them interviewed in order to listen to their experiences and demands.

Defining clean energy

Clean energy is a concept which translates into a wide area of energy-related solutions that aim to generate energy without or with reduced environmental pollution, in particular the reduction of CO2 emissions. However, a narrow definition also exists that describes clean energy as energy that does not pollute the atmosphere when used[6]. In other instances, it is often used as a synonym for renewable energy[7]. Various related concepts also exist, from cleantech and greentech to "green energy" and "sustainable energy". In Japan, clean energy is often classified under "new energy", which makes no differentiation of whether the technology is clean.

The International Energy Agency (IEA) sees clean energy as all the technologies that are connected to energy and bring about a reduced environmental burden. On the side of power generation, it includes renewable, nuclear, natural-gas, coal-fired power generation. End-use sectors such as electric and hybrid-electric vehicles and buildings and system integration with smart grids, co-generation and district heating and cooling are also included.

In order to identify opportunities for cooperation in a wide area, the clean energy concept as defined by the IEA is used. The clean energy sector furthermore is used as a *theme* for all the related industries that have a stake in this sector, hence, manufacturers of 'parts' or 'production equipment' that are being used in clean energy solutions are also considered a target of this research.

This report focuses on certain areas in the clean energy concept such as renewable energies and system integration as these have been put forward on the basis of the interviews conducted for this research.

[6] Definition dictionary.com

[7] Goossens, Ehren. 2013. "Clean Energy to Beat Gas in Power Mix by 2016, IEA Says." Bloomberg Sustainability, June 26.http://www.bloomberg.com/news/2013-06-26/clean-energy-to-reach-25-by-2018-on-new-markets-costs.html.

2 EU-Japan Cooperation on Clean Energy

2.1 Overview of EU-Japan Clean Energy Cooperation

EU-Japan clean energy cooperation dates back to 1987 with the launch of the "Renewable Energy" programme for EU and Japanese experts of the EU-Japan Centre for Industrial Cooperation. More recently, since 2007, EU and Japanese policy-makers have held a regular energy dialogue, set up by Prime Minister Shinzo Abe during his previous tenure and European Commission President Barroso. In June 2012, during the 4th EU-Japan Energy Dialogue in Tokyo, they agreed to reinvigorate bilateral energy cooperation, emphasised the need for open, transparent, efficient and competitive energy markets, and shared their views on long-term energy challenges and policies[8]. Increasing clean energy and energy efficiency is also often mentioned in the joint statements that are released after EU-Japan Summits.

The EU-Japan Energy Dialogue

The energy dialogue has served as a forum for an open exchange of views between DG Energy (European Commission) and the Agency of Natural Resources and Energy (METI) on concerns shared by the EU and Japan. Topics that have been discussed include energy security, high oil prices, climate change and energy efficiency. The 4th dialogue on 7 June 2012 marked the first time the dialogue took place on a ministerial level with Minister Yukio Edano and Commissioner Gunther Oettinger. In their statement after the dialogue, they stressed "the importance of moving towards a competitive clean energy economy" and they "recognised that diversifying sources, routes and types of energy as well as enhancing energy efficiency and developing renewable energy sources have an important contribution to energy security, economic competitiveness and environmental sustainability"[9]. Among the seven joint activities that were raised during this dialogue, three concerned nuclear energy, and one was directed to implementing joint activities in the research area related to clean energy technologies.

[8] Delegation of the European Union to Japan.
"Energy." http://www.euinjapan.jp/en/world/environment/energy/. (Accessed 2 May 2013)

[9] METI. 2012. "Meeting of the Regular Energy Dialogue Between the Ministry of Economy, Trade and Industry of Japan and the European Commission 7 June 2012".
METI. http://www.meti.go.jp/press/2012/06/20120607004/20120607004-3.pdf.

The Science and Technology Agreement

When talking about clean energy cooperation, the Science and Technology Agreement (S&T Agreement) between Japan and the EU (entered into force on 29 March 2011), provides some clear examples of actual cooperation in this field. This agreement aims to boost EU-Japan R&D cooperation in many fields including clean energy. Until the end of 2013, five coordinated calls were launched in the area of energy, aeronautics, ICT and critical raw materials. The first EU-Japan project under this agreement tackled ultra-high efficiency concentration photovoltaic cells, modules and systems (NGCPV), and includes 16 partners such as the Technical University of Madrid, Tokyo University, Fraunhofer-ISE and two European SMEs: BSQ and PSE[10].

This project started in June 2011 and will run until November 2014. It is mainly funded by the FP7 programme with a contribution of EUR 5 million. While at the first joint committee meeting of the S&T Agreement in June 2011, low carbon societies/technologies and critical raw materials were among the main areas that were discussed[11], during the second joint meeting in June 2013, it was decided that cooperation will focus on three flagship priorities: critical raw materials, aeronautics and ICT[12].

The combination of the *Comprehensive Science Technology and Innovation (STI) Strategy* from June 2013 on the Japanese side, and the new framework programme called *Horizon 2020* on the European side, is seen as a chance to enter a new stage of Science and Technology cooperation. In Horizon 2020, clean energy can be found under the heading "Societal Challenges", where energy, climate, environment, resource efficiency and raw materials are listed. From the Japanese side, "realization of clean and economical energy system" is the first out of five challenges that will be addressed by the Comprehensive STI Strategy[13].

In the previous FP7, 63 proposals involving 79 Japanese participants have been selected for funding. The most active areas include information and communication

[10] For more information: http://www.ngcpv.org
[11] MOFA. 2011. "The First Joint Committee on Scientific and Technological Cooperation Between Japan and the EU." June 16. http://www.mofa.go.jp/policy/s_tech/j_eu1106.html.
[12] EU in Japan. 2013. "EU-Japan Joint Committee on Science and Technology Cooperation." June 24. http://www.euinjapan.jp/en/media/news/news2013/20130624/182801/
[13] Cabinet Office. 2013. "Comprehensive STI Strategy Outline." June 7. http://www8.cao.go.jp/cstp/english/doc/20130607cao_sti_strategy.pdf

technology, materials, environment and health[14]. Two EU-Japan research projects can be found that are related to clean energy apart from the S&T Agreement, namely Co2CARE and CONCERT-Japan.

CO2CARE (2011-2013) was a project that aims to support the large scale demonstration of CCS technology by addressing the research requirements of CO2 storage site abandonment. It is an FP7 project in which Research Institute of Innovative Technology for the Earth from Japan is involved[15]. CONCERT-Japan (2011-2013) "Connecting and Coordinating European Science and Technology Development with Japan" was also an FP7 with the aim to promote an effective and coordinated science and technology cooperation between European countries and Japan with a view to further expanding and harmonizing already existing cooperation between them.

This project launched two successful pilot joint calls of which one related to clean energy, namely "Efficient Energy Storage and Distribution", for which four projects were selected: iTHEUS, SolarFuel, UMBLA and NASEMS (see Table 1).

Table 1: CONCERT-Japan Efficient Energy Storage and Distribution Projects
iTHEUS: Fundamental investigations on Improved Materials and Storage Concepts for a Hydrogen based Integrated Total Energy Utilisation System. partners: IFE (Norway), AIST (Japan), IMR-TU (Japan), HZG (Germany), EMPA (Switzerland), Århus Univ. (Denmark)
SolarFuel: Solar photocatalysis for generation of fuel. Ulm University (Germany), Hokkaido University (Japan), University Paris-sud (France)
UMBLA: Understanding Mesoscopic Behaviour of Li ion in All-solid-battery. Toyota Motor Corp. (Japan), Universidad Politécnica de Madrid (Spain), Helmholtz Institute for Electrochemical Energy Storage (Germany), IEK-1 Forschungszentrum Jül. (Germany)
NASEMS: Nanoradiator-Equipped Adsorbents for Safe and Energy Saving Methane Storage. Shinshu University (Japan), University of Milano (Italy), Budapest University of Technology and Economics (Hungay), Chemistry at Université Pierre et Marie Curie (France), Department of Inorganic Chemistry, Alicante University (Spain)

Instrumental for the EU-Japan research cooperation to succeed, is the *Jeupiste* project[16], which was launched in December 2013. This project follows up the similar J-BILAT project and has as main objective to enhance EU-Japan cooperation in research and innovation by effectively informing the S&T research community in Japan about the EU programmes and funding instruments. A list of items for which cooperation with Japan is expected has been published, but does not include clean energy at this time.

[14] EU. 2013. "European Union Factsheet: EU-Japan Summit."http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/EN/foraff/136370.pdf.
[15] For more information: http://www.co2care.org
[16] For more information: http://www.jeupiste.eu/

European level initiatives in Tokyo

In Tokyo, the main actors on the EU level are the EU Delegation, the EU-Japan Centre for Industrial Cooperation[17] and the European Business Council[18]. During 2013, these organisations organised the main seminars and events in Tokyo that can be linked to clean energy (see Table 2). An analysis shows that the topics that are being tackled during these activities are quite broad. They range from solar power to power sector reform and energy efficiency, and include the whole spectrum of academic, civil society and business actors.

Table 2: European level initiatives on Clean Energy in Japan		
29 January 2013	Promoting Energy Efficiency Actions in Industry through Corporate Networks in Europe and Japan	EU-Japan Centre for Industrial Cooperation
4-8 February 2013	Business Mission: Environment and Energy-related Technologies	EU Gateway Programme (European Commission)
14 February 2013	International Symposium: The Strategic Cooperation between the EU and Japan for the Development of Smart Community and the Safety of Electrical Control System	EU Institute in Japan, Kansai, EU Studies Institute Tokyo, EU Institute in Japan, Kyushu, Nippon Electric Control Equipment Industries Association (Co-host: Delegation of the European Union to Japan, Ministry of Economy, Trade and Industry, Japan External Trade Organization, Japan Business Federation, Japan Association of Corporate Executives, Kansai Economic Federation and Osaka Chamber of Commerce and Industry)
06 March 2013	The Economics of Solar Power - How can PV contribute best to Business, Energy Production and Growth?	EU Delegation in Japan, in cooperation with the European Business Council in Japan and the CNRS Institute PV Next at University of Tokyo
11 September 2013	EU-Japan Workshop on the Power Sector Transition	European Commission (DG Energy), EU-Japan Centre for Industrial Cooperation, EURELECTRIC. in cooperation with: Ministry of Economy, Trade and Industry, Japan
13 December 2013	Energy Efficiency in Buildings in the EU and in Japan	EU-Japan Centre for Industrial Cooperation and Saint-Gobain

[17] A venture between the European Commission (DG Enterprise) and the Japanese Government (Ministry for Economy, Trade and Industry), established in 1987

[18] The trade policy arm of 17 European National Chamber of Commerce and Business Associations in Japan since 1972

On a bilateral level, Japan also holds energy dialogues with several EU member states, such as the Japan-UK Energy Dialogue. This bilateral dialogue has been held since 2006 between Agency for Natural Resources and Energy (METI Japan) and Department of Energy and Climate Change (UK)[19]. A Japan-France energy policy dialogue was first held in 2012[20]. In addition, organisations such as NEDO often cooperate on a bilateral level with organisations within member states. The embassies of European countries in Tokyo are also involved in various activities related to clean energy.

It is useful to also look at how energy relations with the US are handled. A comparison between the US and the EU tells us that the US has been focusing more specifically on clean energy cooperation than the EU. Since 11 February 2011, they have held five Clean Energy Policy Dialogues with Japan that focus on electric vehicles, transformative energy, peaceful nuclear energy, Hawaii-Okinawa cooperation and rare earth elements. In addition, a US-Japan Renewable Energy Policy Business Roundtable was organised in December 2012 and December 2013[21].

2.2 Clean Energy Cooperation in the Forthcoming FTA/EPA and SPA

Energy is an area that can be subject to a Free Trade Agreement. In the case of the Trans-Pacific Partnership (TPP), this agreement could make it easier for Japan to import LNG from the US[22]. Also, in the current debates surrounding the Transatlantic Trade and Investment Partnership (TTIP), energy comes up as an issue confronting EU sustainability policies as NGOs worry about the influence on environmental legislation related to oils sands, LNG and shale gas[23].

When it comes to the forthcoming EU-Japan FTA, energy commodity trade between Japan and the EU is low. However, clean energy could be part of these EU-Japan talks and could be an incentive for wider participation of European companies in the

[19] METI. 2013. “Fifth Japan-UK Energy Dialogue Was Held.” July 5. http://www.meti.go.jp/english/press/2013/0705_02.html

[20] METI. 2012. “Outline of the First ‘Japan-France Energy Policy Dialogue’.” February 21. http://www.meti.go.jp/english/press/2012/0221_02.html

[21] METI. 2013. “Second US-Japan Renewable Energy Policy Business Roundtable to Be Held.” December 9. http://www.meti.go.jp/english/press/2013/1209_02.html.

[22] Klump, Edward , and Mark Drajem . 2013. “Japan’s Bid to Enter Trade Talks Opens Route For U.S. LNG”, March 18. http://www.bloomberg.com/news/2013-03-17/japan-s-bid-to-enter-trade-talks-opens-route-for-u-s-lng.html.

[23] OilPrice.com. 2013. “How an EU-US Free Trade Agreement Will Affect the Energy Sector”, November 20. http://oilprice.com/Energy/Energy-General/How-an-EU-US-Free-Trade-Agreement-will-Affect-the-Energy-Sector.html.

Japanese clean energy market. The European Business Council in Japan expects energy to be discussed during these negotiations[24].

A precedent exists with an Asian country where clean energy was prominently featured in the FTA. In the EU-Singapore FTA, which was initialled on 20 September 2013, a full chapter on "Non-Tariff Barriers to Trade and Investment in Renewable Energy Generation"[25] has been included in line with global efforts to reduce greenhouse gas emissions. It has been called the EU's first "green FTA". Apart from renewable energy, there are solid commitments on environmental services and new rules on green tendering[26]. Previously, the EU had already included a sustainability chapter in the EU-South Korea FTA, concluded in 2009, that strives "to facilitate and promote trade and foreign direct investment in environmental goods and services, including environmental technologies, sustainable renewable energy, energy efficient products and services and eco-labelled goods, including through addressing related non-tariff barriers".[27]

In particular, the Strategic Partnership Agreement (SPA) that is negotiated in parallel could give way to an elaborate framework for clean energy development since this would fit into the climate change discussions. During the interviews with that were conducted as part of this research, most interviewees confirmed the need for clean energy to be part of these discussions.

2.3 How to Move Cooperation Forward between Japan and the EU?

Japan is actively looking abroad for examples, competence and advice to develop their clean energy market. The EU is an obvious example that has a strong policy for renewable energy, unification of electricity markets and energy efficiency. For the energy restructuring process, government, industry and academia in Japan are already looking at Europe and every effort for capacity building and experience transfer is

[24] European Business Council in Japan. 2012. "Delivering Trade Potential: The EBC Report on the Japanese Business Environment 2012". White Paper. Tokyo: The European Business Council in Japan. http://www.ebc-jp.com/downloads/2012-WP-E.pdf

[25] EU. 2013. "Text of the EU - Singapore Free Trade." http://trade.ec.europa.eu/doclib/press/index.cfm?id=961.

[26] EU. 2012. "Facts and Figures: EU Trade Agreement with Singapore." http://europa.eu/rapid/press-release_MEMO-12-993_en.htm

[27] Cissé, Hassane; Menon, N. R. Madhava; Cordonier Segger, Marie-Claire; Nmehielle, Vincent O. 2014. "The World Bank Legal Review, Volume 5 : Fostering Development through Opportunity, Inclusion, and Equity". Washington, DC: World Bank.

appreciated. Providing the information is the first step to be noticed and through this process a wide variety of actors can be reached. It is particularly important to reach industry actors. The Japanese government is considered to be aware of best practices, but has difficulty putting certain solutions into practice due to a strong industry lobby. The EU could send a stronger signal about what solutions and approaches can be implemented instead of giving help and advice on request. By working closely with already established European companies on the Japanese market, the EU should be able to pinpoint precisely the issues that keep European companies from moving forward.

If Japan introduces similar solutions as those in Europe, this will open up opportunities for European technologies to find their way into Japan. It will also open up more collaboration based on the relationship that has been established. This long term approach could be successful in Japan's case since in particular trust and relationship building are the main ingredients for a successful business relationship in this country.

A policy strategy relationship on clean energy could be established in context of the SPA, with as a result workshops, seminars and dialogues to deepen the collaboration. Focused dialogues on clean energy aspects, such as renewable energy, may lead to new business. The EU could take the lead in bringing together European embassies in Japan and businesses in order to increase the exposure of European technology and solutions in Japan. The alignment of standards and regulations in order to create a seamless flow of technology can be tackled by the EU-Japan FTA as the previously concluded EU-Singapore FTA shows.

Research collaboration is a good starting point that has already been explored and could be further expanded. In the new framework programme Horizon 2020, more joint calls in the clean energy sphere could be facilitated.

As renewable energy power generation in Japan is still fairly low, there is a clear benefit from the EU experience in technologies and solutions to accommodate this energy source and provide a smooth introduction. For example, the negative pricing issue of renewable energy in Germany in September 2013 [28] marks the problems utilities can face when they are not investing accordingly with the prospects of renewable energy.

[28] The Economist. 2013. "European Utilities: How to Lose Half a Trillion Euros." The Economist, October 12. http://www.economist.com/news/briefing/21587782-europes-electricity-providers-face-existential-threat-how-lose-half-trillion-euros.

Therefore, deeper cooperation and exchange could avoid a similar scenario. More efforts to move the cooperation forward at the political level is welcomed to bring all the stakeholders together in a dynamic framework.

3 Investment and Cooperation Conditions for EU Clean Energy Companies in Japan

3.1 Competitiveness of the EU Clean Energy Sector

Europe is well positioned to export to other markets. The EU is the world leader in several clean energy technologies thanks to clear support policies. State-of-the-art technologies have been developed and their feasibility and sustainability has been demonstrated on a large scale. EU firms are global leaders in increasing cross-border "eco-investments" in clean and more energy-efficient technologies, products and services. They are frontrunners in renewable energy and other eco-technologies that are used to provide environmental goods and services. Even though competition is increasing from multinational enterprises in emerging economies, these European companies are highly internationalised and well positioned in the global competition[29].

In particular renewable energy technologies have been able to grow as a result of well-defined policy goals. The economic activity of this sector in the EU for 2011 is valued at more than EUR 137 billion[30]. With regards to the export perspective, EU companies accounted for almost two thirds of the FDI by multinational enterprises worldwide in renewable energy between 2007 and 2011[31]. European companies in this sector have already ventured in other key markets such as the US and China. Several companies have also gained a good position in Japan[32].

Overall export data on clean energy related technologies and services from the EU is not readily available as the trade codes are scattered along various categories in the trade databases[33]. However, some data exists for individual member states. For

[29] European Commission. 2012. "European Competitiveness Report 2012: Reaping the Benefits of Globalization." http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=7657.

[30] EurObserv'ER. 2012. "The State of Renewable Energies in Europe. Edition 2012. 12th EurObserv'ER Report". Paris. http://www.energies-renouvelables.org/observ-er/stat_baro/barobilan/barobilan12.pdf.
1 billion = 1.000 million

[31] European Commission. 2012. "European Competitiveness Report 2012: Reaping the Benefits of Globalization." http://ec.europa.eu/enterprise/newsroom/cf/_getdocument.cfm?doc_id=7657.

[32] For example, in the wind energy sector, the majority of wind turbines are made by European manufacturers

[33] Wind, Izaak. 2008. "HS Codes and the Renewable Energy Sector." http://ictsd.org/downloads/2010/01/hs-codes-and-the-renewable-energy-sector.pdf

example, 5% of Denmark's total exports are green energy technology related[34].

For the sake of obtaining a snapshot of the renewable energy sector exports, the codes that were listed in the EU-Singapore FTA have been analysed, namely Chapter 84 (excluding 8401), HS850231 and HS854140. Following calculations on these codes, there is a clear upward trend in exports from the EU to Japan, but the figures are clearly lower than those for China and South Korea (see Table 3).

Table 3: Export Value from the EU Member States (million EURO) for Chapter 84 (excluding 8401), HS850231 and HS854140
Calculation by author

	2010	2011	2012
Japan	5361.219	6282.712	6669.845
China	31603.111	36671.807	33582.995
South Korea	8127.539	8840.930	9465.634

While an analysis of these codes can give a certain direction, they can only draw a limited and incomplete picture of the status of the clean energy sector as a whole that is the subject of this report.

3.2 Clean Energy in Japan

Driven by the urgency of energy security and the energy crisis that followed the Fukushima disaster, clean energy has become a top priority among Japanese policymakers. While the future of nuclear power is subject to debate, it is certain that clean energy sources will continue to be a focus in Japan. Clean technology is not a new area for Japan, as companies in Japan have been developing solutions since the 1970s.

The Japanese market related to global warming mitigation, such as energy saving and renewable energy, is estimated to experience a substantial increase of 53% from JPY 32 trillion in 2005 to 49 JPY trillion in 2015 according to statistics from the Ministry of Economy, Trade and Industry[35]. As the Japanese energy market will further liberalize, the FIT and additional support from the government for green energies will enable the creation of attractive business models and further growth.

[34] Danish Energy Agency. 2013. Energy Technology Exports to China
[35] JETRO. "Attractive Sectors." http://www.jetro.go.jp/uk/Invest_in_Japan/Attractive_Sectors/

Power Generation

The most dynamism and growth in clean energy in Japan is currently to be found in the renewable energy market. As Japan lags behind in renewable energy generation as compared to other developed countries, high growth can be expected. In the near future, the FIT is set to continue and diversify to include a separate tariff for offshore wind. Moreover, in the mid-term Japan's support for renewable energy is set to continue as the Japanese government said in a biennial report to the UN in December 2013[36].

Various policy restrictions and the time it takes before electricity can be produced for certain types of power generation facilities signify that growth apart from solar power still has to take place. This does not reflect the lack of potential of the market. Several reports have been written on how Japan can achieve 100% renewable energy. These reports show how Japan has the potential to use this power source to provide energy security for the country[37].

Cleaner natural gas and clean coal appear to be less of a focus from the Japanese budget's perspective. In Japan's electricity mix in fiscal 2012, natural gas amounted to 42.5% and coal to 27.6%[38]. Natural gas used to produce electricity increased with 15% through 2012 compared to 2011 as a result of the nuclear shutdowns, while coal did not see a similar increase[39]. Regarding coal, the focus appears to lie on exporting Japan's highly efficient technology to other Asian countries as coal use is projected to grow significantly in those counties[40].

This level of activity in the power generation sector is reflected in the Japanese

[36] Bloomberg New Energy Finance. 2013. "Japan Eyes Smart Meters, Fuel Cells to Tackle Climate Change", December 27.http://about.bnef.com/bnef-news/japan-eyes-smart-meters-fuel-cells-to-tackle-climate-change/.

[37] Kojima, Takatoshi. 2012. "How Is 100% Renewable Energy Possible in Japan by 2020?" Global Energy Network Institute (GENI); Wakeyama, Tatsuya, and Sachio Ehara. 2011. "Estimation of Renewable Energy Potential and Use - A Case Study of Hokkaido, Northern-Tohoku Area and Tokyo Metropolitan, Japan-." In Sustainable Cities and Regions. Linkoping, Sweden. http://www.ep.liu.se/ecp/057/vol12/012/ecp57vol12_012.pdf

[38] Figures from presentation by Mr. Yuki Shimazu, Deputy Director New and Renewable Energy Division, Agency for Natural Resources and Energy (METI)

[39] U.S. Energy Information Administration. 2013. "Japan's Fossil-fueled Generation Remains High Because of Continuing Nuclear Plant Outages."http://www.eia.gov/todayinenergy/detail.cfm?id=10391

[40] METI. 2013. "Released from Japan! Future Coal-Fired Thermal Power Generation –Advancing Highly Efficient Technology and Environmental Performance-." METI Journal - English Edition. http://www.meti.go.jp/english/publications/pdf/journal2013_10a.pdf

government budget for fiscal year 2014. While JPY 136.4 billion is put forward for maximizing the installation of renewable energy (an increase of 62% as compared to 2013), just JPY 24.9 billion is attributed to acceleration of research and practical use of high efficiency thermal power generation (an increase of 5%). This latter budget also includes carbon capture and storage research and implementation[41].

Nuclear power is in an uncertain position as most of the reactors have been stopped. The draft new energy policy of December 2013 sees nuclear power as a "foundation", however, in an updated draft in February 2014, the word "foundation" has been removed and an emphasis was added to the section on renewable energy, saying that efforts to accelerate the introduction of such sources will continue beyond the period of about three years starting from 2013[42].

End use sectors

Energy efficiency is often viewed as an energy resource because the need for supply-side energy resources can be displaced by the adoption of more efficient equipment in industry, buildings and transport. Within the end use sectors, two areas require particular attention in Japan, namely electric and hybrid-electric vehicles, and buildings.

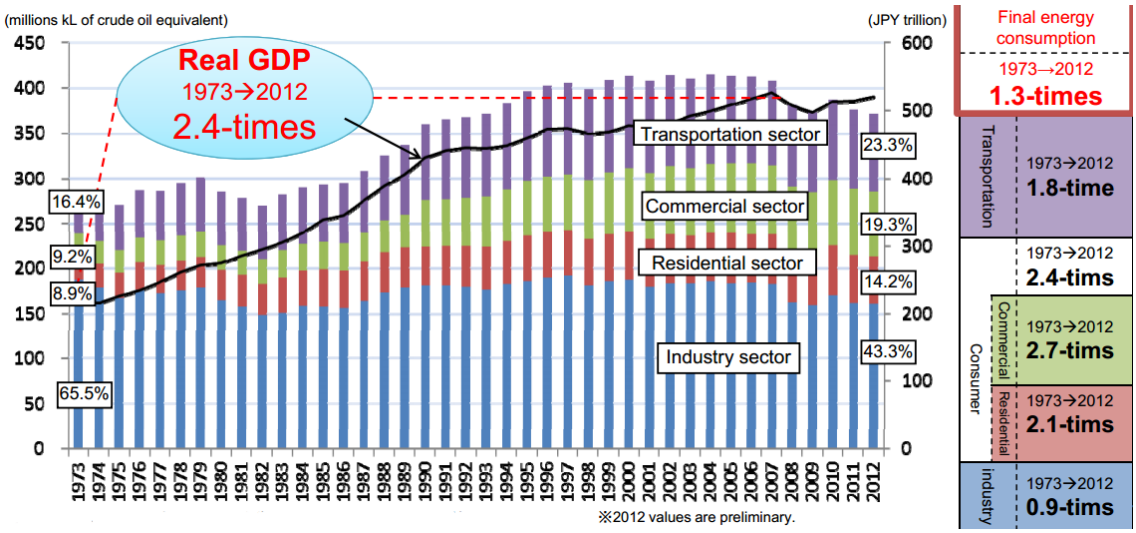
From 1973, the time of the first oil shock, energy saving has become an important topic in Japan. While the real GDP in Japan increased 2.4 times from 1973 to 2012, energy consumption only rose by 1.3 times. Therefore, the energy efficiency has been substantially improved and Japan has, as a result, one of the most efficient economies in the world as measured by energy intensity. However, while energy consumption has become more efficient in the industry sector, energy consumption in the consumer sector has gone up 2.4 times. In particular, the building sector shows room for improvement. For example, in residential houses the outer walls have a thickness of only 5-10 cm, while in Germany the average is 30 cm. In addition, the average temperature inside Japanese houses is around 10 degrees Celsius, which is relatively cold. One reason to explain this difference is the way Japanese people heat their house with only heating in certain rooms[43].

[41] METI. 2013. "Budget Request for Fiscal 2014 Related to Resources and Energy (in Japanese)." http://www.meti.go.jp/main/yosangaisan/fy2014/pdf/04_2.pdf

[42] Japan Times. 2014. "In latest draft energy policy, government calls nuclear power 'important'". 25 February.

[43] From "Energy Pass" presentation, 13 December 2013, EU-Japan Centre for Industrial Cooperation seminar on Energy Efficiency in Buildings

There are at the moment only voluntary codes for the full building sector. However, Japan's Innovative Strategy for Energy and Environment (September 2012), will make building energy codes mandatory for all building types by 2020[44]. The Top Runner programme of the Japanese government encourages competition among companies based on the most energy-efficient product on the market and now includes building insulation materials. However, the deployment of these technologies is slow and might need more incentives to become significant as regulations are now set to follow the market.



Graph 1: Energy Usage by Sector in Japan 1973-2012
Source: Comprehensive Energy Statistics and Annual Report on National Accounts, Agency for Natural Resources and Energy (METI)

Electrical vehicles are important to decarbonise the transport sector in the long-term as they reduce dependency on oil and can potentially make use of clean electricity. Japan was the leader of battery electric vehicle (BEV)[45] sales in 2012, representing 15.937 cars that translate in 28% of the global market. The US was in second place at 26%, France the first European country with 11%. Japan was also the world's second largest market for Plug-in Hybrid Electric Vehicles (PHEV) with 6.528 cars, 12% of the global market[46]. According to a study by the University of Duisburg-Essen for the

[44] Internation Energy Agency. 2013. "Tracking Clean Energy Progress 2013". Paris. http://www.iea.org/publications/TCEP_web.pdf
[45] When talking about Electric Vehicles, several types are being discussed, in the Japanese context mainly Plug-in Hybrid Electric Vehicles (PHEV) and Battery Electric Vehicles (BEV)
[46] Internation Energy Agency. 2013. "Global EV Outlook 2013: Understanding the Electric Vehicle Landscape to 2020". Paris. http://www.iea.org/publications/globalevoutlook_2013.pdf

European Commission[47], registrations of electric vehicles in Japan will increase to ca. 16 percent share in 2020 and ca. 34 percent share in 2030.

System integration

Japan has been working on the "smart cities" concept since 2010, but there has been limited discussion on smart grids before the events surrounding Fukushima. Due to the ensuing energy crisis, the reliability of the grid was questioned and the introduction of renewable energy meant a smarter grid was necessary. There are currently 6 smart grid pilot projects. Four of these are part of the smart cities initiative since 2010 supported by METI (Yokohama, Kyoto Keihanna, Toyota and Kitakyushu). Two other projects were also started in 2010: in Rokkasho and in Okinawa[48].

Japan plans smart meters in every house and factory by the early 2020s and ca. 5.3 million fuel cells in homes by 2030 to tackle climate change[49]. This would add up to a total of 80 million smart meters in the next decade. For this purpose several partnerships and acquisitions have already taken place. For example, Landis+Gyr AG, a Swiss company focused on metering technologies, was acquired by Toshiba Corporation in 2011. Another example is Itron, an American technology and services company dedicated to the resourceful use of energy and water that announced in November 2012 that it has formed a strategic alliance with Panasonic Corporation to develop a smart meter platform tailored to the Japanese market[50].

Policy Framework

Japan has a long history of policies for reducing CO2 and promoting clean energy sources. It excelled in implementing air pollution control and improving energy efficiency from a technical perspective. The oil shortages in the 1970s led to energy

[47] Proff, Heike, and Dominik Kilian. 2012. "Competitiveness of the EU Automotive Industry in Electric Vehicles." http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report-duisburg-essen-electric-vehicles_en.pdf.

[48] Ling, Amy Poh Ai, Kokichi Sugihara, and Masao Mukaidono. 2012. "The Japanese Smart Grid Initiatives, Investments, and Collaborations."International Journal of Advanced Computer Science and Applications 3 (7).http://arxiv.org/ftp/arxiv/papers/1208/1208.5394.pdf

[49] Bloomberg New Energy Finance. 2013. "Japan Eyes Smart Meters, Fuel Cells to Tackle Climate Change", December 27.http://about.bnef.com/bnef-news/japan-eyes-smart-meters-fuel-cells-to-tackle-climate-change/

[50] SmartGridNews.com. 2012. "It's Game on for Japan's Smart Grid - and Itron Jumps In", November 20. http://www.smartgridnews.com/artman/publish/Technologies_Metering/It-s-game-on-for-Japan-s-smart-grid---and-Itron-jumps-in-5299-page2.html.

efficiency measures to reduce dependency on foreign oil and, in 1974, the Sunshine Project was started that aimed to develop solar and geothermal energy[51]. By efforts involving both the public and private sectors, improvements in energy efficiency have been achieved by about 33% in the 30 years from 1979 to 2009[52]. However, it can be said that the Fukushima disaster has given a different dimension to Japan's energy policy and that particularly renewable energy has received an unprecedented boost.

The "Basic Act on Global Warming Countermeasures" is currently governing Japan's CO2 reduction measures. It has a long term target of 80% emission reduction cut by 2050[53]. A range of measures are included, from an emission trading scheme, over promoting lifestyle changes and local development[54]. However, Japan has weakened its greenhouse-gas reduction target in November 2013 from a 25% cut from 1990, to 3.8% from fiscal 2005 levels by 2020[55]. Still, this act provides stimulus for a transition to cleaner technologies.

Renewable energies are the most eye-catching element with the FIT that started in July 2012. As the world's highest starting at 57.75 yen per kWh for wind power (under 10KW capacity) and 38 yen per kWh under 10kW (under 10KW capacity), they should enable a swift increase in renewable energy capacity. They will be revised by April 2014.

It is important to also look at the policies of local government. The national government supports the initiatives of local governments that often go much farther in their targets for renewable energy and CO2 emission reductions. They are often giving tax reductions and subsidies to domestic and foreign companies that wish to develop activities in their region[56].

[51] Jordan-Korte, Katrin. 2011. Government Promotion of Renewable Energy Technologies: Policy Approaches and Market Development in Germany, the United States, and Japan. Springer Gabler.
[52] Agency for Natural Resrources and Energy. 2011. "Energy Conservation Policies of Japan". January. http://www.enecho.meti.go.jp/policy/saveenergy/save01/genjo_English.pdf
[53] Ministry of Environment, Japan. 2013. "Japan's Climate Change Policies". April 12. http://www.env.go.jp/en/focus/docs/files/20130412-68.pdf
[54] Ministry of Environment, Japan. 2010. "Overview of the Bill of the Basic Act on Global Warming Countermeasures". http://www.env.go.jp/en/earth/cc/bagwc/overview_bill.pdf
[55] Iwata, Mari. 2013. "Japan Retreats in CO2 Emissions Cut Target." The Wall Street Journal, November 15. http://online.wsj.com/news/articles/SB10001424052702303789604579199063912364466
[56] JETRO, KACHAN, and Ellisa Feinstein. 2012. "Cleantech Opportunities in Japan". San Fransisco: JETRO.

The electricity market in Japan

Closely related to the introduction of clean energy in Japan is what is happening in the electricity market. After the energy issues following the nuclear disaster, several severe limitations were found:[57]:

- lack of system to transmit electricity beyond regions
- little competition and strong price control
- limit in digesting the change in energy mix including the increase in renewable

The electricity market is dominated by ten regional electric power companies (EPCOs), such as the Tokyo Electric Power Company (TEPCO), that are vertically integrated across power generation, transmission, distribution and retailing. There is already a partial liberalisation of the electricity market in place with retail competition for customers that consume over 50kW. However, the share of non-EPCO players only amounts to 3.6%. Market competition is non-existent in the residential sector.

Three steps are on the agenda for Japan's electricity reform that will be steadily carried out from now until 2020, as the corresponding bills will be discussed in the Diet. The first bill to establish the Organisation for Cross-regional Coordination of Transmission Operators (OCCTO) has already been passed last year. The second stage includes full retail competition and will seek to expand the retail competition to the residential sector at around 2016 and stimulate the wholesale market. The third and final stage will attempt to unbundle the power generation and transmission sector by 2020.

3.3 Attractiveness of the Japanese Clean Energy Market

Even before the Fukushima disaster accelerated new stimulus policy for new energy solutions, the plan called "The New Growth Strategy: Blueprint for Revitalizing Japan" (2010) was in place to create new environment related markets of JPY 50 trillion by 2020, which includes the expansion of the renewable energy-related market to JPY 10

[57] Yamazaki, Takuya. 2013. "Electricity Market Reform in Japan" presented at the EU-Japan Workshop on the Power Sector Transition, September 11, EU Delegation Tokyo.http://www.eu-japan.eu/sites/eu-japan.eu/files/Session2_Yamazaki.pdf

trillion by the same year[58]. This would be done through promoting the spread of renewable energy through feed-in tariffs and investment in smart grids, encouraging green buildings and public transport, and revitalising forestry[59]. In June 2013, Japan's new growth plan "Japan is back" was presented. In its "Strategic Market Creation Plan", one out of four themes aims to "realize clean and economical energy demand and supply" in order to create a domestic market of JPY 10 trillion by 2020 (JPY 4 trillion at present) and an overseas market of JPY 108 trillion (JPY 40 trillion at present). This will include renewable energy, low cost and highly efficient thermal power, storage battery, next-generation device, parts and materials, energy management system, next-generation automobiles, fuel cell, products and services of energy-saving technology such as energy-saving appliances, and energy-saving housing and buildings[60].

Due to the developments in Fukushima, the FIT has become the most prominent incentive that brings renewable energy related companies to Japan. With one of the highest FITs in the world, interest has rapidly increased. This has attracted a lot of attention from abroad and in particular from Europe. According to JETRO Invest in Japan, about 40-50% of the requests they receive on the clean energy market come from European companies[61].

Apart from government policy, there are plenty of other attractions to get active on the Japanese market. The following are most often named in relation to clean energy:

- **Market scale.** As the 3rd largest economy in the world, Japan is a big market. The scale of the activity in the clean energy sector makes it worthwhile to enter this market by itself. A market of 49 JPY trillion is foreseen by 2015 for global warming mitigation[62].

- **Trendsetting market.** It is as a company beneficial to be part of a trendsetting market as it provides a learning opportunity to be more competitive at home. This

[58] Cabinet Japan. 2010. "On the New Growth Strategy." http://www.meti.go.jp/english/policy/economy/growth/report20100618.pdf

[59] Jones, Randall S., and Byungseo Yoo. "Japan's New Growth Strategy to Create Demand and Jobs". Working Paper 890. OECD Economics Department Working Papers. OECD. http://www.oecd-ilibrary.org/docserver/download/5kg58z5z007b.pdf?expires=1390374514&id=id&accname=guest&checksum=EF6C2424E20F7A1E245322108BD91DF8

[60] Kantei. 2013. "Japan Revitalization Strategy -JAPAN Is BACK". http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en_saikou_jpn_hon.pdf.

[61] Data obtained by interview

[62] JETRO. "Attractive Sectors." http://www.jetro.go.jp/uk/Invest_in_Japan/Attractive_Sectors/

is in particular true for floating offshore wind, electric vehicles and geothermal energy.

- **Quality reference.** Japan is a good reference for the rest of Asia and even the world since the Japanese are known for quality.

- **Greater protection of intellectual property** and a **more secure legal environment** when compared to other Asian markets[63]

3.4 Market Access Issues for European Companies and SMEs in Japan

Many large European energy companies are already active on the Japanese market. Examples include Vestas, ABB and Siemens. Many of these companies have re-engaged with the Japanese market after the Fukushima disaster. For example, Siemens has re-entered the market in 2011 after renewable energy came back on the agenda[64], and Vestas has formed a joint venture with Mitsubishi Heavy Industries focusing on offshore wind.

These companies are in general active on the market by establishing a sales subsidiary, creating joint ventures or signing agreements with Japanese distributors or system integrators. Conversely, several Japanese companies are investing more and more in Europe in clean energy projects to get access to know-how and technologies that they could bring back to Japan.

Clean energy-related companies experience the same problems for market access as has been documented for other sectors[65]. When it comes to SMEs, it needs to be stressed that the Japanese market requires innovative concepts and technologies in order to gain a good market position. It is hence important to evaluate the competitiveness position of the technology on the market since Japan is already a highly industrialised market. Moreover, customer service is a key factor to take into account for technology products, as well as staff experience, the business culture, and the time it takes before you can be successful[66].

[63] These two characteristics were the top results in a suvey on Cleantech opportunities in Japan by JETRO and Kachan & Co. in June 2012 comparing the advantage of Japan to other Asian countries.
[64] ModernPowerSystems. 2011. "Siemens Re-enters Japan's Wind Market", October 20. http://www.modernpowersystems.com/news/newssiemens-re-enters-japan-s-wind-market
[65] Conclusion reached through inteviews conducted for this research
[66] EU-Japan Centre for Industrial Cooperation. 2012. "Strategies for Promoting the Internationalisation of

The entry hurdles are high for foreign companies in Japan since these companies will need to compete with Japanese suppliers that are often preferred by their established network[67].

Table 4: General challenges in the Japanese clean energy market for European companies[68]	
Service Network	Due to the high service expectations of Japanese customers, high quality products that do not fail and a good service network which promises a quick response time is necessary. For companies new to the Japanese market this is challenging to set up. The general expectation of service in Japan is that it has been included in the purchase price. It has been remarked that in the wind power sector, unsatisfactory service pushed to more domestically made turbines to be bought
Local vs. Foreign made	Japanese customers prefer generally domestic products due to the burden that is associated with foreign products such as language and time it takes to deal with foreign-based companies. However, they will buy foreign goods if the product is a specialty product, less expensive, social status brand or not available in Japan. For example, solar panels from domestic suppliers are more popular the residential PV market. However, for developers of solar farms this is less of an issue as price is a bigger issue here.
Japan is a Mature Market	Competing with large corporations with a similar product is seen as futile. The only way to succeed in this type of markets is to partner with a corporation with the necessary size and market clout. Typically, foreign companies pursue a niche strategy, where they concentrate on a sector that is of little interest to the larger Japanese companies (but is still of sufficient interest to medium sized companies).
Partnering/Merger and Acquisitions	Find a local partner and building a solid business relationship takes considerable time. Most successful foreign companies have first linked up with local Japanese companies by using them as agents or distributors, and then, over time, built up a closer and more integrated business relationship. Hostile takeovers are, in Japan, almost unheard of, but mergers or acquisitions are possible if the Japanese partner has developed the necessary trust in the foreign partner, believes that the partner is in Japan for the long term, and that the Japanese company's obligations and employees will be taken care of. It is important to understand that the key objective of a high number of Japanese companies is not to generate wealth for their shareholders only, but to pursue a business which is in the interest of the main stakeholder which is society as a whole.
Complexity of National, Prefectural and Local Government	The three different levels of government often issue similar but different policies which make it extremely difficult to understand what the exact rules and regulations are. There are, for example, a number of subsidies and eco friendly measures adopted at different government levels. Understanding what the entitlement actually is (what is applicable in any given case), and

SMEs in the EU and Japan". Seminar Report. Tokyo.

[67] Clark, Pilita. 2012. "Japan Beats Path to Renewable Energy." Financial Times, October 3. http://www.ft.com/cms/s/0/f729c024-0caa-11e2-b175-00144feabdc0.html#axzz2azTJWIyT.

[68] Based on OSEC report, supplemented by interviews. OSEC. 2012. "The Japanese Market for Cleantech. Opportunities and Challenges for Swiss Companies". http://www.s-ge.com/switzerland/export/en/filefield-private/files/43092/field_blog_public_files/22203

	how to apply for the subsidy may take considerable time and effort. There is clearly a lack of coordination between ministries and the different levels of government. For European solar developers in Japan this posed an additional difficulty for their activities, but not insurmountable.

A survey about what core business attributes are necessary for North American cleantech companies to seek investment and partnerships in Japan found that technology innovation is the most important attribute (30% very important, 8% important). It is followed by business model differentiation (24% very important, 13% important), potential markets/competitors (23% very important, 16% important), cost breakthrough (21% very important, 15% important) and team/management capabilities/track record (11% very important, 22% important)[69].

Table 5: Policy and technical issues limiting European companies to enter the Japanese renewable energy market[70]

Lack of liberalisation of the electricity market	Infrastructure and energy market barriers are created by the effective monopolies held by the country's ten regional utilities across the electricity value chain. The Japanese government has embarked on an electricity market reform to loosen the control these regional utilities have in their respective areas on generation, transmission and distribution. A first reform package to set up an independent body to coordinate supply and demand across Japan has been approved by Japanese lawmakers in November 2013. Next up is the liberalisation of the retail electricity market by 2016 and the unbundling of generation, transmission and retail operations into separate legal entities from 2018 to 2020. However, the keidanren is still opposed to a liberalized market as they are concerned about maintaining security of supply and affordable prices[71]. In addition, it is said that real competition in the electricity market will not take place until utilities' operations are structurally "unbundled"[72].
Limited access to the electricity grid	The current grid has not been designed for distributed energy sources. Investment in and expansion of Japan's electricity grid is necessary to accommodate these new energy sources. The idea persist in Japanese utilities that only a limited share of electricity production can be allocated to renewable energy, in the same way that other energy sources have their allocation. Companies right now are facing refusals in connecting to the grid,

[69] JETRO, KACHAN, and Ellisa Feinstein. 2012. "Cleantech Opportunities in Japan". San Fransisco: JETRO.
[70] Information acquired through interviews
[71] UK Trade and Investment. "Japan/UK; Electricity Market Reform Dialogue– January 2014." Open to Export. Tokyo.http://opentoexport.com/article/japan-uk-electricity-market-reform-dialogue-january-2014/.
[72] Adelman, Jacob. 2013. "Japan Passes First of Reforms to Reshape Power Industry."Bloomberg Sustainability, November 13. http://www.bloomberg.com/news/2013-11-13/japan-passes-first-of-reforms-aimed-to-reshape-power-industry.html

	together with a lack of transparency on how these decisions are being made[73].
Regulatory issues	Unclear specifications that are different from utility to utility and sometimes even inside the same utility give a burden to foreign companies.
	Even if standards are used, extra tests are necessary that are sometimes difficult to perform. For example, while a certain component can be delivered under the IEC standard, a local test in Japan is still necessary. For highly advanced components this is often not an easy task to comply with, in particular since SMEs and even larger companies do not have production facilities in Japan where these components can be tested.
	Utilities are required to purchase the renewable electricity that is generated, but can refuse under certain conditions, for example when the stability of the grid is endangered. However, a satisfactory explanation is often not given. Limitations have also been put in place in some regions such as Hokkaido due to lack of grid capacity.
	Often there is the need for local government certification.
Lack of project financing	True project financing is said to not exist in Japan, while this is crucial for clean energy projects. Some domestic banks also have local content criteria. It is suggested by people in the business it is often easier to consult foreign banks in Japan or bring in money from abroad.
Insufficient experience in renewable energy	In banks, in government, even in (domestic) consultancies there is a still insufficient of experience with renewable energy, which affects the decision making. Knowledge on solar power is fast increasing, but for other sources such as wind and biomass, there is still a steep learning curve.
Fixation on technology	In particular, Japanese partners have a fixation on technology, while services related to these technologies such as engineering and project development are equally important. This is also apparent in the lack of independent engineering companies on the Japanese market that can design installations separately from suppliers of technology.

3.5 Funding and Cooperation Opportunities from Japan

When a non-Japanese company sets up a presence in Japan, this presence will be a Japanese company and hence eligible for support measures directed towards Japanese domestic operations. However, foreign companies accessing the Japanese market have in general limited interest in these subsidies and promotion measures since they consider them to be too time consuming. SMEs rather want to get their product on the market and they do not have the resources to investigate the specific requirements that go with certain policies. This is not to say they are not open to receive suggestions on measures that are appropriate to the development of their business.

[73] According to a survey of solar energy companies by the Japan Renewable Energy Foundation, 20% of the respondents said they were denied access by local utilities due to overcapacity, while 37% were told there would be limits to the amount of electricity that the utilities could accept.

The FIT is a good example of a promotion measure that has the power to attract foreign businesses to Japan.

National government support for clean energy

The Japanese budget on a national level to support clean energy is quite substantial. For fiscal year 2014[74], the total Japanese budget amounts to JPY 95.88 trillion. Out of this, JPY 872.7 billion is reserved for the "Energy Resources Special Account", which is an extra budget for METI[75]. Half of this budget can be directly related to clean energy projects (see table 6), an increase of 16%[76] compared with the previous fiscal year.

Table 6: Clean Energy headings in the METI Energy Resources Special Account budget 2014 (In billion JPY)	
For the maximum installations of renewable energy	136.4
Acceleration of research and practical use of high efficiency thermal power generation	24.9
Acceleration of energy conservation investments related to energy costs reduction	156.5
Expansion of fuel cells utilization	14.9
Establishment of new energy management model	11.6
Promotion of innovative technological development	117.6
Total	461.9

Related to clean energy, smaller budgets for clean energy can also be found at other ministries such as the Ministry of Environment (e.g. low-carbon society development) and the Ministry of Agriculture, Forestry and Fisheries (e.g. biomass development[77]). Furthermore, the "Special Account for Reconstruction from the Great East Japan Earthquake" provides on its part support for clean energy related reconstruction (e.g. renewable energy support). The distribution of these public funds improves the growth of the clean energy sector in Japan as it often targets bottlenecks in the system such as power grid development.

The budgets that are listed above find their way towards the private sector. For example, the floating offshore wind power project off the coast of Fukushima is funded by METI and was awarded to the Fukushima Floating Offshore Wind Farm Fukushima Floating Offshore Wind Farm Demonstration Project Demonstration Project (Fukushima

[74]The Japanese fiscal year starts on 1 April
[75]METI. 2013. "Energy Resources Special Account (In Japanese)". http://www.meti.go.jp/main/yosan2014/131224_energy2.pdf
[76]Calculation of the same categories in budget FY 2013 = JPY 397.5 billion
[77]MAFF. 2013. "Highlights of the 2014 budget (in Japanese)". http://www.maff.go.jp/j/budget/2014/pdf/26_kettei_point.pdf

FORWARD), a consortium lead by Marubeni[78]. However, it is often difficult for European companies, even less well-connected Japanese companies, to gain access to this type of public procurement.

The Feed-in Tariff

The FIT is the main attraction that brought renewable energy companies to Japan after the Fukushima disaster. This policy foresees continuous support for new renewable energy installations over 20 years in order to promote investment in renewables. Foreign investment is welcomed by the government and no restrictions apply for foreign players[79]. Until October 2013, the large majority of introduced projects were solar power with 5.6GW out of 5.8GW[80].

Particular about this FIT is that the FIT price for a project is set at the time of the METI approval. In other countries such as Germany, the FIT is awarded at the time the installation starts delivering[81]. In addition, there is no connection between obtaining the approval and a project's feasibility. This led in Japan to a boom in applications as there was no regulation about when exactly the installation was required to start providing electricity. As a result, a discrepancy emerged between the approved and introduced renewable energy projects since the introduction of the FIT. As of 31 October 2013, 26.2 GW of projects have been approved, but only 5.9 GW has been introduced[82]. METI has launched a review of approved projects over 400kW in September 2013 to investigate the issues surrounding this discrepancy. They plan hearings in March 2014 with developers of 672 solar ventures approved in fiscal year 2012, and may revoke the approvals[83].

[78] Fukushima Forward. "Fukushima Floating Offshore Wind Farm Demonstration Project (Fukushima FORWARD)". http://www.fukushima-forward.jp/pdf/pamphlet3.pdf

[79] Orrick. 2012. "Green Rush Hits Japan". 27 June. http://www.orrick.com/Events-and-Publications/Documents/4802.pdf

[80] METI. 2014. "Announcement Regarding the Present Status of Introduction of Facilities Generating Renewable Energy as of October 31, 2013". http://www.meti.go.jp/english/press/2014/0110_02.html

[81] Lenz, Karl-Friedrich.2013. "Setting Prices for FIT Solar Projects in Japan". 16 December. http://k.lenz.name/LB/?p=10161

[82] METI. 2014. "Introduction and approval of renewable energy according to prefecture". http://www.meti.go.jp/press/2013/01/20140110002/20140110002-5.pdf

[83] Watanabe, Chisaki. 2014. "Japan May Cancel Solar Projects on Concern Delays Are Deliberate." Bloomberg, February 14.http://mobile.bloomberg.com/news/2014-02-14/japan-may-cancel-solar-projects-on-concern-delays-are-deliberate.html.

In the future, the FIT can be adjusted if the minister deems it necessary. So far, the FIT has been adjusted once in April 2013, when the FIT for solar power was cut by 10%[84]. The lack of project requirements, setting of the FIT at time of approval and this price cut resulted in a sharp decline of approval rates in April 2013 in May 2013[85]. The FIT is likely to continue at a good price over the next three years as Japan has made the pledge to the UN in December 2013 to promote renewable energy as much as possible over the next three years[86].

Tax incentives and installation subsidies

Japan has negative and positive incentives to promote clean energy. There are taxes on fossil fuels, such as an oil tax, gas tax, diesel oil delivery tax and aviation fuel tax. When a comparison is made with fuel taxes in other western countries, Japan is generally seen as a country that has relatively low taxes[87]. A carbon tax is also enforced in Japan since October 2012. The tax rate of JPY 289 per t-CO2 is expected to bring in JPY 262.3 billion in tax revenue is to be used for the introduction of renewable energy and the enhancement of energy savings measures[88]. These taxes go into a "Green Fund", administered by the Green Finance Organisation that makes equity investments into domestic green projects and leverages private finance into these projects[89]. It targets projects with the potential to become business models used by regional communities

[84] METI. 2013. "Settlement of FY2013 Purchase Prices for Newcomers and FY2013 Surcharge Rates under the Feed-in Tariff Scheme for Renewable Energy". http://www.meti.go.jp/english/press/2013/0329_01.html

[85] 5.6 GW was approved in February 2013, 8.1 GW was approved in March 2013, in April 2013 only 522 MW. Approval rates reached over 1GW again in October 2013 (calculation from monthly METI reports)

[86] Bloomberg New Energy Finance. 2013. "Japan Eyes Smart Meters, Fuel Cells to Tackle Climate Change", December 27.http://about.bnef.com/bnef-news/japan-eyes-smart-meters-fuel-cells-to-tackle-climate-change/

[87] Finnish Energy Industries. 2011. "Energy Taxation in Europe, Japan and The United States."http://energia.fi/sites/default/files/et_energiav_naytto_eng_040211.pdf

[88] Ministry of Environment Japan. 2012. "Carbon Tax (Tax for Climate Change Mitigation)". http://www.env.go.jp/en/policy/tax/env-tax/20120814b_ct.pdf

[89] "The fund never invests more than 50% of the total equity in any project. It has so far, invested in two renewables projects: i) a mega solar project covering Wakayama and Kyoto prefectures (100 million yen). This has stimulated private investment from local companies and residents and the revenues generated will be used in regional low-carbon activities; ii) a biogas power project in Gumma prefecture (100 million yen) to use food debris from factories. The Feed In Tariffs introduced in 2012 have led many to focus on solar power. The GFO focuses support on decentralised renewable deployment particularly in the biomass, wind and small hydro areas". UK Trade and Investment. "Japan/UK; Electricity Market Reform Dialogue– January 2014." Open to Export. Tokyo.http://opentoexport.com/article/japan-uk-electricity-market-reform-dialogue-january-2014/

to promote and profit from renewable energy[90].

Furthermore, a tax is levied on electric utilities at the rate of JPY 375 per 1000kW/h to promote electric power development. This tax originates from the 1970s in order to promote clean power. Both households and industry pay this tax[91]. In Europe, a wide variety of taxes exist on electricity, some higher and some lower than Japan[92].

In terms of renewable energy, there are subsidies for residential PV of JPY 15.000 to 20.000 per kW and tax deductions if a PV system is introduced as part of energy renovation. For non-residential renewable energy installations, a grant is given of 33% of total cost of facilities for business operators, or 50% for municipalities or NPOs[93]. On the part of taxes, there is a 7% tax exemption for small companies[94], a special initial depreciation up to 100% of the acquisition price (only for wind and solar) and a reduction of a third of the property tax[95]. Renewable energy projects in the disaster struck Tohoku area have 10% of CAPEX[96] (up to 500 million yen/year for 4 years). Tax incentives also exist for other clean energy areas such as environmental friendly vehicles and energy efficient renovation. For example, a new generation car (including hybrid car) is completely tax exempt[97].

Furthermore, the Japan Finance Corporation (JFC), a public corporation wholly owned by the Japanese government, is offering loans up to JPY 72 million for clean energy and energy efficiency installations over a 15 year period[98].

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[90] Watanabe, Chisaki. 2013. “Japan Government Green Fund Wants to Set Local Investment Model.”Bloomberg, November 6.http://www.bloomberg.com/news/2013-11-06/japan-government-green-fund-wants-to-set-local-investment-model.html.

[91] KPMG. 2013. ”Renewable Energy & Fuels”. http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/green-tax/Pages/renewable-energy-fuels.aspx#japan

[92] Finnish Energy Industries. 2011. “Energy Taxation in Europe, Japan and The United States.”http://energia.fi/sites/default/files/et_energiav_naytto_eng_040211.pdf

[93] For more information (Japanese): http://www.enecho.meti.go.jp/saiene/support/business.html

[94] According to Japanese law: A corporation whose capital is less than 100 million yen and employs less than 1000 people excluding the subsidiaries of a large enterprise

[95] Figures from presentation by Mr. Yuki Shimazu, Deputy Director New and Renewable Energy Division, Agency for Natural Resources and Energy (METI) and KPMG. 2013. ”Renewable Energy & Fuels”. http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/green-tax/Pages/renewable-energy-fuels.aspx#japan

[96] Capital expenditures (CAPEX or capex) are expenditures creating future benefits

[97] Ministry of Environment Japan. 2012. “Greening Vehicle Taxation”. http://www.env.go.jp/en/policy/tax/env-tax/20120814c_gvt.pdf

[98] Japan Finance Corporation. 2013. “Counter measures for Environment and Energy (in Japanese)”. http://www.jfc.go.jp/n/finance/search/15_kankyoutaisaku.html

Local government and actors

Supporting policies for clean energy are often found on a local level in Japan because various local governments have set their own environmental targets. For example, the disaster-struck Fukushima Prefecture set a target to become 100% energy self-sufficient using renewable energy by 2040 and Nagano Prefecture eyes 70% of renewable energy by 2050. Also on the regulation front things are moving. For example, Kyoto made the installation of 3 kW solar PV or Solar Water Heating (SWH) mandatory in all large buildings and Iida (Nagano prefecture) announced a municipal regulation in 2012 to facilitate community-based renewable energy project development[99]. Many more examples can be found, including initiatives that were started before the Fukushima disaster, such as the smart cities initiative[100] and the biomass town initiative[101].

Local communities also reach out to foreign actors. So has the Danish Embassy received inquiries and delegations from Japanese local communities concerning renewable energy since they are anxious to participate in a clean energy projects as they face structural employment challenges as nuclear energy plants remain shut down[102].

Local governments provide services to help with the set up of the offices and entry in the market. Examples include the Osaka Business and Investment Center[103] and the Tokyo Business Entry Point[104]. Some private initiatives also try to attract foreign business to certain areas and provide services to support a company's entry in Japan. For example, EGG JAPAN Business Development is a platform for creating new businesses located in the Marunouchi area in Tokyo and specifically looks for IT and environmental technology related companies to open a branch office.

JETRO

JETRO (Japan External Trade Organisation) provides foreign investors with information

[99] REN21. 2013. "Renewables 2013 Global Status report". http://www.ren21.net/Portals/0/documents/Resources/GSR/2013/GSR2013_lowres.pdf
[100] For more information: http://jscp.nepc.or.jp/en/ (Japan Smart City Portal)
[101] For more information: http://www.maff.go.jp/e/biomass.html (Ministry for Agriculture, Forestry and Fisheries)
[102] Fischer, Martin. 2012. "Wind Energy in Japan 2012". Danish Export Association
[103] For more information: http://o-bic.net/
[104] For more information: http://www.tokyo-business.jp/eng/index.html

on all aspects of doing business in Japan and offers free temporary office space up to 50 days[105]. Occasionally they publish reports on attractive sectors that include clean energy sectors. In November 2013, they released a report on renewable energy and batteries[106]. JETRO also runs the "Environmental and Energy Sector Business Matching Program" in Osaka where foreign companies are invited with the prospect of buying Japanese technologies or collaborating with Japanese firms[107]. They often invite companies to Japan and provide them with the opportunity to be represented at major trade fairs. For example, several foreign companies, including European SMEs, were presented at the JETRO booth at the World Smart Energy Week 2014 in Tokyo.

3.6 Funding and Cooperation Opportunities from Europe

Apart from support by the European Union under the Small Business Act for Europe[108], most member states and/or regions have their own promotion measures to advance the internationalisation of SMEs. Export promotion is a form of government intervention that is a main pillar of economic policy in many European countries and has a positive impact on trade volumes[109].

The main support for European companies in Japan is given by the embassies and export promotion agencies. They generally offer consultation services, partner search and the organisation of seminars to increase the appeal. However, not every country has a focus on clean energy companies and staff limitations make bigger member states more able to provide support than smaller member states. Countries such as Germany, The Netherlands and Denmark are in particular active and give companies of forum in Japan (see table 7).

Table 7: Activities of European Countries on Clean Energy in 2013 (non-exhaustive list)
German-Japanese Wind Energy Symposium 2013 (February 2013) in Tokyo
Smart Cities in Japan – Business Opportunities (7 June 2013) during the Asia-Pacific week in Berlin
Knowledge mission renewable Offshore energy (July 2013) by the Dutch Embassy
Renewable Energy World Fair 2013 (July 2013) in Tokyo, participation of several embassies, export promotion agencies or ministries: France, Germany and Italy

[105] For more information: http://www.jetro.go.jp/en/invest/ibsc/facilities/
[106] For more information: http://www.jetro.go.jp/en/invest/attract/
[107] JETRO. 2013. "Buyer Invitation Programme : Environmental and Energy Sector Business Matching Programme in Osaka". https://www.jetro.go.jp/uk/topics/20130626164-topics
[108] http://ec.europa.eu/enterprise/policies/sme/small-business-act/ See also: "What the EU does for SMEs": http://ec.europa.eu/enterprise/policies/sme/what-eu-does-for-smes_en.htm
[109] Beringer, S. 2013. Managing Globalization: government export promotion in Germany and Europe/EU. http://casgroup.fiu.edu/events/docs/2813/1358194132_.pdf

Austria Forestry Industry Forum in Nagano (29 August 2013), with special focus on wood biomass
Floating offshore wind (29 August 2013) in Tokyo by the Norwegian Embassy
Workshop - Restructuring of the Electricity system (30 August 2013) in Tokyo by Dutch and Norwegian Embassy
Cooperation agreement between Amsterdam Smart City and Aizu-Wakamatsu city (24 September 2013)
Austria Forestry Forum (23-24 October 2013) in Nagano
Nordic Green Japan conference (24 October 2013) All Scandinavian embassies together in Tokyo
German-Japanese Biomass day (5 and 8 November 2013) in Tokyo and Morioka
Renewable Energy Industial Fair (6-7 November 2013) in Fukushima. Paticipation by embassies from Finland and Norway, and regional agencies from NRW and Flanders
Danish companies have formed a consortium together with the Danish Embassy for the purpose of providing know-how and experience of Denmark in Higashimatsushima (Miyagi prefecture). There are no SMEs involved.

On an EU-level, the EU-Japan Centre for Industrial Cooperation can additionally give support through training, business matching (though the European Enterprise Network), cluster support, free temporary office space (Step in Japan) and a portal with information for EU businesses[110]. The EU is also running two programmes to help companies on the market, namely the Executive Training Programme (ETP) and the EU Gateway Programme. In particular the EU Gateway programme has a focus on clean energy. This programme brings European companies, largely SMEs, to Japan to give them an introduction to the Japanese market along various thematic lines, one of them "Environmental and Energy-related Technologies"[111].

3.7 Clean Energy Sector Procurement Processes in Japan

It is often found that the processes in which larger companies buy products from smaller companies is not transparent since Japanese business practice favours Japanese suppliers and their established supply chain. This is not only an issue for foreign companies in Japan, but also for Japanese companies themselves.

While in recent years, some Japanese manufacturing companies established overseas procurement offices to import directly from overseas suppliers, the majority of companies prefer to deal with actors in Japan. Therefore it is often essential to have a local representation in Japan to provide information and maintenance. Even if a local office is present, the time that is needed to get repairs from those companies could pose an additional drawback to procure by Japanese actors. It has been argued that the drop of orders from overseas wind turbine makers in the last couple of years is partly the result of this issue. A strong and fast maintenance service are indispensable

[110] For more information: http://eu-japan.eu/what-do-we-offer
[111] For more information: http://www.eu-gateway.eu/home

to convince Japanese buyers.[112]. For products that are not available in Japan such as certain highly advanced clean energy technologies, procurement from overseas companies can take place, but when a similar product becomes available that is domestically produced or has a proper maintenance and information service, the overseas players can lose out.

From the interviews conducted for this report, two methods of being successful were identified. One is to concentrate on selling to smaller companies, as it is more likely to be in contact with the right person and a personal relationship can often be built with the CEO. Another is to approach highly networked consultants that can find the appropriate persons in large companies. It is also crucial to have people in Japan that are convinced about the superiority of the technology and can bring this message to prospective customers.

Procurement processes in Japan's ten electric utilities are said to be not transparent, with just 10% of purchases to be announced publicly. Even if the tender is public, it is likely to go to the company that was involved in the preliminary study that was done by one of their established suppliers before the tender was published[113]. Since the public announcement is usually made only ten days before the deadline, non-involved companies do not have the time to make a successful bid. In January 2014, an in-house TEPCO panel has found that the utility paid two to five times more than reasonable levels in buying goods and services to run its operations[114]. Legally they are not required to adhere to announcing their tenders, but more competitive bidding could decrease the cost of utilities.

However, a more transparent bidding processes can be observed. For the procurement of smart meters by TEPCO for fiscal year 2014, a briefing seminar was organized beforehand to inform all interested partners of the bidding process[115].

In government procurement, tenders are also not communicated well in advance. Hence it is beneficial to have a Japanese partner or local office to quickly respond to these calls. Prior registration is also necessary, adding another layer of difficulty.

[112] Information obtained through interview
[113] Information obtained through interview
[114] Japan Times. 2014. "Tepco overpaying to procure goods, services: contract-screening panel". 10 January. http://www.japantimes.co.jp/news/2014/01/10/national/tepco-overpaying-to-procure-goods-services-contract-screening-panel
[115] TEPCO. 2013. "Notice of Briefing Session on Smart Meter Bidding (Mainly for 60A)". http://www.tepco.co.jp/en/corpinfo/procure/invited/bid_smartm_60a-e.html

With regards to the surge in renewable energy investment by local government, only one example could be identified of a European company which has won a tender to build a solar park[116]. For the reconstruction of the Tohoku area, some European countries invested a lot in bringing experts to Japan and also invited people from Japan to Europe to learn about how to rebuild in smarter way. However, there is not the impression among EU stakeholders that these efforts have paid off[117].

3.8 Experiences of European SMEs on the Japanese Clean Energy Market

As part of this research, SMEs active in the clean energy sector were identified and subsequently contacted for a more in depth analysis of their experiences. Through the support of embassies, consultants and visits to industry fairs, a number of SMEs active on the Japanese clean energy market were found[118].

Table 8: European SMEs on the Japanese Clean Energy Market	
Number of companies found	61
Most represented countries	Germany (12) France (8) Belgium (6) Netherlands (5) Spain (4) Austria (4) UK (4) Greece (4)
Representation in Japan[1]	31
Local Office in Japan	9
No partner or identifiable sales	21

This segment reports on the results of a series of interviews and meetings with ten SMEs (of which six had started successful sales on the Japanese market) and the analysis of 61 SMEs active on the Japanese market, either through a representative office or an export relationship through a partner. It also includes 21 companies that show a clear interest in the Japanese market, but have no identifiable sales record or partner. Answers were also obtained through interviews with business consultants in Tokyo and European embassies/export promotion agencies.

The characteristics of the Japanese market and business culture usually require a physical presence in Japan in order to show a long term commitment and to provide

[116] Infrastrutture. 2013. "Hergo Sun Japan KK has been selected for the construction and operation of 3,5 MW solar PhotoVoltaic plant in Japan". http://www.infrastrutture.eu/download/130515_CS_Kumagaya_Final_ENG.pdf

[117] Information obtained through interview

[118] Not all organisations that were contacted for this research have responded, hence these results might lean towards certain countries. The mapping of these companies, available as an annex to this report, was used as a tool, not to produce a comprehensive list of SMEs in the clean energy sector.

maintenance for their products. The cost of a branch office is often too high for SMEs. For this reason, these companies often operate through business partners and distributors and the number of SMEs with a local office is low.

Main findings

A prior connection to Japan often existed for successful companies on the Japanese market, either a relationship was started in Europe with a Japanese company or there was a partner on the Japanese market that could introduce them to a potential partner.

Most see the Japanese market as similar to any other market since the same business logic prevails. However, there is the need for a higher level of preparation and there is the need to listen to what the Japanese partners are asking in order to be successful. As a result, the process towards a deal is longer than in other markets.

Already having a representation in Asia makes the step to Japan easier, as costs for flight tickets and time usage are smaller. International experience in general also counts as beneficial when entering Japan, but is no guarantee for success.

Most have not used any supporting measure, except the FIT. Their respective embassies and JETRO were most named as being helpful for their market entry. There is interest in governmental supporting measures, but they do not have the resources to go and look for them themselves and regard the application process as time consuming, in particular from the Japanese government.

While most follow the classic approach to the Japanese market by seeking a Japanese partner or hiring Japanese personnel when they establish a local office in Japan, some use different approaches. Accessing the market through a partner is not the most successful avenue and is contested among professionals, but in case of SMEs an understandable choice. Some companies can be seen hiring Japanese speaking Europeans (in their European office) or English speaking Japanese (also in their European office) to prepare their first sale in Japan. Others make use of a consultant that plays the role as company representative in Japan. In this role, the consultant can follow up the market much more closely and spend more time looking for and liaising with clients than a partner usually does. By hiring Japanese speaking staff or a long term consultant, a stronger commitment can be shown to the Japanese clients. This is one of the key variables on which the European company is evaluated by the Japanese.

Success factors

- **Hiring of a local expert.** Persons with large expertise of the clean energy field and the Japanese market, as a consultant or staff member, facilitate the search for partners and clients. It was also found that all of these consultants had a technical background. The setup in which a certain consultant is representing several companies is often used as it is cheaper in the early stages of market entry. Four companies out of six companies interviewed that are successful on the market have followed this path.

- **International experience.** When companies have experience in other countries (other continents), they often say that Japan is equally challenging as any other market. Four companies out of six companies interviewed that are successful on the market had other international experience.

- **Prior connection to Japanese clients.** It might not be so important from the European company's point of view, but for prospective partners it is quite important that the product was already selected by other Japanese companies. Three companies out of six companies interviewed that are successful on the market had a prior connection.

Government support measures used by SMEs

Apart from the support through JETRO and embassies/export agencies, the EU Gateway programme is by far the most popular government support measure to advance on the Japanese market. From the Japanese side, the FIT has been a major attraction for European companies to the Japanese market. One company has also been found that used the Tokyo Metropolitan Government support measures for the Special Zone for Asian Headquarters[119].

Requests from Clean Energy related SMEs

SMEs have a low interest in supporting measures for SMEs of the Japanese government and have modest expectations of what the EU can do for them. Procedures for

[119] For more information: http://www.chijihon.metro.tokyo.jp/ahq_project/. Unfortunately, this company has currently withdrawn from the Japanese market due to issues with their Japanese partner.

Japanese government support are perceived to be too complicated. It can be said that the Japan supporting measures are helpful, but add another layer of difficulty to the operations in Japan. There is, however, a consensus on the necessity of more information and an active engagement of the EU, specifically on:

- **Market information.** Information on the market segment companies are aiming at and where exactly opportunities can be found. The newly launched website www.eubusinessinjapan.eu (launched January 2014) could provide this information.

- **Trade fair participation.** A monthly list of trade fairs that take place categorized by sector and in particular fairs in which the EU will participate. It is expected that apart from embassies and export promotion agencies, the EU itself would participate in these trade fairs and give the opportunity to European SMEs to get access to these events. In context of the "Cluster Support Pilot Mission to Japan on Green Materials and CleanTech" at the end of 2012, a European booth had been set up at a major trade fair and brought companies in a specific sector to Japan through clusters in order to achieve a multiplying effect of the activity.

- **Activities to showcase companies.** Give the floor to European companies at events that would attract sector representatives and potential partners.

- **Access to Japanese funds.** Tapping into Japanese funds could provide credibility towards potential Japanese investors and clients. Detailed information is necessary on who is eligible and how the procedure works. It has also been suggested to create a special EU-Japan fund to ease the startup phase of innovative technologies, as this could provide the incentive for other investors to participate.

4 Opportunities on the Japanese Clean Energy Market for European SMEs

4.1 Overview

From data gathered through literature review and interviews with stakeholders in the energy field and export promotion in Tokyo, wind energy and bio energy have been most often identified as having potential on the Japanese Clean Energy market for European companies. Several other areas have also been named, of which a short overview is added. These are electric systems and smart grid technologies, solar energy, geothermal energy and energy efficiency technologies for buildings. Furthermore, electric vehicles and all types of clean transportation have also been put forward. Due to time constraints for this paper, these have not been considered in a detailed segment as the wind and bio energy sectors.

In general, all renewable energy sources that are covered by the FIT are considered to have potential for SMEs, in particular when it comes to related niche technologies that are not available on the Japanese market.

Table 9: Renewable energy introduction in Japan since the introduction of the FIT

Renewable energy generating facilities (type of source)	**Before introducing the Feed-in Tariff Scheme**	**After introducing the Feed-in Tariff Scheme**	
	Combined total capacity of facilities before July 1, 2012	**Combined total capacity of facilities in FY2012 (from July 1, 2012, to March 31, 2013)**	**Combined total capacity of facilities in FY2013 (from April 1 to July 31, 2013)**
Photovoltaic power (for households)	About 4,700,000 kW	969,000 kW	552,000 kW
Photovoltaic power (other than households)	About 900,000 kW	704,000 kW	1,691,000 kW
Wind power	About 2,600,000 kW	63,000 kW	3,000 kW
Small and medium hydropower	About 9,600,000 kW	2,000 kW	1,000 kW
Biomass power	About 2,300,000 kW	30,000 kW*	71,000 kW
Geothermal power	About 500,000 kW	1,000 kW	0 kW
Total	About 20,600,000 kW	1,769,000 kW	2,317,000 kW

Source: Agency for Natural Resources and Energy, METI

4.2 Wind Power

It is often said that Japan is not the most suitable country for wind power since there is little room for turbines onshore and the waters are too deep to build offshore windmills[120]. It is true that Japan is lagging behind other nations when it come to wind power, with only 0.4% of electricity powered by wind in 2012[121], as compared to an EU average of 11%[122]. However, onshore wind has a lot of potential particularly in Tohoku, Hokkaido and Kyushu, and the potential for offshore wind is even greater.

Direct subsidies that paid for a third of the cost of renewable energy projects were phased out in 2010 and explain partly the low level of new capacity that was added to the Japanese wind market in 2011 and 2012. This subsidy was ended in order to be replaced by the FIT. However, this FIT was introduced later than expected and has so far failed to increase new wind projects. Only 66 MW of capacity has been introduced between 1 July 2012 and 31 July 2013, as compared to 3.9 GW for solar power[123]. 823MW has been approved. Mainly the long environmental assessment procedure has been blamed for this lack of additional capacity, but also grid issues have been named.

Since the Fukushima nuclear disaster, a lot of focus has been placed on floating offshore wind. METI and the Ministry of Environment realized the potential of this source soon after the disaster and each commissioned a demonstration project, respectively near Fukushima and near Goto Island, Nagasaki[124]. The costs, in particular of the Fukushima project, have received criticism. The Fukushima turbine operates at JPY 2 million per kilowatt, while onshore wind projects typically operate at JPY 250.000. Efforts to halve the cost per megawatt are underway for the next phase of the installation of two additional turbines[125]. Similarly in Europe, Statoil is projecting that

[120] Clark, Pilita. 2012. "Japan Beats Path to Renewable Energy."Financial Times, October 3. http://www.ft.com/cms/s/0/f729c024-0caa-11e2-b175-00144feabdc0.html#axzz2azTJWIyT.

[121] Observ'ER. 2013. "Worldwide Electricity Production from Renewable Energy Sources. Fifteenth Inventory - 2013 Edition." Stats and Figures Series.http://www.energies-renouvelables.org/observer/html/inventaire/pdf/15e-inventaire-Chap03-3.12.4-Japon.pdf

[122] The European Wind Energy Association. 2013. "Wind in Power: 2012 European Statistics."http://www.ewea.org/fileadmin/files/library/publications/statistics/Wind_in_power_annual_statistics_2012.pdf.

[123] METI. 2013. "Announcement Regarding the Present Status of Introduction of Facilities Generating Renewable Energy as of June 30, 2013". Agency for Natural Resources and Energy. http://www.meti.go.jp/english/press/2013/1004_02.html

[124] For more information: http://goto-fowt.go.jp/english/

[125] Watanabe, Chisaki. 2013. "Fukushima Floating Offshore Wind Project Seeks to Halve Cost." Bloomberg, November 29.http://www.bloomberg.com/news/2013-11-28/fukushima-floating-

their second floating offshore wind project near Scotland will have a cost reduction of 70%, a cost reduction that also could be directly projected onto Japan.

On a policy level, floating offshore is seen as a technology that needs support in order for it to be exported to other markets. In Prime Minister Abe's growth strategy of June 2013 titled “Japan Revitalization Strategy: JAPAN is BACK”, one of the three related action plans is the "Strategic Market Creation Plan". In this plan, specific attention is given to the "promotion of offshore floating wind power generation" in order to aim for competitiveness on the global market.

Europe, as the world’s top region for wind energy is a strong player in the wind energy field and developments into floating offshore are also underway. Four out of six of the biggest companies in the wind sector are European and hold a combined share of 37.8% on the global market[126]. Offshore wind deployment is biggest in European countries with the United Kingdom (3461MW), Denmark (1274MW) and Belgium (453MW) as the top 3 countries with this power source in the world[127]. There is a clear interest to export wind technology from Europe, initiatives have been started in Denmark[128] and the Netherlands[129]

Market potential

The Environment Ministry estimates that the amount of offshore wind energy that can be potentially generated in Japan is 1600 GW as compared to 280 GW for onshore wind. Hence, offshore alone could generate ten times that of solar power and eight times the current total capacity of Japan’s power companies[130]. The majority of this wind potential is located in deep sea and will require floating offshore technology.

The Japan Wind Power Association (JWPA) has a more conservative view on the

offshore-wind-project-seeks-to-halve-cost.html

[126] REN21. 2013. "Renewables 2013 Global Status report". http://www.ren21.net/Portals/0/documents/Resources/GSR/2013/GSR2013_lowres.pdf

[127] mid-2013 statistics compiled by the Earth policy institute (http://www.earth-policy.org), and calculation by author

[128] Fischer, Martin. 2012. “Wind Energy in Japan 2012”. Danish Export Association

[129] Rijksdienst voor Ondernemend Nederland. 2013. "Windenergieconsortium gaat Japanse en Koreaanse markt op". http://www.rvo.nl/actueel/nieuws/windenergieconsortium-gaat-japanse-en-koreaanse-markt-op

[130] Matsutani, Minoru. 2013. “Japan Hopes to Blow Ahead in Renewables with Floating Wind Farm.” Japan Times, September 10. http://www.japantimes.co.jp/news/2013/09/10/business/japan-hopes-to-blow-ahead-in-renewables-with-floating-wind-farm.

potential of wind capacity with 144 GW onshore and 608 GW offshore, of which 519 GW is for floating offshore wind. It proposes in their "Wind Power Potential and Long Term Target" to make wind power 10% of total electricity production by 2050. In their roadmap, wind power generation would grow from the current 2.6 GW in 2012 to 11.3 GW in 2020 and 50 GW in 2050[131]. They forecast the growth of Japan's purchasing of wind turbines, parts and maintenance services to grow from around JPY 300 billion a year now to JPY 500 billion in 2030.

Key Players in the sector

Apart from the ten regional utilities (see 3.2), several players have a stake in the Japanese wind energy sector. There are several domestic wind turbine makers of which Mitsubishi Heavy Industries (MHI) and Japan Steel Works (JSW) are the largest, but none of them are among the ten biggest wind turbine makers worldwide[132]. A third Japanese player, Hitachi, acquired the wind-turbine business of Fuji Heavy Industries in 2012. All the largest European makers are already active on the market, such as Vestas, Siemens, Enercon, Gamesa and Re-Power, with a considerable market share. However, most of the newly installed capacity in recent years was from Japanese turbine manufacturers, stating the need for a local and fast maintenance service as the main reason why domestic companies were chosen by developers. This point has been put forward as why certain European turbine makers have not been successful in recent years. Lack of a strong presence for maintenance on the Japanese market can be a threat to business success.

Wind projects, in particular offshore, will be larger endeavours than the currently prevalent solar projects. Therefore, it is likely that Japanese companies will take the lead and form Special Purpose Companies (SPC) in which they invite foreign companies in order to obtain the right technologies. In September 2013, MHI and Vestas agreed to form a joint-venture company (JV) dedicated to the offshore wind turbine business. This JV is planned to be in place before the end of March 2014. This could be the trend for European companies to enter this business area.

On the developer side, Eurus Energy is the largest wind farm developer, operating about 20% of all wind power in Japan. It is partly owned by Toyota Tsusho (60%) and

[131] Japan Wind Power Association. 2012. "Potential for Introduction of Wind Power Generation and Mid/Long Term Installation Goals (V3.2)" February 22. http://jwpa.jp/pdf/roadmap_v3_2.pdf.

[132] Clark, Pilita. 2012. "Japan Beats Path to Renewable Energy."Financial Times, October 3. http://www.ft.com/cms/s/0/f729c024-0caa-11e2-b175-00144feabdc0.html#axzz2azTJWIyT

Tokyo Electric Power Company TEPCO (40%). They developed the first major wind farm in Japan in 1999 (Tomamae Green Hill, 20MW) and are now operating the biggest wind farm in the country (Shin Izumu, 78MW). Eurus also operates projects in Europe (a total of 833MW in 2013). Another big developer is Japan Wind Development Co., Ltd. which is running 293MW (11% of total wind capacity in Japan)[133].

The industry is represented by the Japan Wind Power Association (JWPA)[134] representing 58 companies and organisations, including foreign members. Another industry association is the Japan Wind Energy Association (JWEA)[135] representing 50 individual members, among them several representatives from companies and a high participation of universities.

In terms of research, the National Institute of Advanced Industrial Science and Technology (AIST), the New Energy Foundation (NEF) and the New Energy and Industrial Technology Development Organization (NEDO), all have projects related to wind energy.

The companies in the wind sector can be divided into 5 categories. Namely, Project Management & Operations; Suppliers; Original Equipment Manufacturer (OEMs) and Developers; Financial Institutions (banks, venture capital) and Owners (Independent Power Producers, Utilities, financial consortiums)[136]. SMEs are mainly to be found as suppliers (parts and components) and developers.

[133] Japan Wind Development Co., Ltd. 2013. "Business Companies and Power Plant Outline." Japan Wind Development Co., Ltd. March.http://www.jwd.co.jp/english/outline.html.
[134] For more information: http://jwpa.jp/index_e.html
[135] For more information: http://www.jwea.or.jp/ (Japanese only)
[136] Zaveri, Bhavin. 2009. "Drivers of M&A Activity in the Wind Energy Industry". London: Rajiv Gandhi Centre for Innovation and Entrepreneurship at Imperial College Business School.https://workspace.imperial.ac.uk/rajivgandhicentre/public/Bhavin%20Zaveri%20-%20MBA%20Project%20Summary.pdf.

Laws and regulations

The FIT for wind energy is currently JPY 23.10 per kWh (0.17 Euro) for large installations (20kW or more) and JPY 57.75 per kWh for small installations (less than 20kW)[137] for a period of 20 years. These are the highest in the world and substantially higher than in Europe (2.5 times the amount in Germany). These tariffs for wind remained unchanged after the first price drop in April 2013, which only affected solar power. The current price is set in relation to onshore wind energy. In order to provide more support for offshore installations, a FIT for offshore wind is expected to be set in the first half of 2014.

Table 10: Regulatory hurdles in the Wind sector
Environmental Impact Assessment increases the time until a new wind project can be developed
Specific Safety Standards due to extreme weather conditions and natural disaster
Agricultural Land Act that limits the conversion from agricultural land
Forest Act makes release from forest conservation difficult
Natural Parks Act, which has vague rules for landscape code
The Coast Act and Ports and Harbors Act, which makes it difficult to locate projects near ports and coasts.

In the report on EU-Japan trade barriers by Copenhagen Economics for DG Trade[138], one non-tariff measure is listed related to wind energy, namely a call to consolidate regulatory processes for reconstruction and operation of wind power projects. These are indeed the major stumbling blocks for companies to start in this area.

Extreme weather conditions (typhoons, high turbulence) and susceptibility to natural disasters (earthquakes, tsunami) give a partial rise to a set of specific safety standards that diverge from the International Electro Technical Commission (IEC), which apply to wind related technologies[139]. Therefore, integration of the Japanese Industrial Standards (JIS) is often essential to sell products on the Japanese market. The EU-Japan FTA negotiations are giving attention to the harmonisation of standards and could mitigate these issues over time.

The biggest hurdle to new wind farms is the Environmental Impact Assessment law. In addition, a series of environmental laws are limiting site availability for both onshore

[137] 1 EUR = 133.822 JPY

[138] Copenhagen Economics. 2009. "Assessment of Barriers to Trade and Investment Between the EU and Japan."http://trade.ec.europa.eu/doclib/docs/2010/february/tradoc_145772.pdf

[139] Worldview. 2012. "Wind Energy Opportunities in Japan". Worldview Report.http://worldviewnz.files.wordpress.com/2012/04/wind-energy-opportunities-in-japan.pdf.

and offshore wind turbines[140]. It requires power companies to conduct a complex assessment for projects greater than 10MW that can take up to four years. 3.5GW is at the moment 'stuck' in this assessment procedure[141]. There is a need for the government to start with a streamlined process before carrying out a full-fledged study[142]. Currently, METI is aware of the problem and actively working to shorten the assessment procedure. However, even with the current plans to shorten the procedure, it will still take two years. This shorter procedure could start earliest from 2015. In Europe, European legislation requires member states of the EU to carry out assessments of the environmental impact of certain public and private projects such as railway projects, wind farms, etc. The average duration of these assessments is 11.3 months[143].

The fishing industry needs to be taken into account in case of offshore wind and need to be included in the decision making process. However, while they were reluctant to cooperate before the great earthquake in 2011, dialogue and cooperation has been established since[144].

The Agricultural Land Act, Forest Act, Natural Parks Act, Coast Act and Ports and Harbors Act are all additional hurdles on which the JWPA asks the government to act upon, but they are not seen as equally disruptive as the environmental impact assessment.

Challenges

As mentioned above, the regulatory burden embodied by the Environment Impact Assessment law is currently the biggest challenge for the sector. However, the government is aware of these limiting regulations. As a result, the requirement to comply with the Japanese Building Code for wind turbines of 60 meter or taller has

[140] Ernst and Young. 2013. "Renewable Energy Country Attractiveness Indices". 37. http://www.ey.com/Publication/vwLUAssets/Renewable_energy_country_attractiveness_indices_-_Issue_37/$FILE/RECAI-May-2013.pdf.

[141] Information provided by the Japan Wind Power Association

[142] Kotsubo, Yu, and Keiji Takeuchi. 2013. "Japan's Feed-in-tariff System for Clean Energy Mired in Regulations ." Asahi Shimbun, May 22. http://ajw.asahi.com/article/economy/environment/AJ201305220009.

[143] GHK. 2010. "Collection of information and data to support the Impact Assessment study of the review of the EIA Directive". http://ec.europa.eu/environment/eia/pdf/collection_data.pdf

[144] Bossler, Annette. 2013. "Floating Turbines - Japan Enters the Stage." Wind Power Offshore, September 12.http://www.windpoweroffshore.com/article/1211680/floating-turbines---japan-enters-stage.

already been removed in April 2013.

The lack of sufficient grid connections in the areas with the best wind resources such as Hokkaido and Tohoku is another pressing challenge. METI is supporting the improvement of local grid connections providing half of the funds necessary. Extension work is expected to be finished within the next ten years[145].

An additional difficulty is the inaccessibility of government funded deployment projects. The floating offshore projects are entirely carried out by Japanese actors with no or very limited foreign involvement, potentially limiting future participation of foreign players in this market.

SME opportunities

The following areas have been identified as opportunities for European SMEs, based on interviews with selected stakeholders.

- ***Developers of wind farms***. Developing a wind farm is an area where Europeans have ample experience. As was the case with a flood of solar developers after the high FIT was introduced, the same can happen for wind after the FIT for offshore wind is settled and the regulatory issues become easier. It is crucial to be a part of the market sooner than later.

- ***Capital intensive wind turbine component makers.*** A wind turbine is made of ca. 10000 individual parts. There is a potential shortage of some of these components due to the continued global growth of the wind energy market and several barriers for new manufacturers of these components[146]. In particular, components that are capital intensive, and have high barriers of entry in terms of manufacturing are expected to do well on the Japanese market. These components are blades, bearings and gearboxes**.** However, not all manufactures in Japan outsource these components. For example, Mitsubishi has its blades manufactured 100% internally and only occasionally outsources the manufacturing of the gearbox and generator.

[145] Global Wind Energy Council. 2013. "Global Wind Report: Annual Market Update 2012."http://www.gwec.net/wp-content/uploads/2012/06/Annual_report_2012_LowRes.pdf

[146] Poncin, Anais, Lena Noëlck, Rémi Spinnewyn, Zheyu Huang, John Paul, and Dominique Estampe. 2011. "SCOR Supply Chain Benchmark: European Wind Turbine Manufacturers". BEM ISLI. http://www.management-supplychain.fr/wp-content/uploads/2012/02/BENCHMARK-SUPPLY-CHAIN-SCOR-Wind_Turbines-Industry.pdf-Adobe-Acrobat-Professional.pdf

However, the tower is equally sourced internally and externally, and the castings and forgings are completely outsourced[147]. In particular, the smaller wind turbine makers next to MHI might need to purchase components from experienced part makers to stay competitive on the market. In addition, as new challenges arise to build more turbines in new offshore locations, it could make these companies consider choosing proven technology from Europe. If the total cost of the Japanese turbines is too expensive, they will be bought elsewhere by developers.

- ***Technologies tailored to the specific meteorological conditions of Japan***. Technologies such as wind forecasting software & wind control systems in order to increase capacity utilization and cost reduction.

- ***Consultancies with experience on large wind farms***. All the know-how is available in Japan to build wind turbines, but less experience is considered to be available related to larger projects, even though big wind developers such as Eurus are engaged in global markets and handle big projects. For example, in Germany alone, there are 460 wind farms over 20MW, while in Japan there are only 51 such wind farms operational[148]. As wind power is likely to expand, more expertise is necessary to build large farms. Managing and operating larger farms requires a different skill-set as compared to small wind farms. Developers and consultancy firms can be engaged in these larger projects.

- ***Project finance for wind projects***. There is little knowledge in Japanese banks to assess wind projects and provide financing. On the solar market, this know-how was similarly not available, but as that market boomed since 2012, this type of expertise is growing. It gives the opportunity for investors to get a head start in financing wind projects.

- ***Offshore wind installation gear.*** When the FIT for offshore wind will be decided, a boost in new projects is to be expected. Japan currently possesses only a limited amount of offshore wind installation vessels. Any supporting service to install offshore wind power could be welcomed. Ship designers, towing companies and anchoring experts have been named as having potential if they start make their

[147] Lutton, Josh. 2010. "Wind Turbine Manufacturer Recommendations (Round 2)" April 27, Woodlawn Associates Management Consulting.http://www.woodlawnassociates.com/wp-content/uploads/WA-WT-Recs-R2-100427b.pdf.

[148] Calculations by the Author based on thewindpower.net, Wind Turbines and Wind Power database, 13 November 2013

alliances in Japan.

- ***Companies aiming towards the offshore floating wind market.*** Floating offshore wind is a new sector, where Japan is determined to take the lead and become bigger. They might be more drawn to floating technology since close to shore fixed offshore turbines might pose various obstacles such as fisheries and aquaculture. Floating wind is still a competitive field where no single type of technology dominates the market. Hence, Japan can create a competitive edge in this market that they intend to export globally. The floating offshore wind market in Japan presents itself as good opportunity to develop insights into a new global energy source. As more than 70% of the world offshore wind potential[149] is located in deep sea, there is a long-term future for this power source.

4.3 Bio energy: Woody Biomass and Biogas

While solar has seen a rapid increase, biomass has not gained significantly since the introduction of the FIT. Merely 101 MW has been added to biomass in the period 1 July 2012 to 31 July 2013. This is slightly better than wind power, but only a small fraction of the 3.9 GW of solar power that was introduced during the same period. Almost half of the newly installed biomass power generation comes from waste. Several reasons underpin this slow uptake such as the longer time until a project can start generating power. Combining timber from forest thinning and other woody materials, ca 500 MW in projects have been approved of which just 35 MW started operations.

The bio energy sector is quite complex since there are many forms of biomass resources (various solid, liquid, and gaseous bio energy carriers) and numerous conversion technologies (wood biomass to pellets, gasification, bio- and wood gas to electricity, and others). In addition, a distinction needs to be made between electricity generation and heating. In this section, attention will mainly be given to woody biomass and biogas, as they have been most often named by the interviewees for this report as having the most potential in Japan.

The figures on biomass electricity generation are divergent depending on the issuing

[149] Bossler, Annette. 2013. “Floating Turbines - Japan Enters the Stage.” Wind Power Offshore, September 12. http://www.windpoweroffshore.com/article/1211680/floating-turbines---japan-enters-stage.

authority. In a METI report on the FIT[150], biomass consumption is set at ca 3.5 TWh in 2010. However, according to the Institute for Sustainable Energy Policies (ISEP) "Renewables 2013 Japan Status Report", biomass electricity consumption was ca. 12 TWh in 2011[151]. This would respectively represent ca. 0.35% and 1.2% of total electricity consumption. The difference in statistics can be explained by the exclusion of self consumption in the METI figures.

The electricity generation capacity for biomass is currently 2.4 GW (July 2013) according to METI[152], but 3.25 GW in 2011 according to ISEP[153]. Biomass power generation is rising thanks to the spread of power generation making use of municipal waste and industrial waste[154]. Additionally, woody biomass has seen a significant increase in recent years, from 5.8% in 2010 to 8% in 2012 of total biomass capacity in Japan. According to ISEP, 55% of production is from municipal waste, 35% from industrial waste, 8% from woody biomass and 2% from food/livestock biomass in 2012[155].

Heat utilisation from biomass amounts to 1.563.000 kL (fuel oil equivalent or ca. 63 PJ), of which 28.7% is from municipal waste, 18.9% from sawmill scrap wood and 17.7% from the paper industry in 2006. It represents 46% of the total energy from biomass[156]. Following the introduction of the FIT in 2012, more than 50 biomass power generators are planned. However, they are viewed as too big (over 5 MW), without combination for heat usage and lacking a high energy efficiency[157]. In Germany, it is a condition to make use of the heat if the biomass electricity is to be used. Cogeneration of heat and electricity is important from a cost perspective.

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[150] METI Agency for Natural Resources and Energy. 2012. "Feed-in Tarriff Scheme in Japan" July 17. http://www.meti.go.jp/english/policy/energy_environment/renewable/pdf/summary201207.pdf.

[151] Institute for Sustainable Energy Policies. 2013. "Renewables 2013 Japan Status Report - graphs. (in Japanese)"http://www.isep.or.jp/wp-content/uploads/2013/04/JSR2013_Graph.pdf

[152] METI. 2014. "Announcement Regarding the Present Status of Introduction of Facilities Generating Renewable Energy as of October 31, 2013". http://www.meti.go.jp/english/press/2014/0110_02.html

[153] Institute for Sustainable Energy Policies. 2013. "Renewables 2013 Japan Status Report - graphs. (in Japanese)"http://www.isep.or.jp/wp-content/uploads/2013/04/JSR2013_Graph.pdf

[154] ISEP. 2013. "Renewables 2013 Japan Status Report". Institute for Sustainable Energy Policies (ISEP). http://www.isep.or.jp/en/wp-content/uploads/2013/05/JSR2013_Summary_Final_Eng0530.pdf

[155] Institute for Sustainable Energy Policies. 2013. "Renewables 2013 Japan Status Report - graphs. (in Japanese)"http://www.isep.or.jp/wp-content/uploads/2013/04/JSR2013_Graph.pdf

[156] ANRE METI. 2009. "The Current Situation of Biomass Energy Use (in Japanese)."http://www.meti.go.jp/committee/materials2/downloadfiles/g90213d03j.pdf

[157] Kajiyama, Hisashi. 2014. Opportunities and Challenges of Japan's Bioenergy Market: Micro- and small-scale biomass technologies after Fukushima.

When it comes to biogas, 200.000 kL (fuel oil equivalent or ca. 8 PJ) has been produced in 2006, of which 75% originated from sewage sludge[158]. Several cities have large biogas projects with biogas from sewage sludge, these include Kobe (800,000m3 per year), Nagaoka (600,000m3) and Kanazawa (280,000m3)[159]. It is said that the market is just starting for biogas[160].

Market potential

Besides waste biomass power generation, most other developed countries are ahead of Japan in the other biomass areas. Biomass in Japan is marked as a growing market as reported in the International Energy Agency's annual report to the Clean Energy Ministerial that expects the largest developments in China, Brazil and Japan[161]. The Ministry for Agriculture, Forestry and Fisheries (MAFF) is in charge of Japan's agricultural and forestry statistics. They have put forward a goal of how much biomass resources they would like to see utilized by 2020 (see Table 11).

Type of biomass	Amount generated annually	Present and target utilization ratio 2009 → 2020
1 Animal waste	Approx. 88 million tones	90% → 90%
2 Sewage sludge	Approx. 78 million tones	77% → 85%
3 Black liquor	Approx. 14 million tones	100% → 100%
4 Waste paper	Approx. 27 million tones	80% → 85%
5 Food waste	Approx. 19million tones	27% → 40%
6 Sawmill wood residue	Approx. 3.4 million tones	95% → 95%
7 Wood waste from construction	Approx. 4.1 million tones	90% → 95%
8 Non-edible parts of food crops	Approx. 14 million tones	85% → 90%
9 Forest off-cuts	Approx. 8 million tones	0% → 30%

Note: 1 Black liquor, saw mill wood residue, forest off-cuts are dry-weight, all others are wet weight.
2 Target for energy crops is 400,000 carbon tones produced by 2020.

Table 11: Biomass Targets for 2020 in Japan
From: Ministry of Agriculture, Forestry and Fisheries. 2012. "Biomass Policies and Assistance Measures in Japan". http://www.maff.go.jp/e/pdf/reference6-8.pdf

[158] ANRE METI. 2009. "The Current Situation of Biomass Energy Use (in Japanese)."http://www.meti.go.jp/committee/materials2/downloadfiles/g90213d03j.pdf
[159] Ministry Of Environment Japan. 2012. "Biomass Utilization Technology."https://www.env.go.jp/en/focus/docs/files/20120201-29_12.pdf.
[160] OSEC. 2012. "The Japanese Market for Cleantech. Opportunities and Challenges for Swiss Companies". http://www.s-ge.com/switzerland/export/en/filefield-private/files/43092/field_blog_public_files/22203
[161] Internation Energy Agency. 2013. "Tracking Clean Energy Progress 2013". Paris. http://www.iea.org/publications/TCEP_web.pdf

The Biomass Industrialization Strategy (2012) sees a potential of 13 TWh (equivalent of 2.8 million households) if the 2020 targets are achieved. If all unused biomass are to be used, 23 TWh (equivalent of 4.6 million households) could be reached[162].

Biomass from Forestry

Japan, as a major forest nation, has abundant resources for the woody biomass industry. 66% of the land area in Japan is covered by forests, accounting for 25 million ha of forested land[163]. According to Hisashi Kajiyama of Fujitsu Research Institute, Japan's timber accumulation is growing by more than 100 million cubic meters annually and has reached 6000 million cubic meters, double that of Germany which is the largest lumber producer in Europe. As most of the forests have been planted after WWII, Japan's forests have now reached an age where they can be used on a larger scale. In addition, MAFF statistics show that the forest residues are currently almost completely unused.

However, log production has consistently declined in Japan since the 1970s. As a result, forests became increasingly unmanaged, mechanisation of logging fell behind and less wood is available for biomass[164]. Japan is the largest importer of wood pellets in Asia and a study found that most of the pellets it consumes are used for co-firing at power plants[165].

Biomass from Agricultural land and by-products

The available amount of crop residue is comparatively low to contribute significantly to energy production in Japan. 14 million tons per year of unused residue available from major food crops grown in Japan, such as rice, corn and wheat, is available of which 30% is used.

[162] Ministry of Agriculture, Forestry and Fisheries. 2012. "Biomass Policies and Assistance Measures in Japan". http://www.maff.go.jp/e/pdf/reference6-8.pdf

[163] Yamamoto, Kayoko, Jun Izumi, and Shifeng Zhang. 2013. "Comparative Study on Woody Biomass Use and Application in Japanese Biomass Towns." Journal of Environmental Science and Engineering: 82–94.

[164] Kumazaki, M. 2013. "Wood Energy Industry in Japan – Current Situation and Problems" http://jp.fujitsu.com/group/fri/downloads/events/other/20131105-06kumazaki-en.pdf

[165] Roos, Joseph A.; Brackley, Allen, M. 2012. "The Asian Wood Pellet Markets." Gen Tech Rep. PNW-GTR-861. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station

Biomass from Waste

Municipal waste amounted to 45 million ton in Japan in 2011[166]. Incineration is common in Japan due to the limited habitable land[167]. In 2011, 1.211 municipal solid waste incineration plants were operating in Japan, of which 791 used the residual heat for other purposes. Heating water was the number one usage with 720 facilities. Furthermore, 314 facilities used heat to generate electricity, representing 1.740 MW of capacity and generating 7.487 GWh with an efficiency of 11.73%[168].

Key Players in the sector

The key players in the biomass sector depend on the specific type of biomass. However, there are common players as well. Apart from METI and MAFF, there is the National Biomass Policy Council composed of seven ministries involved in biomass policy[169]. In addition, the prefectural and municipal governments are important since they initiate biomass projects in accordance with the biomass promotion plans (*cfr. Laws and Regulations*). By January 2014, 328 municipalities have formulated biomass promotion plans, with the highest concentration in Hokkaido (30), Kagoshima (15) and Niigata (15)[170]. 14 prefecture-wide plans have also been established.

Table 12: Prefectures with biomass promotion plans
Hokkaido, Aomori, Gunma, Saitama, Chiba, Shizuoka, Kyoto, Hyogo, Shimane, Yamaguchi, Ehime, Kumamoto, Miyazaki and Kagoshima

Behind the biomass towns are so called Biomass Town Advisors, who are registered by a private body, namely the Japan Organics Recycling Association (JORA). This group is largely composed of employees of private consulting companies. Biomass towns can receive their consultation for free.

Companies from different sectors are getting involved in the biomass sector. For

[166] Ministry Of Environment Japan. “White Paper 2013 (in Japanese).” https://www.env.go.jp/policy/hakusyo/h25/index.html

[167] Japan Business Alliance for Smart Energy Worldwide. 2012. "Presentation of Presentation of Japanese technology Japanese technology of waste to energy". http://www.mofa.go.jp/region/latin/fealac/pdfs/4-9_jase.pdf

[168] Ministry Of Environment Japan. “White Paper 2013 (in Japanese).”https://www.env.go.jp/policy/hakusyo/h25/index.html.

[169] Ministry of Agriculture, Forestry and Fisheries. 2012. "Biomass Policies and Assistance Measures in Japan". http://www.maff.go.jp/e/pdf/reference6-8.pdf

[170] MAFF. 2014. “Situation of biomass towns and plans (in Japanese)”. http://www.maff.go.jp/j/shokusan/biomass/b_kihonho/local/pdf/chizu2601.pdf

example, major paper makers create their products from their own forests. However, wood chips from forest thinning cannot be used as raw materials for paper making and are generally discarded. For this reason, several paper makers in Japan such as Oji Holdings and Nippon Paper Industries are starting to construct biomass power plant to make use of this waste, helped by the FIT for biomass[171]. Other major energy players are also entering the market such as Showa Shell Sekiyu that will construct Japan's largest biomass plant with a generating capacity of 49 MW[172] and Sumitomo Forestry Co. and Sumitomo Joint Electric Power Co., who will build a 50 MW biomass power plant in Hokkaido[173].

Industry-related organisations are only operating in specific fields of biomass energy, except for the Biomass Industrial Society Network[174], which produces an annual Biomass White Paper since 2003[175]. Specifically in the woody biomass area, the Committee for the Promotion of the Use of Woody Biomass Energy[176], representing 67 companies and organisations, and the Japan Forest Biomass Network[177], representing 24 entities, are present. In the wood field there is also the Japan Wood Pellet Association[178] and the Pellet Club Japan[179]. In the biogas field, Biogas Net Japan[180] has been set up in 2008. It was a joint venture, set up by 11 companies, in order to pursue the commercial recovery, refining and distribution of biogas. This organisation completed its mission and has since been dissolved[181].

In terms of research, the National Institute of Advanced Industrial Science and

[171] Owada, Takeshi. 2013. “Paper Makers Seeing Profit Potential in Biomass Power Industry.” Asahi Shimbun, August 27.http://ajw.asahi.com/article/economy/business/AJ201308270079

[172] Asian Power. 2013. “Major Japanese Firms Turning to Biomass for Power”, August 19. http://asian-power.com/environment/news/major-japanese-firms-turning-biomass-power

[173] Watanabe, Chisaki. 2013. “Sumitomo Forestry Partners to Build 50MW Biomass Plant in Japan.”Bloomberg, October 23.http://www.bloomberg.com/news/2013-10-23/sumitomo-forestry-partners-to-build-50mw-biomass-plant-in-japan.html.

[174] For more information (Japanese): http://www.npobin.net

[175] More information (Japanese): http://www.npobin.net/hakusho/2013/

[176] For more information: http://www.w-bio.org. Note: The Wood Energy Industrial Network that was operating in the Kansai region has been dissolved in 2013.

[177] For more information: http://jfbn.org/

[178] For more information: http://www.w-pellet.org/

[179] For more information: http://www.pelletclub.jp/

[180] “Establishment of Biogas Net Japan.” 2008. January 15. http://www.jri.co.jp/english/release/2007/080115/.

[181] OSEC. 2012. “The Japanese Market for Cleantech. Opportunities and Challenges for Swiss Companies”. http://www.s-ge.com/switzerland/export/en/filefield-private/files/43092/field_blog_public_files/22203

Technology (AIST)[182], the New Energy Foundation (NEF) and the New Energy and Industrial Technology Development Organization (NEDO), all have projects related to biomass energy. Furthermore, Fujitsu Research Institute is actively advocating the usage of biomass and is involved in the organisation of several events and the publication of papers. They intend to build a model plant with the help of European companies[183].

On an international level, Japan's New Energy Foundation has established the Asia Biomass Energy Cooperation Promotion Office, responsible for linking East Asian countries and Japan in the field of biomass energy. Through their "Database of Renewable Energy Organisations in East Asia"[184], all biomass organisations in Japan and most of Asia can be found. NEF and AIST, in addition to METI and MAFF are involved in the annual Biomass-Asia Workshop.

Most of the woody biomass boilers that are installed in Japan are European made and few Japanese manufactures offer similarly advanced technologies[185]. The market is dominated by Schmidt (Swiss) with 57 installed boilers. Oyamada Engineering (Japan) has 11, Environtech (Japan) has 10, Tallbots (UK) has 7, Takahashi-kikan (Japan) has 5, Politechnik (Austria) has 5 and Tomoe techno also has 5[186]. In the overall biomass boiler market, three Japanese companies hold the largest share, namely Takuma (51%), Yoshimine (20%) and Sumitomo Heavy Industries (10%)[187].

Laws and regulations

The first biomass promotion plan called the "Biomass-Nippon Comprehensive Strategy"

[182] Through the "Biomass Refinery Research Center (AIST)". For more information: http://unit.aist.go.jp/brrc/eng/outline.html

[183] Kajiyama, H. (2014) Opportunities and Challenges of Japan's Bioenergy Market: Micro- and small-scale biomass technologies after Fukushima.

[184] For more information: http://jrdb.asiabiomass.jp/index.php?lang=en. In addition to biomass, solar, wind, low head hydro power and geothermal energy organisations can also be looked up. However, the focus is on biomass.

[185] Kajiyama, H. (2014) Opportunities and Challenges of Japan's Bioenergy Market: Micro- and small-scale biomass technologies after Fukushima.

[186] Aikawa, Takanobu. 2013. "Challenges on Biomass Use Technology and Engineering in Japan" presented at the Japanese German biomass day, November 5. http://jp.fujitsu.com/group/fri/downloads/events/other/20131105-09aikawa_murc-en.pdf.

[187] OSEC. 2012. "The Japanese Market for Cleantech. Opportunities and Challenges for Swiss Companies". http://www.s-ge.com/switzerland/export/en/filefield-private/files/43092/field_blog_public_files/22203

was launched in 2002 and the first Biomass towns appeared in 2004[188]. The "Basic Act for the Promotion of Biomass Utilization" in 2009 and "Biomass Application Promotion Basic Plan" of 2010 continued the biomass policy making process. These measures foresee the formulation of biomass application promotion in 600 cities, towns and villages. New biomass industries are foreseen to be created reaching ca. JPY 500 billion representing approximately 26 million tons of biomass in carbon content conversion by 2020[189].

The events surrounding Fukushima led to the Biomass Industrialization Strategy in 2012 that specified the targeted conversion technologies and set principles and policies for realizing biomass industrialization. The industrialization strategy has seven different initiatives: basic strategy, technological strategy, entrance strategy, exit strategy, specific strategies, comprehensive support strategy and overseas strategy. The specific strategies include strategies for individual biomass sources, such as the establishment of a woody biomass (forest off-cuts) energy utilization system in biomass power plants, in addition to the application of the FIT scheme. Tax reductions are also part of the plan, for example a one-third reduction of property tax for 3 years (same for other renewable energies) [190].

The FIT for biomass energy is divided by biomass type and only includes electricity generation:

- Biogas: 40.95 yen per kWh
- Wood fired power plant (Timber from forest thinning): 33.60 yen per kWh
- Wood fired power plant (Other woody materials): 25.20 yen per kWh
- Wood fired power plant (Recycled wood): 13.65 yen per kWh
- Wastes (excluding woody wastes): 17.85 yen per kWh

[188] Ministry of Agriculture, Forestry and Fisheries. 2012. "Biomass Policies and Assistance Measures in Japan". http://www.maff.go.jp/e/pdf/reference6-8.pdf

[189] Yamamoto, Kayoko, Jun Izumi, and Shifeng Zhang. 2013. "Comparative Study on Woody Biomass Use and Application in Japanese Biomass Towns." Journal of Environmental Science and Engineering: 82–94

[190] Ministry of Agriculture, Forestry and Fisheries. 2012. "Biomass Policies and Assistance Measures in Japan". http://www.maff.go.jp/e/pdf/reference6-8.pdf

It is expected that these figures will not be updated in April 2014 as not enough data is collected from current biomass projects.

Challenges

There are several challenges in the biomass sector right now. Regarding the FIT, the Biomass Industrial Society Network list three main issues in their 2013 white paper:

- Lack of separate tariff for small scale operations, making it difficult for smaller biomass plants
- No consideration towards the heat usage of a biomass plant, only electricity is supported
- No consideration for life cycle assessment and sustainability standards

The price level of the various categories is also a matter of concern, the timber from forest thinning is higher than from other woody materials such as sawmill off-cuts and bark, making these less interesting to use.

Another issue to get biomass plants started is their cost compared to Europe. The cost of small biomass installations is said to be five times higher than in Europe, which makes it difficult to make these projects commercially viable. The lack of engineering companies is also an additional burden. It was found that engineering firms in Japan aim to sell in-house products, which delivers a mismatch with the desires of the customer and the characteristics of the site, resulting in unsatisfactory biomass installations[191]. Many issues with the engineering of biomass projects have been found such as disregard of economic and environmental performance due to focus on forest resource utilisation or activation of local economy and inappropriate sizing due to inappropriate analysis of daily/seasonal heat demand profile[192]. In order to mitigate the issues on the Japanese market, a manual has been written on woody biomass usage in Japan[193]

[191] Kajiyama, Hisashi. 2014. Opportunities and Challenges of Japan's Bioenergy Market: Micro- and small-scale biomass technologies after Fukushima

[192] Aikawa, Takanobu. 2013. "Challenges on Biomass Use Technology and Engineering in Japan" presented at the Japanese German biomass day, November 5.http://jp.fujitsu.com/group/fri/downloads/events/other/20131105-09aikawa_murc-en.pdf.

[193] Download the manual here (in

On the regulation side, the Japan's Electricity Business Act makes the introduction of Organic Rankine Cycle (ORC) turbines impossible as they are treated as a pressure vessel of which anything over 300 kW requires a boiler/turbine engineer and 24 hour surveillance and hence too expensive[194].

It has been pointed out by several interviewees that finding the right partner for European companies in this sector is also particularly challenging. It is foremost important to find a good consultant and system developer to build a cost efficient installation. The consultant should be someone that has experience on biomass in both the EU and Japan. However, the consultants that are deemed favorable are in short supply.

SME opportunities

Biogas and woody biomass were put forward by the interviewees as the most promising areas in the biomass area. The following opportunities are based on these interviews, unless otherwise stated.

- **Woody biomass boilers and related technologies.** The woody biomass market is growing fast and there is a need for knowhow and solutions to reach higher efficiency rates. In particular, advanced biomass boilers systems that make use of both electricity and heat generation, since now the technology in Japan is often insufficient. European technologies (Switzerland, Austria, UK) are already installed.

- **Engineering companies that can deliver independent engineering solutions**. Currently, the boiler maker will provide the engineering for new projects which creates a mismatch with consumer demand and delivered installations. It is said there is a lack of independent engineering capacity in Japan. Engineering companies could come to Japan and seek local partners, in cooperation with European biomass boiler manufacturers.

- **Small scale Combined Heat and Power (CHP) technology.** The Japan Wood Energy Association suggests that small scale gasification CHP units can be used as a regional heater. At the moment, the only generation technologies are steam

Japanese): http://www.rinya.maff.go.jp/j/riyou/biomass/pdf/250610biomass1.pdf

[194] Kumazaki, M. 2013. "Wood Energy Industry in Japan – Current Situation and Problems" http://jp.fujitsu.com/group/fri/downloads/events/other/20131105-06kumazaki-en.pdf

boilers or steam turbines in large scale biomass plants. ORC turbines should also be considered, but Japan's Electricity Business Act makes the introduction of this technology at this moment difficult as it is treated as a pressure vessel of which anything over 300 kW requires a boiler/turbine engineer and 24 hour surveillance.[195]

- **Cooperation with small gas companies to deliver biogas.** Since the landscape has hundreds of small players next to Japan's big 4 gas companies (Tokyo Gas, Toho Gas, Osaka Gas and Saibu Gas), who could benefit from biogas. European SMEs, together with a Japanese partner could find access through these smaller companies. There is also a market for small scale farm installations.

4.4 Other Opportunities

Apart from wind power and bio energy, several other opportunities were highlighted during the interviews. However, several issues underpin the areas that are outlined below. While opportunities exist in these fields, there is no agreement on the immediate potential for SMEs.

Electricity systems and smart grid technologies

The move towards clean energy goes hand in hand with an enhanced electricity system in order to handle demand response and distributed energy generation. Electricity systems and smart grid technologies are understood here as products and services such as electricity control devices, IT services suppliers and storage systems for use with clean energy sources.

Japan is embarking on a massive electricity system reform plan. Following the limitations that became appartent after the Fukushima disaster, a roadmap for electricity market reform in Japan was proposed in three stages. A first bill that was adopted last year establishes an organisation to optimise supply and demand across regions by 2015 called the Organisation for Cross-regional Coordination of Transmission Operators (OCCTO). Two other stages are foreseen for the electricity market reform, namely the full liberalisation of the retail market and unbundling of the utilities and transmission. In the process of this reform, new industries will be created

[195] Kumazaki, M. 2013. "Wood Energy Industry in Japan – Current Situation and Problems" http://jp.fujitsu.com/group/fri/downloads/events/other/20131105-06kumazaki-en.pdf

in the electricity market which will be worth JPY 16 trillion by 2020[196].

At the same time, a lot of attention is being given to update the electricity infrastructure by creating more transmission lines, storage systems and smart meters[197] to integrate more renewable energy into the grid. There are also many projects underway to create smart cities.

Europe has ample experience on deregulated electricity markets and knows on how to handle renewable energy in the grid, an issue that Japanese utilities are very concerned about. However, it is unsure how large the opportunities will be as existing competitors for technologies such as smart meters are found to be closely tied to the ten electric power monopolies[198]. As the current move towards more open tendering at TEPCO shows, Japanese companies could be committed in making the best choices and giving opportunities to foreign companies. Moreover, as the liberalisation of the market will continue, more opportunities are expected to arise.

Solar Energy

While the first big surge in solar has passed, this market is expected to continue for several years driven by the FIT. After this period, rooftop solar will still present itself as a substantial market.

The FIT for non-residential PV is likely to be cut further, by as much as 20 percent[199]. Also the lack of appropriate land in the vicinity of grid connections is put forward as a reason why the non-residential market will slow down.

Market size for solar power was JPY 1.625 billion in 2012, with 53.5% for residential systems and 46.5% for non-residential systems. While the market is dominated by

[196] Kantei. 2013. “Japan Revitalization Strategy -JAPAN Is BACK”. http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en_saikou_jpn_hon.pdf.

[197] Ernst & Young. 2013. "Renewable Energy Country Attractiveness Indices (39)". Ernst & Young. http://www.ey.com/Publication/vwLUAssets/RECAI_39_-_Nov_2013/$FILE/RECAI%20Issue%2039_Nov%202013.pdf.

[198] OSEC. 2012. “The Japanese Market for Cleantech. Opportunities and Challenges for Swiss Companies”. http://www.s-ge.com/switzerland/export/en/filefield-private/files/43092/field_blog_public_files/22203

[199] McCue, Dan. 2013. “Expert Believes Robust Projections for PV Overblown.”Renewable Energy Magazine. November 22. http://www.renewableenergymagazine.com/article/experts-believes-robust-projections-for-pv-overblown-20131122/.

domestic manufacturers, JETRO expects that foreign manufactures will increasingly find opportunities as competitiveness grows with regards to scale and price[200].

A current debate in the solar market is the discrepancy between the approved and introduced solar energy since the start of the FIT in July 2012. Due to a lack of requirements for solar developers, METI has launched a review of approved solar projects in September 2013 for projects over 400kW after it became known less than 4GW of new projects were actually introduced out of 22GW of approved projects. Lack of experience with solar energy projects is said to be the main reason for the discrepancy between approved and introduced solar power.

Most solar related European companies with interest in the Japanese market have already moved in. Also many European solar developers are active on the market, as the European experience in developing solar farms can be directly transferred to Japan, in particular if the company has international experience. New opportunities are expected to arise for niche technologies, with a focus on rooftop solar.

Geothermal energy

The prospects for geothermal energy are mixed. Geothermal energy seems to be a logical choice by judging the large potential of 20GW[201] and the fact that the global market in geothermal is largely controlled by Japanese companies. Japan also has the third biggest potential for geothermal energy after the US and Indonesia. The Ministry of Environment has announced a plan to double geothermal power generation to 1 GW by 2020 and nearly 4 GW by 2030. However, many seem to be hesitant to whether it can deliver on that promise, despite a generous FIT and the lifting in 2012 of a moratorium on geothermal prospecting in national parks. The fact that it can take more than 10 years to complete a project because of the environmental assessment hampers growth[202].

During the committee meeting on new energy policy in June 2013, it was remarked

[200] JETRO. 2013. “Attractive Sectors: Renewable Energy/Secondary Energy”. Tokyo.https://www.jetro.go.jp/en/invest/attract/pdf/e_renewable.pdf

[201] The Geothermal Research Society of Japan. “Geothermal Energy Japan: Resources and Technologies.”http://grsj.gr.jp/en/all.pdf

[202] Nagata, Kazuaki. 2014. “Renewable Energy’s Future Rosy If Grids Ever Get Updated.” Japan Times, February 10.http://www.japantimes.co.jp/news/2014/02/10/reference/renewable-energys-future-rosy-if-grids-ever-get-updated

that a new dispute settlement mechanism is necessary as local opposition is currently a major stumbling block. It is crucial to convince onsen[203] owners of the value of this power source and let them share in the rewards.

Regardless of this outcome, geothermal energy in Japan remains steady on the number two place in recent Ernst and Young Country Attractiveness Indices reports. However, since 2000, hardly any new capacity has been installed. In December 2013, METI has expanded their projects from 10 to 20[204].

Opportunities can be found mainly for companies that wish to learn from the Japanese market and have a long time horizon.

Energy efficiency in buildings

Energy efficiency is often forgotten when talking about clean energy. The Japanese market has potential when it comes to technologies and services that increase energy efficiency, particularly in buildings. After the energy issues following the Fukushima disaster, measures to reduce the peak load were considered and the Top Runner programme for building insulation materials was introduced. The targets of this programme are materials that prevent heat loss such as insulation and windows. Labelling of this product groups will be introduced as has been the case for the other product groups under the Top Runner programme.

This Top Runner programme ensures Japanese appliances are on top when it comes to energy efficiency and encourages competition among companies based on the most energy-efficient product on the market. The product with the best energy efficiency serves as the benchmark with which other companies have to comply after a certain period. It is based on the 1998 amendment of the Act concerning the Rational Use of Energy. Next to building insulation materials, this programme also focuses on other categories such as cars, electronic appliances and more. Through this programme, an improvement of 48.8% was achieved for fuel efficiency of gasoline-engine passenger vehicles between 1995 and 2010, and an improvement of 30% for air conditioners between 2001 and 2011[205].

[203] Traditional hot spring resorts in Japan

[204] METI. 2013. "Notification of Geothermal Energy Development Resaerch Adoption Results (20 cases) (in Japanese)". http://www.meti.go.jp/press/2013/12/20131213002/20131213002.html

[205] EU-Japan Centre for Industrial Cooperation. 2013. “Policy Seminar: Energy Efficiency in Buildings in the EU and in Japan”. http://www.eu-japan.eu/sites/eu-japan.eu/files/Report_EU-

However, the deployment of these technologies is currently slow and might need more incentives to become significant as regulations are now dependent on how the market takes up new technologies. Even though insulation has been taken up by the Top Runner programme, there is still a lack of comprehensive standards.

JP_Energy%20Efficiency%20in%20Buildings_Dec013_0-update.pdf

5 Conclusion and Recommendations

The Japanese clean energy market is considered to be as any other market by many stakeholders, with the difference that Japan is a large market where there is a specific interest in clean energy technologies. Growth in these technologies is foreseen, particularly for renewable energy as Japan has a lower level of deployment as compared to Europe. To bridge this gap, Japan is looking actively for solutions from abroad, including from Europe.

The Japanese market just started to move after the Fukushima disaster and there is a chance for foreign players to be part of the game. However, Japan is in a luxurious position as it is able to choose from the best approaches worldwide. Therefore, it is essential to present these solutions in Japan and show the Japanese players in this market that Europe is here and engaged.

Several issues underpin the growth of clean energy, but they are not being seen as insurmountable. Japanese policy makers are aware of the necessity to remove the obstacles withholding growth, in order that Japan can attain a higher share of renewables in the energy mix and increase energy efficiency.

Foreign companies accessing the Japanese market have in general limited interest in the subsidies and promotion measures of the government side, except for the FIT. They consider the procedures to be too time consuming. SMEs focus to get their product on the market and they often do not have the resources to study the specific requirements of certain policies. While the interest in these policies is not so strong, they still would like to receive any information related to policies that can help their position on the market, in addition to tailored market information.

Success factors for SMEs on the Japanese market include hiring of a local expert who has a track record in the specific field the company is getting into. A prior connection to Japanese clients and international experience were also found to be correlating factors.

Opportunities for SMEs can be found in most sectors of the clean energy market. In particular, the wind energy market, woody biomass and biogas have been identified as having potential.

Actions the EU can take to promote European companies in Japan

- **Organising activities focused on a specific technology or service.** As Japan is still in its "fact finding mission" for clean energy technologies, solutions can be presented by organising events focused on one specific technology, in particular the ones in which the EU as a whole is advanced and the Japanese market has potential. A clean energy programme at EU level could be started in which embassies can opt in depending on the activity. This can support the work of the embassies, while promoting companies at the same time. With these activities, companies get a platform, and the EU can position itself in Japan.

- **Include clean energy in the upcoming EU-Japan FTA.** Market access issues such as standardisation can be addressed through the FTA. It will give companies in the two regions mutual access to new technologies and new research. The EU-Singapore FTA can serve as an example as how renewable energy is included in this agreement. In order to facilitate how standards are being implemented, it has been suggested that a committee should be formed, which can analyse cases of unclear specifications and additional testing in order to look for solutions.

- **Include clean energy in the upcoming EU-Japan SPA.** An effort to stimulate relations on clean energy between the EU and Japan should be made through the upcoming SPA, since this agreement can create a platform that can lead to business. A dedicated clean energy dialogue could also increase clean energy research, support deployment of clean energy technologies, and contribute to building a more efficient electric grid based on clean and renewable power generation. This kind of dialogue could boost international competitiveness by increasing innovative capacity, business capability and export performance. Crucial is that there is a need to focus cooperation on clean energy and dialogue apart from general dialogue and cooperation on energy, since combining this in the broader energy agenda dilutes the focus and does not reach the right people. There are specific policy experiences at the EU level on climate change and renewable energy that are beneficial to advance the Japanese market. It is about policies, methods in the network, energy markets and financing strategies where the EU and Japan can come together. Moving this into a concrete dialogue ensures that discussions take place and people with busy agendas can meet each other which is a problem when there is a large geographical distance.

- **Trade fair participation.** A monthly list of trade fairs which will take place,

categorized by sector, and in particular the ones in which the EU will participate. It is expected that apart from embassies and export promotion agencies, the EU itself would participate in trade fairs and give the opportunity to European SMEs to get access to these events.

- **EU business missions for SMEs within a specific theme.** As the EU now organises the EU Gateway programme to bring companies (of which the majority are SMEs) to Japan. This could be expanded with narrowly defined themes with particular importance for certain segments of the market. Clean energy, and more specifically areas such as wind and bio energy, could be promoted separately in sync with major trade fairs in Japan. At the same time, activities with these companies could be organised in both Tokyo and certain promising regions. A reference can be made to how Ecos Consult and Fujitsu Research Institute have organised the German-Japanese Wood Biomass Day in Tokyo and Morioka in November 2013[206]. Currently, only a limited number of European countries are involved in activities, such as Germany and Denmark. Export promotion is mainly done at the member state level and every effort should be made to organise these activities in cooperation with the embassies.

- **Expand the information service for EU companies interested in Japan.** The website www.eubusinessinjapan.eu that was launched in January 2014 already serves to give practical information to EU businesses interested in Japan. Market reports and detailed information is planned for the clean energy sector. Information could be included on how to access funds.

Underpinning issues to take into account

- **Specialisation of the activities is necessary in order to facilitate SMEs to get in contact with the right partner.** One of the main issues for SMEs is finding the right partner to do business in Japan with. When companies are coming to Japan, they should have the possibility to talk at industry fairs that are specialised in their type of service and technology, and also visit local areas in Japan where these services and technologies are already deployed in order to facilitate sharing of information among the right partners. A wide focus on environmental technologies and/or renewable energy is seen as unable to attract the right audience.

[206] For more information: http://www.dwih-tokyo.jp/en/home/events/detail/article/2013/11/05/german-japanese-wood-biomass-day-1/

- **European approach for niche sectors.** A European approach might be more appropriate in order to find enough companies to participate in activities for niche sectors such as specific software, energy meters, and transmission technologies.

- **Improve the business conditions by working actively with established EU business in Japan.** In order to improve the situation in Japan, the EU should actively work with the EU industry that is already in Japan to identify bottleneck issues and organise high level seminars to present European approaches. These should be most of all directed to key industry players. In particular, in the energy field where a lot is changing, this European input in the debate can help Japanese government in choosing the best practices.

- **Coordination is necessary for the various EU activities that have a link with clean energy.** The EU runs various services for the promotion of companies in the clean energy sector (EEN, EU Gateway, EU-Japan Centre for Industrial Cooperation activities, EU delegation activities), and there are various embassies and export agencies which hold activities. More cooperation and coordination could help in providing a more complete service for EU companies visiting Japan. A particular synergy can be found between the EU Gateway Programme and the EU-Japan Centre for Industrial Cooperation. As both have a strong focus on SMEs, they could work together on the organization of additional activities and business matching. As a matter of fact, an EU Gateway participant spoke at a policy seminar organised by the EU-Japan Centre for Industrial Cooperation in December 2013 on Energy Efficiency in Buildings in the EU and in Japan.

- **Personnel focus.** It might be beneficial to not focus in the first place on getting a partner on the Japanese market, but instead to direct attention to find qualified personnel. Getting a partner, in particular for niche technologies, is difficult challenge for most SMEs. And even when a partner is found, it is often difficult to attain the full potential on the market. There is value in hiring Japan experts (there is a big pool of Europeans who speak Japanese) and experts in Japan that have vast experience in the sector in which the company is interested. Japanese staff is also possible, either in Europe or in Japan. A first step could be taken by participation in the Vulcanus in Europe programme, where Japanese students do an internship in European companies. Finding the appropriate partner could be the result of this first step.

- **Continue cooperation with Japan on their electricity market reform**. When the

Japanese electricity market is more liberalised and the regional monopolies are abolished, the opportunities for clean energy will increase substantially. This is one of the foremost issues without which the market for European companies will not be able to grow. As part of a potential clean energy dialogue, a series of meetings/workshop with the stakeholders should be organised to exchange successful practices. This topic has already been taken up, but could be focused more on the utility level, because at this level most of the changes will need to be enforced eventually. This point is of crucial importance in order to create business opportunities for EU companies.

- **Japan as export partner in South and Southeast Asia.** Apart from entering the Japanese clean energy market itself, a focus can also be given to cooperation with Japanese companies in developing countries. Japan has a stronger focus than most European clean energy companies in South and Southeast Asia and could provide a gateway to accessing these markets.

Further research

- Look into the Japanese electricity market reform, specifically how the EU can help to facilitate change in the utilities in order to improve the business condition for EU companies.

- Make a comparison of the situation of Singapore, South Korea and Japan related to renewable energy technologies in order to see how the renewable energy chapter can be introduced into the EU-Japan FTA.

- Make a detailed “SME opportunity study” of the electricity systems and smart grid technologies, solar energy, geothermal energy and energy efficiency for buildings technologies.

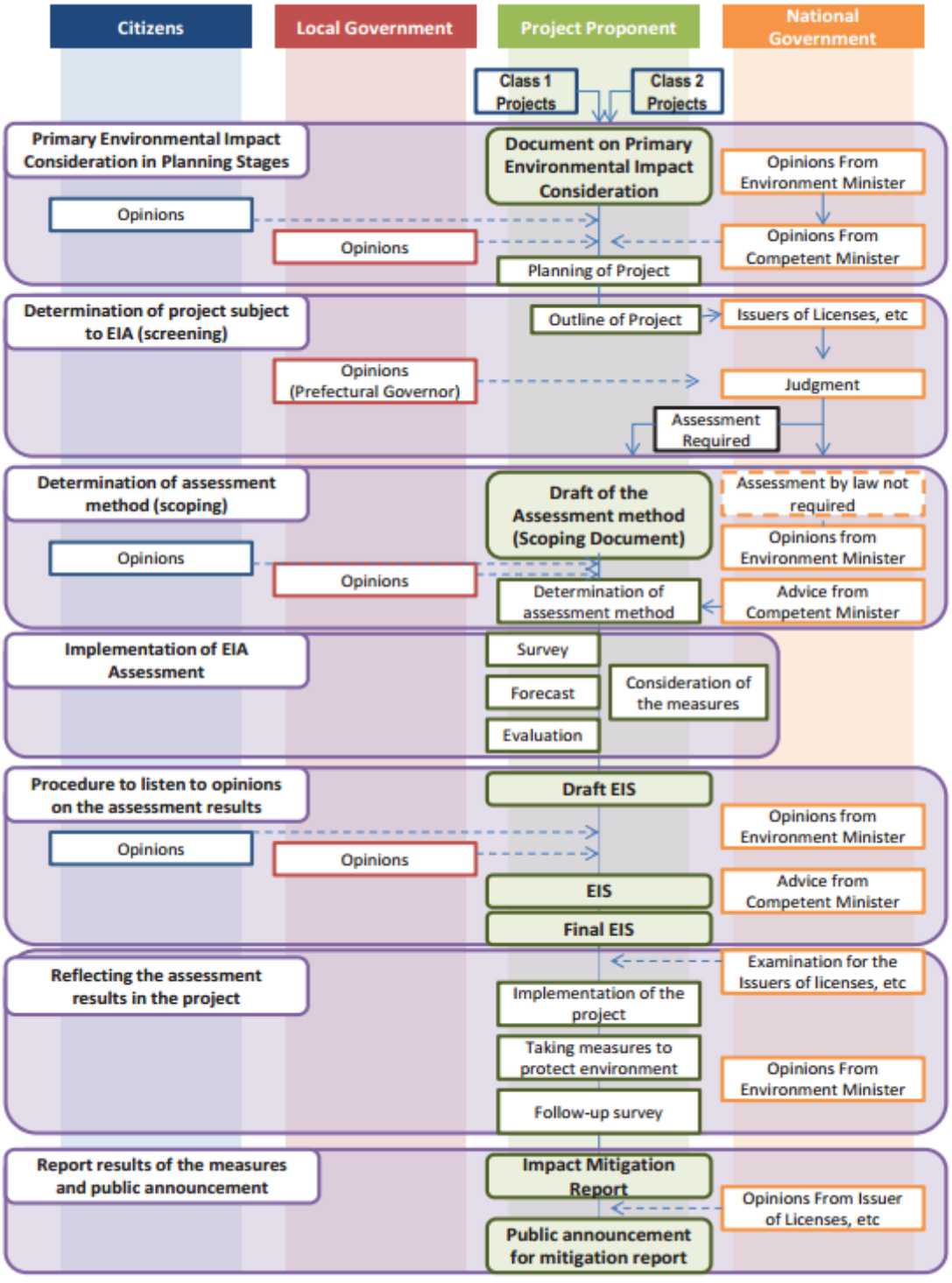
6 Annexes

6.1 Cost of Energy in Japan in 2011

Energy (Yen per kWh)		2010	2020	2030
Wind power	Wind power on land	9.9-17.3		8.8-17.3
	Wind power at sea		9.4-23.1	8.6-23.1
Geothermal		8.3-10.4		8.3-10.4
Solar power	Household solar power	33.4-38.3		9.9-20.0
	Mega solar	30.1-45.8		12.1-26.4
Small hydroelectric power		19.1-22.0		19.1-22.0
Woody biomass	Woody mono-fuel combustion	17.4-32.2		17.4-32.2
	Coal co-combustion	9.4-9.7		
Coal power		9.5-9.7		10.8-11.0
LNG power		10.7-11.1		10.9-11.4

Figure 11 Generating Costs for Each Type of Energy
Source: The Energy and Environment Council, *Committee Report and Cost Verification*, 2011

6.2 Environmental Assessment Procedure



Source: Ministry of the Environment (MOE)

6.3 List of European Clean Energy SMEs in Japan

All companies[207] are listed according to publicly available information. This list has been a tool during this research and is not intended to be a comprehensive overview. It also includes companies that are observed attempting to enter the Japanese market.

	Name	Country	Activity[208]	Representation	JP office
1.	3E	Belgium	Consultancy and software	No	No
2.	A+ Sun Systems	Italy	Solar energy	No	No
3.	Aedilis, UAB	Lithuania	Energy management	No	No
4.	Ammonit Measurement GmbH	Germany	Wind measurement	Yes	No
5.	Asah LM	France	Wind energy	No	No
6.	Atech	Slovenia	Biomass combustion controllers	No	No
7.	Bioprocess control	Sweden	Biogas	Yes	No
8.	Ciel et terre	France	Floating solar	Yes	Yes
9.	Cona	Austria	Solar drying	Yes	No
10.	Croft Filters	UK	Energy efficient filters	No	No
11.	Cys Engineering	Spain	Biomass, solar monitoring	No	No
12.	Deprofundis	France	Consultancy	Yes	Yes
13.	Ecosun	Greece	Solar and wind energy	No	No
14.	Energy Pool	France	Demand response operator	No	No
15.	Enertime	France	ORC, engineering and consulting	No	No
16.	Enhesa	Belgium	Environmental consultancy	No	No
17.	EPHY-MESS GmbH	Germany	Sensors for wind turbines	No	No
18.	Evolution Energie	France	Software solutions for energy management	No	No
19.	Gaia Wind	UK	Small wind turbines	Yes	No
20.	GILLES Biomass Heating	Austria	Biomass heating	No	No
21.	GreenPowerMonitor	Spain	Renewable energy system monitoring	No	No
22.	Hargassner	Austria	Wood Biomass boilers	Yes	No
23.	Hukseflux	Netherlands	Thermal sensors , PV	Yes	No

[207] SMEs, according to the official EU definition, adopted on 1 January 2005. It states that a company is considered an SME if it has less than 250 employees and an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet not exceeding EUR 43 million.

[208] Their activity related to the clean energy market is listed here, which is not always the focus of the company

			monitoring		
24.	HyGear B.V.	Netherlands	On-site gas processing technologies	No	No
25.	Ideol	France	Offshore wind	Yes	Yes
26.	Immodo Solar	Spain	Solar energy	Yes	No[209]
27.	inAccess Networks	Greece	Solar energy	Yes	No
28.	Infrastrutture SpA[210]	Italy	Solar energy	Yes	Yes
29.	Izodom	Poland	Energy efficient buildings	No	No
30.	Jahnel-Kestermann Getriebewerke GmbH	Germany	Gears for wind turbines	No	No
31.	KMB systems, s.r.o.	Czech Republic	Electrical energy management systems	No	No
32.	Kohlbach gruppe	Austria	Biomass	No	No
33.	Lipp GmbH, Germany	Germany	Biomass utilization & conversion	Yes	No
34.	Mecal	Netherlands	Wind energy consultancy	Yes	No
35.	Metacon AB	Sweden	Hydrogen fuel cells, conversion of biogas and natural gas to hydrogen	No	No
36.	Micropelt Gmbh	Germany	Thermal energy harvesting solutions	Yes	No
37.	Mita-teknik	Denmark	Wind control systems	No	No
38.	Mounting systems Gmbh	Germany	Solar PV mounting system	Yes	Yes
39.	Nanoco Technologies	UK	Quantum dots for Solar energy”	Yes	No
40.	Nass&Wind	France	Floating wind	No	No
41.	NEDA S.A	Greece	Solar energy	No	No
42.	Nolting Holzfeuerungstechnik GmbH	Germany	Wood biomass	Yes	No
43.	Organic Waste systems	Belgium	Biomass	Yes	No
44.	PEC Japan	Belgium	Energy storage	Yes	Yes
45.	Plugwise	Netherlands	Wireless energy management and control systems	Yes	No
46.	Polytechnik Luft- und Feuerungstechnik GmbH	Austria	Biomass boilers	Yes	No
47.	Rbr Messtechnik GmbH	Germany	Measuring equipment	No	No
48.	RECOM	Greece	Solar energy	Yes	No
49.	Refusol GMBH	Germany	Solar inverters	Yes	No
50.	Renenergy	Germany	Consultancy	Yes	Yes
51.	Rika	Austria	Biomass stoves	Yes	No
52.	SCANCON	Denmark	Industial encoders	Yes	No
53.	Shecco	Belgium	Environmental consultancy, natural	Yes	Yes

[209] Part of "European Clean Energies": http://ecenergy.jp
[210] through their subsidiary Hergo Sun Japan

			refrigerants		
54.	Skytron Energy Gmbh	Germany	Solar energy monitoring	No	No
55.	Solarig	Spain	Solar energy developer	Yes	Yes
56.	Solion Limited	UK	Solar energy	No	No
57.	SOLVIS d.o.o.	Croatia	Solar energy	No	No
58.	SSP Technology	Denmark	Blades for wind turbines	No	No
59.	SVCS Process Innovation s.r.o.	Czech Republic	Batch horizontal furnaces for semiconductor and photovoltaic industries	Yes	No
60.	Tocardo BV International	Netherlands	Tidal wave turbines	Yes	No
61.	Xylowatt	Belgium	Biomass to gas	No	No

Disclaimer

This report is based on interviews and information available to the researcher and is believed to be reliable but no independent verification has been made. The information does not constitute investment advice or an offer to invest or to provide management services and is subject to correction, completion and amendment without notice.