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The true riches of Japan: High tech and natural energy can secure Japan's peace and prosperity, and give a new sustainable peace and prosperity dimension to its overseas development aid.

By Eckhard Hitzer, revised 31st May 2015

1. High Technology

Japan has a worldwide reputation as high technology nation. This is especially true for sustainable energy technology. Examples are: 1963 - Sharp Corporation produces a viable photovoltaic module of silicon solar cells; 1982 Kyocera Corporation is the first manufacturer in the world to mass-produce polysilicon solar cells using the casting method, today's industry standard [1] ; 1994 Sharp began to commercialize (grid-connected) residential solar power system with 16% efficiency [2]; In 2012 Sharp hit the concentrator solar cell world efficiency record of 43.5% [3] .
When I visited Iceland in 2012, a country with 100% renewable electricity from goethermal and hydro power, I saw modern geothermal steam turbines from Mitsubishi and Toshiba in operation. Another geothermal turbine international top brand is Fuji Electric.
Mitsubishi Heavy Industries-Vestas joint venture has recently developed a commercial 8MW wind turbine, the biggest in the world [4].
In the field of biomass, Japanese researchers take a lead in developing energy rich hyper wood pellets by torrefaction [5], and in advanced biofuel development from microalgae [6], etc.

2. Natural Energy – sustainable and renewable

Sustainable and renewable energy is carbon-neutral, climate protecting, the actual fuel is either cost-free (essentially forms of solar energy and geothermal energy) or substantially cheaper than fossil fuel and unlimited in supply. Only investments into facilities for converting renewable energy to electricity and heat and their maintenance are required.

2.1 Geothermal Energy

Japan is located on the edges of four tectonic plates and is ranked third world wide in volcanic activity. Its underground is very hot. Extensive surveys by AIST and NEDO over many years have shown that there is a geothermal energy potential of 20 GigaWatt of which currently only 0.5GW are exploited. Japan has 31,000 registered hot springs, of which 26,000 go unused. These would be ideal for thousands of local decentralized low temperature Organic Ranking Cycle generators with power ratings anywhere from 35-280 kW, supplying electricity to up to 100 houses each, and supplying at the end still plenty of hot spring water [7,8].

2.2 Solar Energy

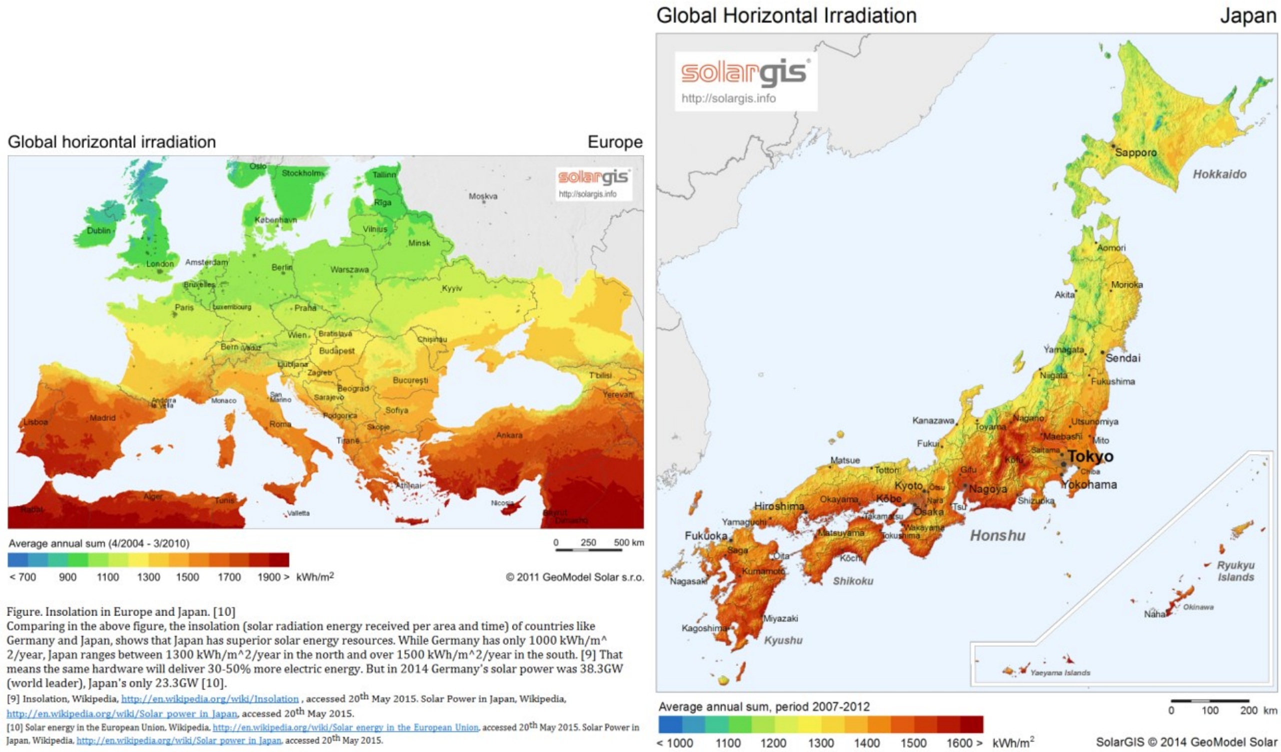

Figure. Insolation in Europe and Japan. [10]

Comparing in the above figure, the insolation (solar radiation energy received per area and time) of countries like Germany and Japan, shows that Japan has superior solar energy resources. While Germany has only 1000 kWh/m^2/year, Japan ranges between 1300 kWh/m^2/year in the north and over 1500 kWh/m^2/year in the south. [9] That means the same hardware will deliver 30-50% more electric energy. But in 2014 Germany's solar power was 38.3GW (world leader), Japan's only 23.3GW [10].

2.3 Wind Energy

A Japan Wind Power Association (industry) study of May 2014 [11] states that by 2050 Japan may develop up to 75 GW of wind power capacity from currently only 2.789 GW. To see that this is indeed realistic compare that Germany had in 2014 installed 39.165 GW windpower [12], China had in 2006 only 2.6 GW of windpower, but already 8 years later in 2014 this grew to 114.7 GW.

2.4 Biomass Energy

Here we focus on wood biomass as an example. Japan is a forest nation with 67% of its land (253,203 km^2) covered with forests, Germany has only 32% (113,176 km^2) covered with forests [13]. The average increase of wood biomass in Japanese forest over the last 50 years was 50 million m^3/year, of which e.g. 8 million m^3/year from tree thinning are left rotting in the forests [14]. Up to 50 million m^3/year of wood could be harvested sustainably from Japan's forests without reducing the total wood biomass. Modern wood gas cogenerators [15] could turn these 50 million m^3/year into 10.7 TWh electric energy/year, and 26.7 TWh heat energy/year, flexibly delivering electricty and heat round the clock.

3. Natural Energy and Peace

The Senkaku Islands are hotly disputed between Japan (with US involvement), China and Taiwan partly because they lie near potential oil and gas reserves [16]. Conflicts in Iraq, Syria, Nigeria, South Sudan, Ukraine, the East and South China Seas can be seen as twenty-first-century energy wars for the control of valuable oil and natural gas assets [17]. The development of sufficient sustainable domestic renewable energy sources, has therefore the undeniable potential to ease international relations, calm tensions, and eliminate a key motivation for armed conflict in the 21st century. Moreover much of the money paid by industrialized nations like Japan for fossil fuel is used by the oil exporting countries for billions of USD of arms purchases. For example, in 2014 Saudi Arabia became the worlds largest importer of military hardware [18].

4. Natural Energy and Prosperity

Estimates show that in the case of natural gas use, 25% of the money spent is used regionally or within a country, but 75% of the money goes abroad. The purchasing power of a fossil energy consuming country is constantly decreasing. On the side of renewable energy, e.g, the use of domestic wood pellets ensures that less than 5% of the money spent goes abraod, ca. 95% are used within the country (of that over 60% are used regionally). Renewable energy therefore offers an enormous increase in local purchasing power, creation of stable local employment and long term sustainable increase in local wealth. The choice is between an ever more expensive import of fossil fuel or that we begin today to invest into our own energy potentials, building a new supply infrastructure, thereby permanently reducing energy import dependence. [19]
Furthermore renewable energy technology has become a enormous growing export market, when comparing the growth rates of, e.g., nuclear power, wind power and solar power. Nuclear power stagnates worldwide, while wind power and solar power experience exponential growth [20].

5. Meaning for Overseas Development Aid (ODA)

Iceland's notable contribution to the United Nations Development Aims is its internationally acclaimed United Nations University Geothermal Training Program since 36 years. By 2014 they have trained 583 scientists and engineers from 58 countries, many of them have become now leading specialists in geothermal research and development in many countries [21]. If a tiny country like Iceland can achieve this, how much more can Japan achieve on whose geothermal turbine technology even Iceland depends. Japan's technological leadership in many areas of renewable energy technology (see above), means, that renewable energy technology transfer to developing countries can bring lasting economic benefit and economic independence to these countries, as these countries can begin to rely on their own sustainable energy resources and spend more money on education, health care, rural development, poverty alevation, etc. And as much as it can secure the peace of Japan, renewable energy related ODA can also contribute to economic stability and peace in developing countries.

References

[1] Timeline of Solar Cells, Wikipedia, http://en.wikipedia.org/wiki/Timeline_of_solar_cells, accessed 20th May 2015.

[2] Over 50 Years of History, Sharp, http://www.sharp-solar.com/en/history/, accessed 20th May 2015.

[3] Zachary Shahan, Sharp Hits Concentrator Solar Cell Efficiency Record, 43.5%, CleanTechnica, 31st May 2012, http://cleantechnica.com/2012/05/31/sharp-hits-concentrator-solar-cell-efficiency-record-43-5/, accessed 20th May 2015.

[4] Type certification awarded for the V164-8.0 MW® by DNV GL, MHI Vestas Offshore Wind, Aarhus, Denmark, http://www.mhivestasoffshore.com/type-certification-awarded-for-the-v164-8-0-mw-by-dnv-gl/, accessed 20th May 2015.

[5] T. Yoshida et al, Fundamental Study on the Production of "Hyper Wood Pellet"- Effect of Torrefaction Condition on Grinding and Pelletizing Properties, Journal of Energy and Power Engineering 7 (2013) pp. 705-710.

[6] K. Furuhashi, et al, "Seawater-Cultured Botryococcus braunii for Efficient Hydrocarbon Extraction," *PLoS ONE* (2013) Vol. 8, Issue 6, e66483.

[7] K. Yasukawa, Recent movements for geothermal development in Japan, Re3build ICU presentation, 13th February 2015, https://re3buildicu.wordpress.com/2015/02/06/recent-movements-for-geothermal-development-in-japan/

[8] T. Giuffre, Geothermal Energy Opportunities in Japan, Re3build ICU presentation, 20th May 2015, https://re3buildicu.wordpress.com/2015/05/12/geothermal-energy-opportunities-in-japan/

[9] Insolation, Wikipedia, http://en.wikipedia.org/wiki/Insolation , accessed 20th May 2015. Solar Power in Japan, Wikipedia, http://en.wikipedia.org/wiki/Solar_power_in_Japan, accessed 20th May 2015.

[10] Solar energy in the European Union, Wikipedia, http://en.wikipedia.org/wiki/Solar_energy_in_the_European_Union, accessed 20th May 2015. Solar Power in Japan, Wikipedia, http://en.wikipedia.org/wiki/Solar_power_in_Japan, accessed 20th May 2015.

[11] 風力発電導入ポテンシャルと 中長期導入目標 V4.3, ２０１４年５月, 一般社団法人日本風力発電協会, http://jwpa.jp/pdf/2014-06dounyuumokuhyou.pdf , accessed 26th May 2015.

[12] Wind power by country, Wikipedia, http://en.wikipedia.org/wiki/Wind_power_by_country, accessed 20th May 2015.

[13] List of countries by forest area, Wikipedia, http://en.wikipedia.org/wiki/List_of_countries_by_forest_area, accessed 20th May 2015.

[14] S.D. Bellingrath-Kimura, Forest in Japan - Current situation and challenge, Re3build ICU presentation, 2nd Sept. 2014,

https://re3buildicu.wordpress.com/2014/11/28/forest-in-japan-current-situation-and-challenge/

[15] J. Haapakoski, Volter 40 Indoor, Volter Oy, Kempele, March 2015.

[16] How uninhabited islands soured China-Japan ties, BBC News, Asia, 10th Nov. 2014, http://www.bbc.com/news/world-asia-pacific-11341139, accessed 26th May 2015.

[17] M. Klare, Fighting for oil: 21st century energy wars, Middle East Eye, 10th July 2014, http://www.middleeasteye.net/essays/fighting-oil-21st-century-energy-wars-608245442, accessed 26th May 2015.

[18] Saudi Arabia eclipses India as world's largest weapons importer, The Jerusalem Post, Middle East, 8th March 2015, http://www.jpost.com/Middle-East/Saudi-Arabia-eclipses-India-as-worlds-largest-weapons-importer-393262, accessed 26th May 2015.

[19] J. Gaukler, SolarComplex, Erneuerbare Energien konkret: SolarComplex AG und ihre Projekte – Regionale Wertschoepfung durch EE (English: Renewable Energy concrete: SolarComplex Ltd. and its Projects – Regional Value Creation by Renewable Energy), 9th July 2014, Singen. (German)

[20] T. Iida, Sustainable energy – definition, theory, and reality, Re3build ICU Presentation, 7th Jan. 2015, https://re3buildicu.wordpress.com/2014/12/30/t-iida-sustainable-energy-definition-theory-and-reality-07jan2015/

[21] Lúdvík S. Georgsson et al., UNU Geothermal Training Programme in Iceland : Capacity Building for Geothermal Energy Development for 36 Years, Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19 - 25 April 2015, http://www.geothermal-energy.org/pdf/IGAstandard/WGC/2015/09010.pdf, accessed 26th May 2015.