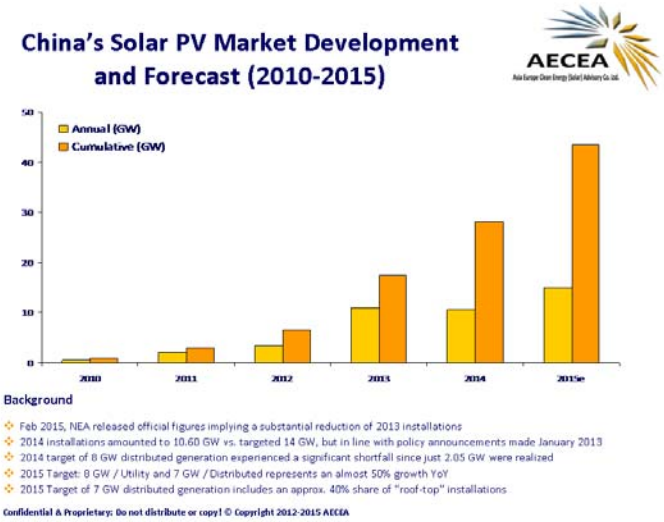
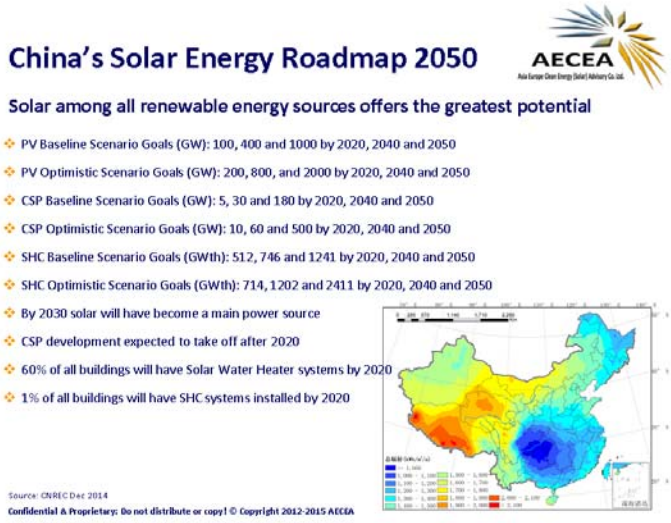
March 2015 – Briefing-Paper – China Solar PV Development

China's Domestic PV Market Development in 2015

The "Goat" is the 8th symbol of the Chinese zodiac and as such represents a symbol of art and peace, seeking a harmonious co-existence and tranquillity, as well good fortune and abundance. 2015 is the year of the "Green Wooden Goat" because wood relates to trees which relates to green. A form of "green energy" is power derived from utilizing renewable energies. According to CLSA's Feng Shui Index 2015 the renewable energy sector is one of its overall top sector picks, next to commodities and properties. The "Goat" representing abundance put into the context of China's 2015 anticipated domestic solar PV market development, if the government's national target of 15 GW, representing a nearly 50% increase YoY of additionally installed capacities will be realized, the "Goat" certainly will have lived up to its beliefs. Early February, information presumably from the National Energy Administration (NEA) suggest that NEA is aiming at 15 GW of additionally installed solar PV power generation capacities in the final year of the on-going 12th Five-Year-Plan for Solar Energy Development (2011-2015). The 15 GW shall be made up by 8 GW (utility-scale) and 7 GW (distributed). The latter itself is subject to a "quota" of 3.15 GW of "roof-top" installations. At the same time all four municipalities directly under the State Council (Beijing, Tianjin, Shanghai and Chongqing) are not subject to any limitations, however a "minimum" of 50 MW in each municipality is envisaged.



AECEA is of the opinion that the 8 GW utility-scale projects could be realized without facing major hurdles, given the fact that during the last two years similar volumes were installed. However, 7 GW of distributed solar PV, representing a roughly 250% increase YoY (Note: 2.05 GW of distributed were installed in 2014) could pose a challenge, in particular since approx. 40% (3.15 GW) shall explicitly be installed on roofs. According to NEA's definition of distributed solar PV, i.e. projects executed on waste land, tidal areas, fish ponds, agricultural areas, etc. qualify as distributed projects are considered the "low hanging fruits" of distributed projects by AECEA and appear to be doable, whereas classic "roof-top" projects remain a challenge in the context of the Chinese economy and society, i.e. barriers in terms of roof-top ownership or structural quality issues of roofs among other issues still prevail, hence the 3.15 GW pose an on-going challenge in the running year.



China's Renewable Energy Roadmap 2050

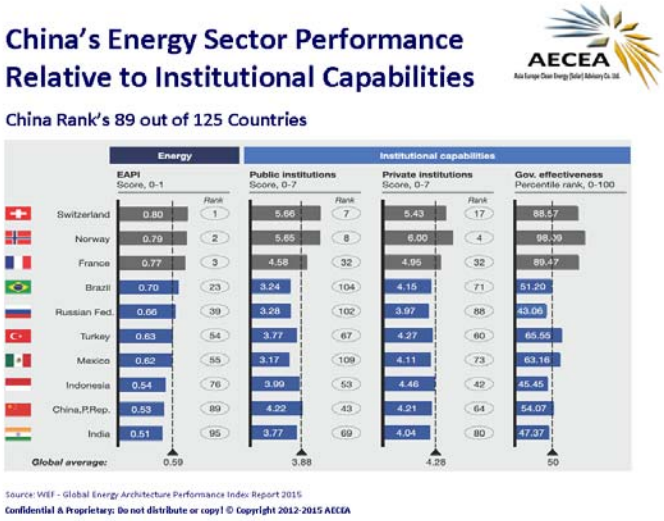
China's central government commissioned its "National Renewable Energy Center" to elaborate a "China Renewable Energy Roadmap 2050" in early 2013. Featuring the engagement of various national and international entities the roadmap was finalized last December. The fairly comprehensive study covers wind, solar [Note: solar means solar PV, solar thermal power, solar heating & cooling] and bio-energy and contains both medium and long-term roadmaps. Each renewable energy source is illustrated by its resource potential, development goals, environmental benefits and a technical roadmap.

The focus of this rather systematic approach was less on quantifying the individual potential for deployment, but rather on the legislative landscape, supplementary regulations and mechanisms designed to enable the realization of the formulated development goals.

2015 is the last year of the ongoing 12th Five-Year-Plan (2011-2015) and the preparatory work for the 13th Five-Year-Plan for Solar Energy (2016-2020) was initiated last summer. Against this background, early September 2014 the National Energy Administration (NEA) already communicated a minimum target of 100 GW of solar PV by the end 2020. However, given the timing of the "roadmap" AECEA is of the opinion that in the remaining months of 2015 the announcement of a 2020 solar target exceeding the 100 GW mark is likely. AECEA estimates a range of 135-150 GW of total solar PV capacity to be installed by the end of 2020.

China's Power Sector Reform – Are existing institutional capacities capable delivering?

A vital element of successful power sector reform is appropriate regulatory and governmental structures. Power sector reform and transition will take several years and decades to implement, hence the importance of conducive and sound institutional and regulatory frameworks is crucial. Such frameworks must be flexible and able to address fast-changing conditions. The last three decades China's transformation was subject to a process of experimentation, i.e. the central government encouraged the local govt. and State Owned Enterprises (SOE) to innovate, selected successful solutions and integrated them into their policy making. Does pragmatism help to create success, policy reform tend not to produce lasting effects if institutional conditions are poor. Sound policies need to be embedded in solid institutions.

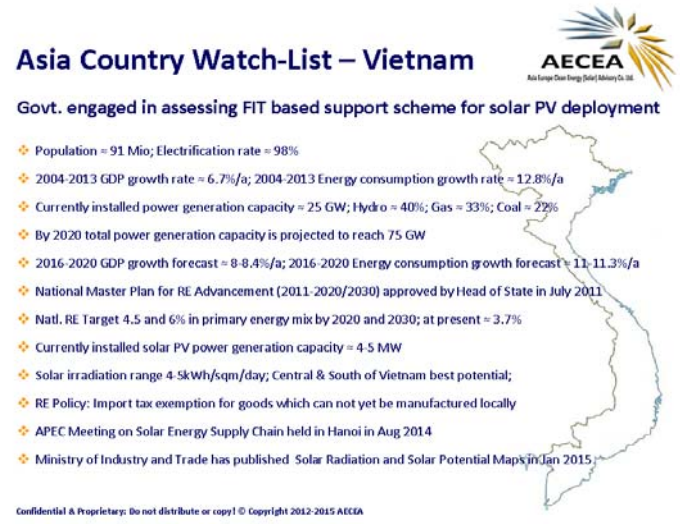


China's energy sector is considered of being subject to low levels of institutional capacities and e.g. lack of regulatory oversight of its power sector has been long highlighted. One example, the State Electricity Regulatory Commission (SERC), although little authority, which had the responsibility to set service obligations and standards, enforce laws, establish balancing areas and to regulate safety, was absorbed by the NEA in 2013. Another example is that although dispatching priority is given to renewable energy, however grid operators continue to prioritize coal-fired power plants operated by SOE's.

The Energy Architecture Performance Index (EAPI) developed by the World Economic Forum (WEF) uses 18 indicators to measure the energy system performance of in total 125 countries. Accordingly, overall, China ranks 89 with an average score of 0.53, whereas Switzerland ranks 1st with an average score of 0.80 and Yemen ranks 125th with an average score of 0.40. Back in March 2012, former Chinese Premier Wen Jiabao in its "Report on the Work of the Government" during the National People's Congress remarked "the country's economic model is likely to prove unbalanced, uncoordinated and unsustainable and deep reforms of the energy sector are central to China's broader structural reforms of the economy". Today, three years later, on March 5th, during this years annual National People's Congress the current Chinese Premier Li Keqiang announced to accelerate the promotion of renewable energies, notably in the following order; wind, solar PV, biomass, hydro and nuclear in 2015. Announcements regarding a possible power sector reforms remains to be seen.

AECEA's Asia Country Watch-List "Vietnam"

Over the course of the last decade Vietnam was one of the fastest growing economies in South-East-Asia experiencing an average annual electricity consumption growth rate in excess of 12%. Unable to meet its domestic power demand the shortfall of approx. 6% is imported from neighbouring China. Estimates suggest that during peak demand times power shortage is in the range of 1.5 and 2 GW. Today, electricity consumption is nearly matching generation but insufficient investment in new power plants puts the electricity grid under constant strain by a growing economy, which is forecasted to grow by another 6-6.5% in 2015.



In July 2011 a National Master Plan for Power Development for the period 2011-2020 and an outlook to 2030 gives priority to the development of renewable energies as a source of electricity. Accordingly, the state power company Vietnam Electricity (EVN) responsible for generation, transmission and distribution has the obligation to purchase all electricity generated from renewable energy sources. Currently, although there is no "renewable energy act/law" or designated renewable energy regulations, Feed-in-Tariffs for wind are available since 2011. Presently, the govt is engaged in a foreign aid support project which among other issues elaborates a potential FIT based support scheme for solar PV.

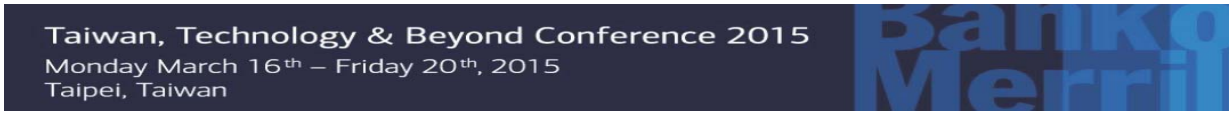
Over the course of the past few years a few announcement made by international companies planning to set-up local module/cell manufacturing never materialized, however according to Boviet Solar Technology Co. Ltd. located in Bac Giang a 200 MW module & cell plant started operation in June 2014. The company itself is a subsidiary holding company of Powerway Group from China. Early March 2015, Spire Corporation announced to have received an order from a govt. agency to deliver a 20 MW module line to be located outside of Hanoi.

Given Vietnam's surging economy combined with anticipated double-digit power consumption growth rates requiring substantial investments in the power sector in the coming years. The announcement made by the Prime Minister that a "Green Growth Strategy to 2020" is under development which builds on the "National Strategy for Climate Change Adaption" ratified in December 2011 leads to the anticipation that solar PV is expected to play a greater role than in the past, hence AECEA is of the opinion that "Vietnam" qualifies to be on it's "Asia Country Watch-List".

AECEA – Internal Affairs

Upcoming Activities **********

Invited by Bank of America / Merrill Lynch (BAML), AECEA will attend BAML Taiwan's "Technology & Beyond 2015" flagship conference, in order to speak on: "Solar: A Crucial Year 2015" scheduled to take place in Taipei from March 17-18, 2015. In addition to AECEA's speaking engagement 1x1 investor meetings are being organized.



AECEA – Internal Affairs

Recent Activities **********

Webinar: China: Just how big will the Chinese solar PV Market get?

In the run-up to the 4th Intersolar China Conference held in Beijing on March 31 + April 1, 2015, Intersolar organized a webinar on March 4th, during which AECEA presented "A Review and Outlook on Development until 2015 and Beyond"! The presentation can be found here: https://onetypo.mpcnet.de/fileadmin/Intersolar-Global/3_Visitor_Material_2014/Webinar_Files/2015_03_04_ISC_China_Solar_Webinar_AECEA_Frank_Haugwitz.pdf

AECEA joined the "**PV Market Alliance**" an alliance formed in 2014 by well-known regional PV experts from the US, Europe, Japan, China and Latin America. The PV Market Alliance was formed at the end of 2014 by AECEA, the Becquerel Institute, Creara, RTS and SPV Market Research to provide research on the global markets for photovoltaic, CSP and CPV technologies from the perspective of experts in these markets. The "PV Market Alliance" will publish an annual **"World PV Outlook"** report on global PV markets. The 2015 edition will be forthcoming in early June. More info here: http://pvmarketalliance.com/

The PV Market Report Alliance

Company Profile

Frank Haugwitz is an independent solar energy consultant based in Beijing since 2002. In his early years in China he was seconded by the German govt. and involved in a bilateral solar / PV energy technical cooperation program. Following this assignment he was responsible for the renewable energy component of the EU-China Energy & Environment Program until the fall of 2009. Since then he has been consulting foreign enterprises and international organizations on the development of renewable energies in general and solar / photovoltaic in particular in China. Since early 2010 he works for the organizer of Intersolar as their Head of Intersolar Conference Development.

From late 2009 until August 2012 he worked as a director in the Deutsche China Consult Co. Ltd. (HK) and in October 2012 he founded his company "Asia Europe Clean Energy (Solar) Advisory Co. Ltd. (AECEA) in HK. His services include working with individual clients to apply his extensive China photovoltaic energy-focused insights to their specific needs. Industry experience and in-depth analysis shall assist strategy development and corporate decision making. Focus is on the regulatory framework conditions, policy, as well market and business development. His advisory services provide objective and independent research.

→ Previous versions of the "Briefing Paper – China Solar PV Development" are available at http://www.aecea.com.de/downloads.html