Japan's Energy Challenge

The Impact of Shale Imports from the US & Energy Cooperation with Russia

Photo credit: https://oilprice.com/Energy/Gas-Prices/Is-US-LNG-Too-Expensive-For-Asian-Markets.html

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08/12/2017

Introduction

Energy security is one of Japan's top strategic interests; as the safety of energy supplies is essential for the economic prosperity and the national security of the country. Tokyo has been traditionally dependent on hydrocarbon imports from the Middle East; a situation that still continues today. However, this causes considerable problems to Japan in geopolitical and geoeconomic terms; as a cut of the energy flow from the Gulf would have catastrophic effects on its economy and on its national security.

As such, the Japanese are taking a series of initiative to decrease their dependence on Middle Eastern energy imports so to improve their energy security condition. In this regard, **there are two elements that have the potential to solve (at least partially) Japan's energy supply problem**: the first is **shale gas & oil**, the other is greater **economic cooperation with Russia**. Both paths present significant advantages to exploit as well as difficulties to overcome.

This report will examine the opportunities and challenges of both these factors in order to assess to what extent they may allow Japan to improve its (energy) security situation.

The Current Status of Japan's Energy Security

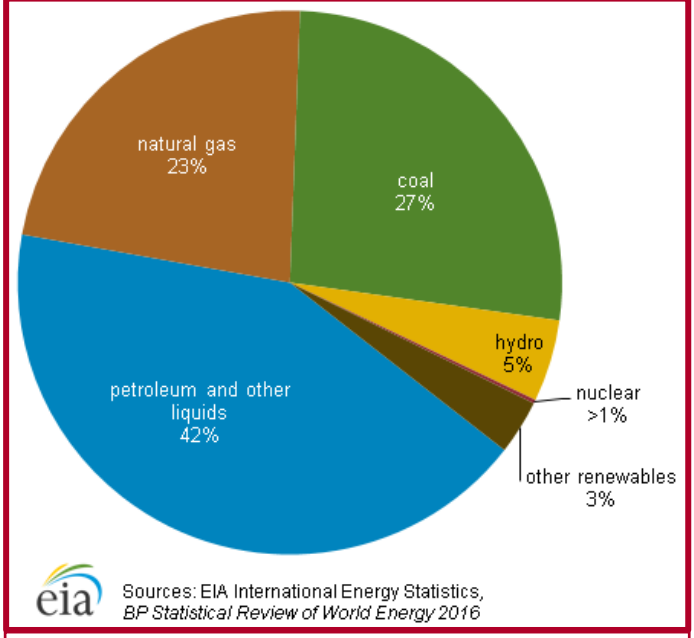
For decades, the Japanese have been dependent on energy imports from the Middle East to satisfy the needs of their economy, which is the 3rd largest in the world in terms of nominal GDP. The following data by the US Energy Information Administration (EIA) allow to understand Japan's energy profile[1]:

- **In 2015, petroleum and gas accounted for 65% of its total energy consumption.**
- **Virtually all of its oil consumption is covered by imports, 82% of which came from the Middle East in 2015.**
- In relation to **Liquified Natural Gas (LNG)**, Tokyo is equally dependent on imports to satisfy almost the entirety its demand; however, its import portfolio is much more diversified in regional terms. Still, at least **24% of it came from the Middle East in 2016.**
- **Gas has started playing a more important role in Japan's energy mix in recent years**, because the decision to stop the nuclear power facilities in the wake of the Fukushima accident in 2011 caused the country to rely more heavily on hydrocarbons to meet its energy demands. As a result, gas (and coal) consumption have increased.

[1] US Energy Information Administration (EIA), Japan country profile.

- The use of renewable energy sources has grown as well after 2011, but it remains insufficient by now. It must be noted that there are plans to increase clean energy use to 22-24% by Fiscal Year 2030, in contrast to the current 12%[2].

This overview shows how **Japan is a country heavily relying on imported fossil fuels** to satisfy its energy needs; and this has a considerable impact in strategic terms.



Japan's energy sources in 2015.

Photo credit: https://www.eia.gov/beta/international/analysis.cfm?iso=JPN

From an economic point of view, **buying fuel from abroad results in a considerable burden for Tokyo.** In 2016, the combination of oil and liquefied petroleum gas imports costed about $85 billion[3]. After the nuclear accident in 2011, the surge in hydrocarbon imports caused Japan's trade balance to become negative for the first time in 30 years, reaching a record low in 2014. Afterwards, the lowering of the energy prices on the international markets allowed Japan to return to a positive trade balance in 2016. But this does not change the fact that the Japanese are sustaining a considerable economic effort to sustain their energy needs.

In geopolitical terms, this dependency on energy imports is troublesome. As seen, much of the energy that literally fuels the Japanese economy flows from the Middle East; and this is a problem because of two reasons. The first is that the area is notoriously unstable; and tensions have been rising in recent years, thus making it even more volatile. **A conflict or contingency in the Middle East** (notably a war in the Gulf) **would severely disrupt the energy flow to Japan**, thus compromising its energy security. Then, there is the maritime dimension. As a matter of fact, such hydrocarbons imports are carried to Japan by ship. The trade routes (known as Sea Lines of Communications, or SLOC) are therefore vital for Tokyo; but they are also vulnerable. The most problematic aspect is that they must cross several choke points (notably the Straits of Hormuz and Malacca) and disputed waters (especially those of the South China Sea). As such, **any incident or conflict affecting the free flow of trade along the SLOC would have deleterious consequences on Japan's energy supplies.** Partially linked to this, there is also the matter of the Sino-Japanese relations. The two powers have diverging interests and are in competition in the Asia-Pacific: they are involved in a dispute over the Senkaku / Diaoyu islands (and the hydrocarbon deposits that are present in their surroundings); Japan is a key ally of the US in the area, while China is the main challenger of America's regional and

[2] Japan Agency for Natural Resources and Energy, Energy White Paper FY2016.
[3] Observatory of Economic Complexity, Japan country profile.

global supremacy and is implementing an Anti-Access / Area Denial strategy (A2/AD) to keep Washington and its allies away from its coasts; finally, the PRC is heavily dependent on fossil fuel imports as well, so it considers the Japanese and American naval presence as a potential threat to its own energy security.

In short, **the continued reliance upon the hydrocarbon imports from the Middle East poses significant risks for Japan in terms of economic convenience as well as of energy and national security.** To this, one can also add the environmental problems caused by such a heavy reliance on fossil fuel. This aspect will not be treated here, but it is equally important in social and economic terms. In this context, shale gas & oil exploitation combined with a closer cooperation with Russia may provide a solution to Tokyo's problems; even though both solutions present some difficulties that may limit their effectiveness.

Shale Gas & Oil

Shale gas & oil have had a notable impact on the global energy markets in the last few years. These hydrocarbons are extracted from particular rock formations known as shale by using two technologies, namely horizontal drilling and hydraulic fracturing (fracking). Even though the existence of fossil fuel in shale formations has been known for decades, only the development of these two techniques has made their exploitation economically viable in recent years. The country that has benefitted the most from shale gas & oil extraction has been the United States, which is at the center of the so-called "shale revolution". Thanks to it, the US (which had been a net energy importer for decades) have become a hydrocarbon producer and even an exporter[4]. This had a considerable impact on the world's energy markets, in the form of a significant reduction of the price of energy: as a matter of fact, the shale production resulted in a drop in America's demand for hydrocarbon imports, and this in turn is largely the cause behind the fall of the international price of oil and gas in the past few years, notably after 2014.

Japan could potentially benefit very much from the shale revolution in the US; at least in geopolitical terms. Tokyo and Washington are close allies, and importing shale gas & oil would allow the former to partially solve the problems linked with buying energy from the Middle East; namely the risks related to the region's instability and to the safety of the SLOC. If Japan imported its energy from the US, its supplies would arrive through the Pacific Ocean, thus avoiding the choke points and the disputed waters that tankers must currently cross to reach the archipelago. As a consequence, Tokyo would benefit from a politically-stable supplier and would eliminate the risks associated with the current energy routes.

[4] Among others, see *The Geopolitics of Shale Gas* (2014) and *America's Energy Edge: The Geopolitical Consequences of the Shale Revolution* (2014).

But while the geopolitical advantages deriving from importing shale gas & oil from the US are practically undisputable, the economic dimension is much more uncertain. The main point is whether importing American shale-derived fuel is economically convenient or not. Some, including several high-ranking Japanese officials, argue that buying shale from the US would allow Japan to save money[5]. Others state that, considering the liquefying and transportation costs plus the fees to cross the Panama Canal, shale would actually result to be an even more expensive energy source for Japan[6]. Making a proper assessment of the economic viability of shale imports for Japan is difficult; especially because all claims are essentially based on economic projections, as there is not a historical record of actual costs to allow a proper quantitative evaluation. As a matter of fact, the first shipment of American shale gas arrived in Japan only in early 2017[7]. By the moment, it appears that shale is indeed not convenient in economic terms for the Japanese, costing twice as much compared to other supply sources: US shale-derived LNG was paid $645/tonne against $337/tonne for shipments from the cheapest source (Angola)[8]; but more **reliable assessments will only be available with time.** Still, the very fact that such imports have started is already an important signal, because it shows the political willingness by Tokyo's authorities to at least explore this possibility, and maybe to increase the imports of American shale in the future.

The arrival in Japan of the first tanker carrying shale-originated LNG from the US, January 2017.

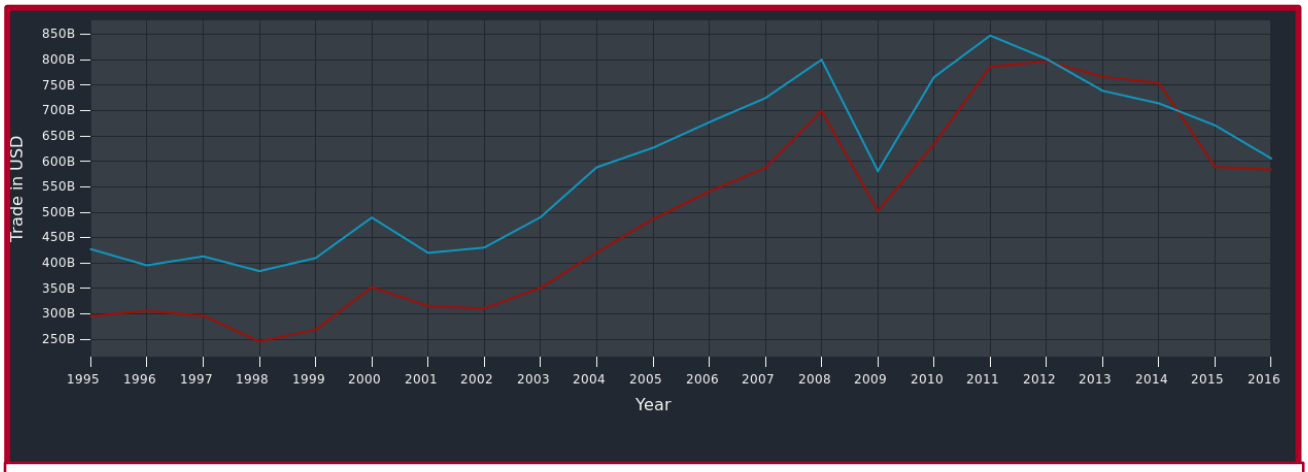
Photo credit: https://www.japantimes.co.jp/news/2017/02/05/national/increase-u-s-energy-imports-table-abe-prepares-meet-trump/#.WimK4LpFyM

To properly evaluate the broader impact of a potential Japanese turn toward shale, other issues need to be considered. In this regard, some interesting considerations are presented in an article dating back to 2012[9], which criticized the "shale option" by stating that its consequences would be catastrophic for Japan in economic terms. Basically, it said that importing shale-originated fuel would result in a trade deficit with the US. Since the US market is the only one capable of absorbing Japan's exports and there are no valid alternatives to it, once the trade balance turns in Washington's favor Tokyo would find itself in a global trade and current account deficit; even in the

[5] Among others, see *U.S. shale gas alters Japan's energy plans* (2013) and *Rebuilding Japan's Energy Policy* (2012).
[6] *U.S. shale gas alters Japan's energy plans* (2013).
[7] *Increase in U.S. energy imports on table as Abe prepares to meet Trump* (2017).
[8] *Is U.S. LNG Too Expensive For Asian Markets?* (2017).
[9] *Japan and the Geopolitics of the Shale Revolution* (2012).

case that the American shale turned out to be a cheaper source of energy than the traditional ones from the Middle East. Considering Tokyo's huge debt-GDP ratio (almost 200% in 2015[10]), this would be a tremendous problem by itself. But when it is combined with the global geopolitical effects of the American "shale revolution", it would ultimately result in a devastating debt crisis. As America would no longer be reliant on Middle Eastern energy imports, it would withdraw from the region; and this vacuum would result in the area's destabilization with deleterious effects on the energy markets. The turmoil in the Middle East, in turn, would cause Japan's debt interest rates to grow (given its dependency on hydrocarbon imports from the region); causing its ability to repay its debt to reach its limit and triggering the debt crisis[11]. Apart from the purely economic drawbacks, this would also mean that Japan would be forced to reduce its defense expenditures; making for it impossible to keep China's rise under control and to maintain the military capabilities that are necessary to respect its commitment to the alliance with the US, thus inducing Washington to scrap it and abandon Tokyo. As a result, Japan's national security would be undermined.

While such claims were valid under some aspects, certain relevant elements were not considered. The concerns that raised by the article are legitimate and some points in the reasoning are valid, notably the fact that **it is extremely hard for Japan to deal with both its economic challenges and maintain relatively high defense expenditures.** But apart from a certain degree of contradiction in this argument[12], there are other factors that may result in the final outcome being different from the article suggests. **Japan's trade deficit with the US has not materialized**: on the contrary, the trade balance remains favorable to Tokyo, who benefitted from a surplus of almost $62 billion in 2016[13], if not more[14].



Japan-US trade balance, 1995-2016. *Photo credit: https://atlas.media.mit.edu/en/profile/country/jpn/*

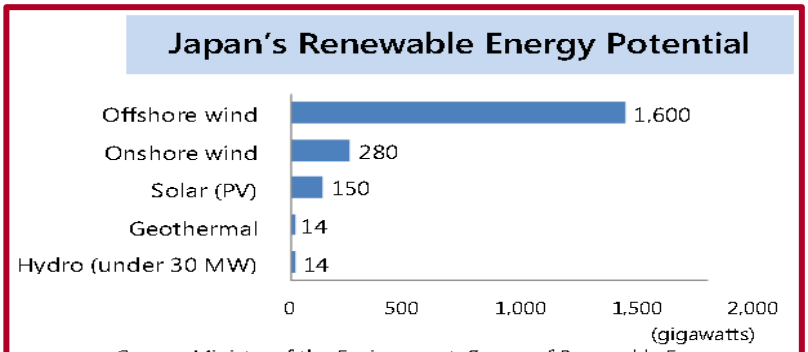
[10] World Bank, Japan data.
[11] There is some degree of contradiction in this reasoning: if Japan actually starts importing shale from the US to a level high enough to result in a trade deficit, it would be reasonable to think that its dependency on Middle Easter energy would be reduced to the point that the risk of rising interest rates due to the region's instability would be mitigated. In this sense, Japan would have an interest in importing shale from the US; contrarily to what is suggested in the article.
[12] For decades, Japan has been spending around 1% of the GDP in defense; but considering the size of its economy, this means it has one of the largest defense budgets in the world in absolute terms.
[13] Observatory of Economic Complexity, Japan country profile.
[14] *Trump lashes out at 'unfair' Japan trade ties* (2017). This BBC article, citing the estimates by the US Treasury Department, talks of $69 billion.

Similarly, the Japanese global trade balance with the world has returned positive, with $21.6 billion in net exports[15]. It is true that these figures refer to the period before to the first shale gas delivery to Japan in January 2017; but they still indicate a situation favorable to Tokyo, and the expected growth in shale imports may not be enough to reverse the positive balance. By now, the lack of data makes it very difficult to make a definitive assessment; still, there are several factors that may have a role in avoiding a catastrophic scenario for Japan.

First, **shale gas & oil imports may ultimately result economically viable**; meaning they could actually allow Tokyo to reduce its energy bill, maybe even without turning the trade balance with the US into a deficit. In this regard, **Japan is undertaking significant reforms so to become an international LNG trade hub**[16], thus favoring a lowering in the cost of shale-originated fuel. The very fact that the first imports have already started could be a signal that this option is expected to become advantageous in economic terms (but it may also be purely based on the willingness to diversify the energy supply and reduce the risks associated with an excessive dependence from the Middle East). Second, **even if a negative trade balance with Washington were to materialize, Japan may still maintain a global surplus by trading with other countries.** In this regard, the Trans-Pacific Partnership (TPP) or the free trade agreement with the EU may play an important role[17]. Third, **there are other countries that hold shale gas & oil reserves and that may become suppliers for Japan**: this is the case of Australia and even of China; but importing shale from the latter is unlikely, because Beijing is facing significant difficulties in developing its own shale industry and because the complicated Sino-Japanese relations limit the possibilities of cooperation in this field. In addition, one must also add the possibility of establishing a larger energy cooperation with Russia, an aspect that will be addressed later. The existence of multiple potential sources means also competition among suppliers, which would likely result in more convenient prices for Japan. Finally, US-imported shale gas & oil is an option among others to solve Tokyo's energy challenges: **other sources like renewables and nuclear power will help diversifying its energy mix.** In this regard it is relevant to note that Japan is gradually reactivating its nuclear plants and that it is investing in green energy

[15] Observatory of Economic Complexity, Japan country profile.
[16] In May 2016, the Japanese government announced the *Strategy for LNG Market Development* with the aim "to play the leading role in realizing a transparent and highly flexible international LNG market". For more details, see: Japan Agency for Natural Resources and Energy, Energy White Paper FY2016. For an assessment on the impact of Japan's market liberalization on LNG trade, see: *Japanese market liberalization to impact LNG trade* (2017).
[17] The TPP negotiations are still ongoing despite President Trump's decision to withdraw from the deal, and a partial agreement has been reached in November 2017 by the remaining participants. In regard to the Japan-EU free trade agreement, a first outline deal was reached in July 2017.

sources[18], thus reducing the need to import fossil fuels and consequently the risks of occurring into a deficit.



Estimates on Japan's renewable energy potential made in 2010.

Photo credit: http://www.tokyofoundation.org/en/articles/2012/rebuilding-japans-energy-policy

In geopolitical terms as well, the impact of shale energy will not be as negative as presented. The catastrophic scenario described by the critics of shale gas & oil is essentially based on the assumption that the US will abandon the Middle East because, thanks to shale fuel production, it will no longer be dependent on hydrocarbons coming from the region. It is true that in recent years the American engagement in the area has diminished, or at least has become less direct; and that the region has become less stable as a consequence. However, due to a series of factors, **Washington is unlikely to totally abandon the Middle East**: it has important allies (Israel, Saudi Arabia, Turkey) as well as rivals (Iran) in the area; it must deal with the terrorist menace; and despite the "shale revolution" it still needs to ensure the free flow of hydrocarbons, because its interruption would cause tremendous damage to the world economy and to America's allies in Europe and the Asia-Pacific. **In regard to the US-Japan security relations, the fear that Washington may abandon its ally seems unjustified.** For the reasons indicated above, it is not certain that an increase in shale imports from the US would cause a trade deficit for Japan that would force it to reduce its defense expenditures and consequently its commitment to regional security. Even if it were actually so, Tokyo and Washington may still reach an agreement according to which the former accepts to import energy from the latter and run a trade deficit in exchange for more protection. This is just a speculation, but a similar deal might be concluded: after all, Japan's trade surplus has often been criticized in the US, and this is particularly the case of the current administration, as President Trump made clear during his visit to the country in November 2017[19]. Moreover, one should also consider the broader security situation in the region. **The US is not going to abandon Japan, because both powers share similar security concerns** (notably China's assertiveness and the tensions in the Korean peninsula) and because Japan is probably America's most important ally in the Asia-Pacific; often defined as its "unsinkable aircraft carrier". This means that the US needs Japan to maintain its power projection capabilities in the region. Finally, **the geopolitical advantages deriving from importing energy from the US rather than from the Middle East are undeniable, as it would reduce Japan's exposure to the risks associated with the area's instability.** This has also an economic dimension: **the possibility that the turmoil in the Middle East resulted in rising interest rates and consequently a debt crisis for Tokyo**

[18] Japan Agency for Natural Resources and Energy, Energy White Paper FY2016.
[19] *Trump lashes out at 'unfair' Japan trade ties* (2017).

would become more remote if it managed to reduce its dependency on energy imports from the region by buying American shale-derived fuel.

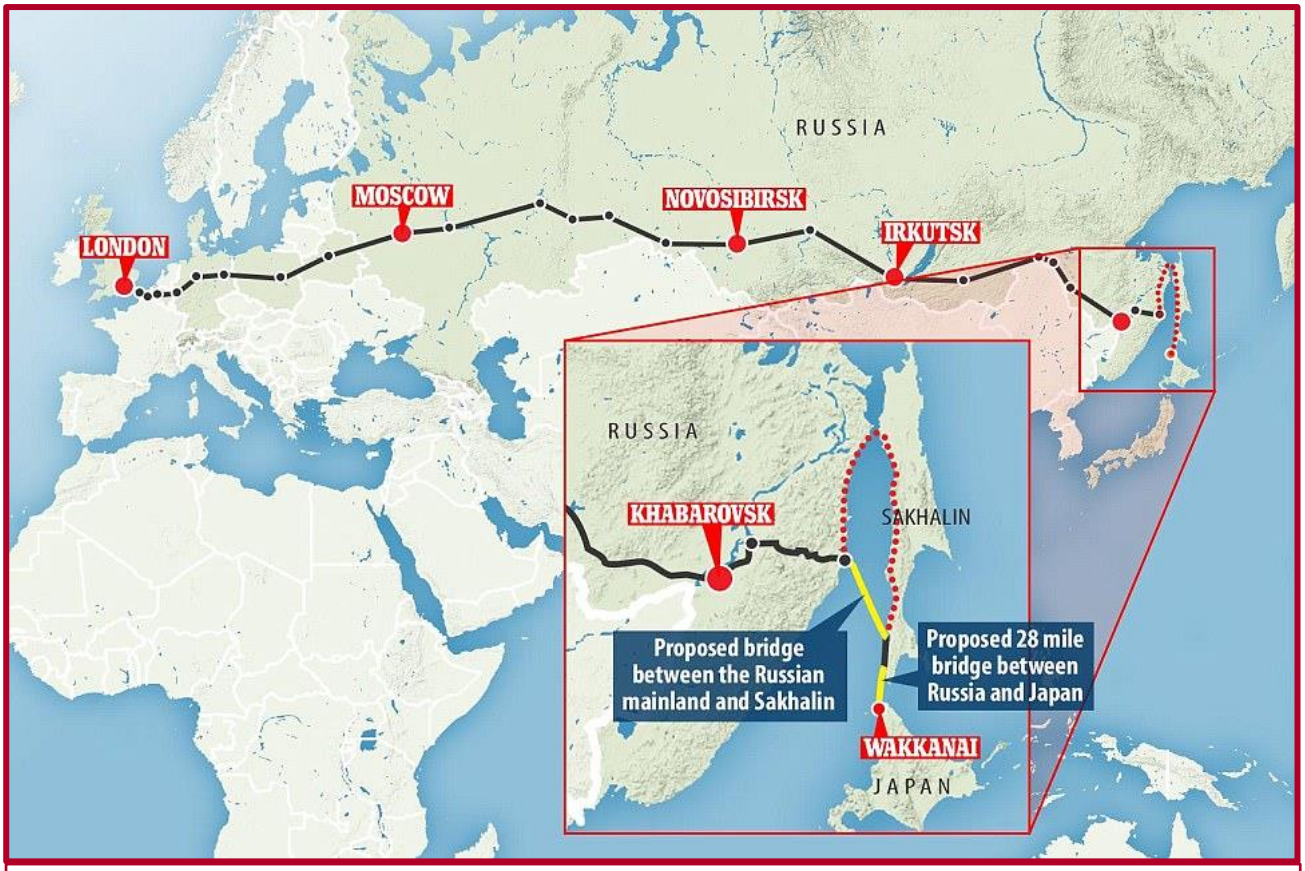
To conclude this part of the analysis, the effects on Japan's security stance need to be considered as well. It may be thought that a reduced dependency on energy imports along the SLOC from the Middle East may reduce Tokyo's needs and commitments to regional security, notably in its maritime dimension. However, this is unlikely to happen. The SLOC are essential not only for importing energy, but also for trading goods with Europe; and this aspect will not be modified by the decision to buy shale from the US. Again, the Japanese need to preserve a robust security presence to deal with China's growing naval power and to respect their commitment to the alliance with the Americans. **As such, while importing shale may solve some of Japan's geopolitical (and also economic) issues, it will not be the solution to all of its maritime security needs; notably the protection of the SLOC.**

Energy Cooperation with Russia

For Japan, the great advantage of importing shale gas & oil from the US would be that of reducing its dependency on hydrocarbons from the Middle East, thus mitigating all the associated risks. But this objective can also be achieved by engaging in a deeper energy and economic cooperation with Russia. As a matter of fact, the Russian Far East holds huge energy reserves, but they need notable investments to be exploited; mainly because of the harsh climate and the lack of infrastructure. If one considers the geographic context, Japan is in a position to benefit from the development of the energy industry in the area. As in the case of importing shale from the US, **buying fuel from the Russia's Far East would allow to reduce the risks associated with being dependent from the Middle Eastern energy**; namely instability in the region and a potential disruption of the SLOC. In this regard, it is notable that Tokyo and Moscow have reached a series of memoranda and agreements for the joint exploration of hydrocarbons in Sakhalin, for closer cooperation in the energy industry, and for establishing common financial funds to support such initiatives[20]. Another notable project is that of creating a direct road connection between the two countries by building a 28-mile bridge or undersea tunnel linking Hokkaido and Sakhalin, as well as a bridge to unite the

[20] *Russia, Japan deepen ties with agreements on upstream, LNG cooperation* (2016).

latter with mainland Russia. In the end, this would result in an 8,400 mile railway enabling to travel from London to Tokyo by train[21].



Map of the project for the London-Tokyo railway, including the Hokkaido-Sakhalin bridge.

Photo credit: http://www.dailymail.co.uk/news/article-4862778/New-8-400-mile-route-link-London-Japan.html

While these are ambitious projects, they present significant difficulties (especially the last one) and their realization is uncertain; still, **the new roads connecting Japan and the Russian Far East may represent an interesting development for the cooperation between the two countries.**

Another issue involving Russia in which Japan may have a stake is the exploitation of the Arctic's resources and the Northern Sea Route (NSR). The area around the North Pole is believed to host immense hydrocarbon reserves, and with the melting of the ice in the Arctic Ocean due to climate warming, a new maritime road connecting East Asia and Europe should open. The exploitation of the Arctic is highly controversial, notably because of environmental concerns; but Tokyo may take significant advantages from this issue. In relation to energy, accessing the resources of the Arctic would allow it to further diversify its supply sources so to avoid the risks associated with importing from the Middle East. In broader terms, the opening of the NSR would make it possible for Japan to exchange goods with Europe through a much shorter course, resulting in a potential reduction of the costs that would benefit trade. Traffic along the NSR is expected to increase (also due to the presence of hydrocarbons); but **such options are largely a prospect for the future by now**[22], as the

[21] *From London to Tokyo by TRAIN: Epic new 8,400 mile route will link the Trans-Siberian railway to Japan* (2017).
[22] For a good overview on trade in the Arctic see *A new era of shipping traffic on the Northern Sea Route* (2017).

current traffic on the NSR is still limited because of the extreme weather conditions and to the lack of proper infrastructure. Additionally, relying on the Arctic for resources and trade may also bring its own problems: if tensions were to rise due to divergences among states on the access to hydrocarbons / minerals and on the freedom of navigation, Japan may be negatively affected or even directly involved. Still, Japan is showing interest in the region, as demonstrates the fact that **it has released an official document on its Arctic Policy in 2015, which reflects such concerns by emphasizing the need to avoid a militarization of the area and to promote cooperation** among Arctic and non-Arctic states [23]. This last aspect probably indicates that the Japanese are worried over Beijing's persistent and increasing activities in the region[24]. As a matter of fact, its interest on that matter as exactly the same as Tokyo's (exploiting the Arctic to reduce its dependency on hydrocarbons from the Middle East and on the SLOC crossing the Indian and Pacific Ocean); and the . Given the complicated Sino-Japanese relations, in the long term this may be a source of conflict between the two powers.

A deeper cooperation with Russia would be necessary for Japan to benefit from these geoeconomic developments; and it appears that the two powers are taking some initiatives in this regard. Still (apart from the inherent challenges of in building a road connecting Japan and Russia, of operating in the Arctic and of extracting fossil fuel in Eastern Siberia) **there are some political factors that obstacle a greater cooperation between Tokyo and Moscow.** The most direct one is the longstanding dispute over the Southern Kuril / Norther Territories[25], a group of small islands located north-east of Hokkaido that are controlled by Russia but claimed by Japan; and that are also believed to host some valuable resources, including hydrocarbons. This dispute is an important problem in the Russo-Japanese relations: it is among the factors impeding the two states to sign a peace treaty[26], and it may hamper the possibilities of further cooperation. Moreover, Japan is a close ally of the US, and this is naturally another obstacle. Moscow does not appreciate it, but at the same time Washington has expressed its concern to Tokyo over the prospect that it may establish a closer energy cooperation with the Kremlin[27].

As a result, **there is some space for greater collaboration between Japan and Russia over energy exploitation, but there are also some political factors limiting their partnership.** Moreover, such cooperation is made difficult by the technical challenges linked to the extreme weather conditions. Of the proposed projects, the joint explorations in Sakhalin and generally in Siberia appears the most realistic ones to achieve; while the operations in the Arctic appear too complicated by now. **Still, there is at least a willingness among the two powers to establish a closer cooperation on energy** matters, and this may actually benefit Japan in the future.

[23] Japan's Arctic Policy (2015).
[24] For example, the Chinese are sending more ships in the Arctic. *China sends more than a dozen vessels through the Arctic Ocean* (2017). See also *A new era of shipping traffic on the Northern Sea Route* (2017).
[25] *The islands in the way of WW2 peace deal between Russia and Japan* (2016).
[26] Japan and Russia are still technically at war, because after WWII the former did not conclude any peace treaty with the Soviet Union; and today's Russia "inherited" this situation.
[27] *U.S. irritated by Japan-Russia offshore exploration deal* (2017).

Conclusions

As seen, Japan is largely dependent on energy imports from the Middle East. This exposes the country to the risks of instability in the area and of an interruption of the SLOC; both events that could interrupt the energy flow to Japan and severely compromise its economy and national security. To solve the problem, Tokyo has various options: investing in renewable energy sources (as it is doing), importing shale gas & oil from the US, and developing closer energy ties with Russia (and other countries). The last two choices present both a series of advantages and challenges. The overall situation can be summarized as follows:

- ***Shale imports from the US***
    - *There is great uncertainty over the economic convenience for Japan of buying shale from America, and there are currently not enough data to make a proper evaluation.*
    - *Most of the concerns over choosing this option (running a trade deficit with the US, the risk of an increase in Japan's interest rates, and ultimately the beginning of a debt crisis) appear exaggerated.*
    - *On the contrary, the geopolitical advantage of this choice (reducing the reliance on the Middle East and on the vulnerable SLOC) is undeniable.*
    - *It appears that Japan is willing to explore this option and maybe even expand its imports of American shale-originated fuel, as the first deliveries started in January 2017.*

- ***Energy cooperation with Russia***
    - *In geopolitical terms, the joint exploitation of hydrocarbon reserves in Sakhalin, Siberia and possibly the Arctic may contribute in diversifying Japan's energy supply, allowing it to become less reliant on the Middle East and the SLOC; but this is technically challenging and will demand important investments.*
    - *There are notable political obstacles to the energy collaboration between Tokyo and Moscow, namely the territorial dispute they are involved in and the former's alliance with Washington; but Japan's interest in accessing these resources and Russia's willingness in attracting investments to develop its Far East may allow them to overcome such difficulties.*
    - *As a matter of fact, there are signs that Japan wants to pursue this policy, since it concluded several deals with Russia in this sense; still, it will take time to expand the energy cooperation between the two powers.*

In the end, it should not be forgotten that both choices are only two possibilities for Japan to diversify its energy supplies, but they can play important role in solving the country's problems. Making projections is not easy, and it is early to assess to what extent these two options will be effective. Still, recent developments indicate that Japan is seeking to increase shale gas & oil imports from the US and to establish greater energy cooperation with Russia, possibly originating a trend that may become more marked in the future.

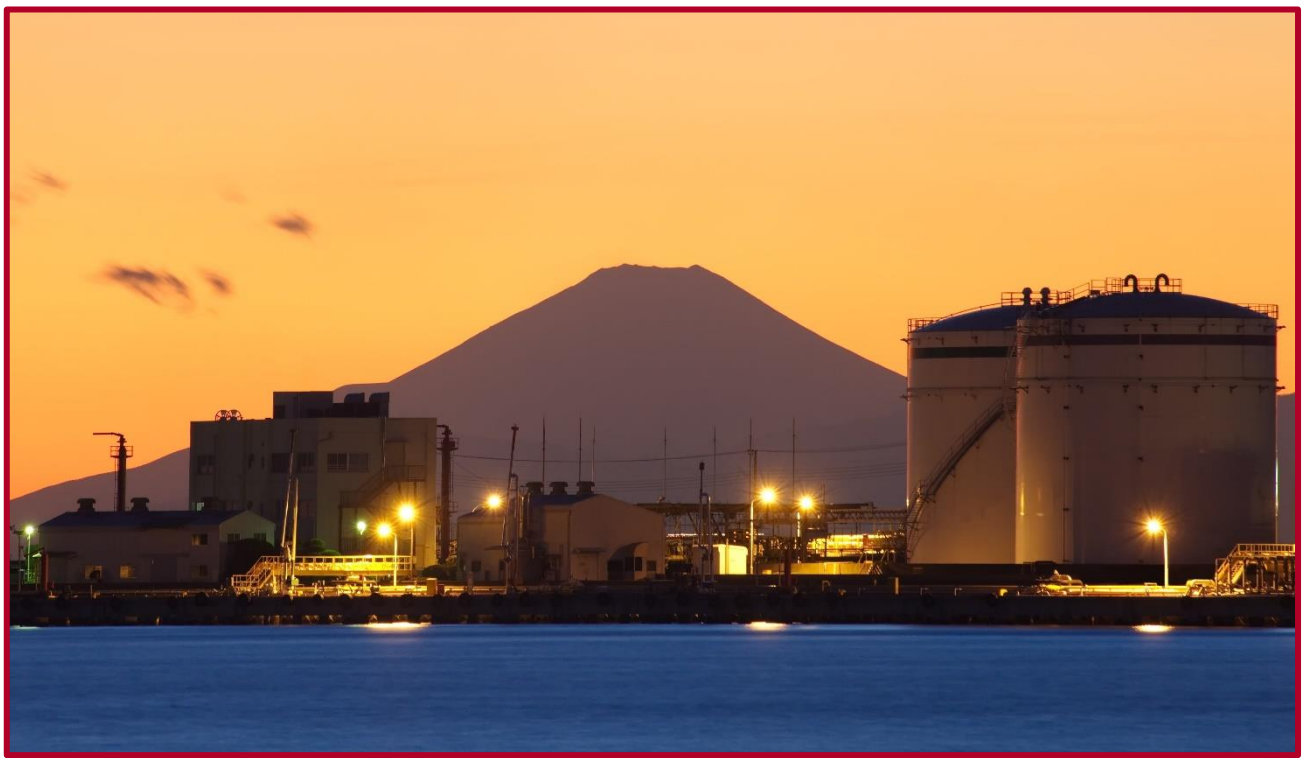


Photo credit: https://breakingenergy.com/2015/06/08/iea-report-high-prices-eroded-asian-gas-demand-more-supply-coming/

References

- ***America's Energy Edge: The Geopolitical Consequences of the Shale Revolution*** (Foreign Policy, 2014): http://www.relooney.com/NS3040/000_New_1364.pdf

- ***A new era of shipping traffic on the Northern Sea Route*** (Arctic Now, 2017): https://www.arcticnow.com/voices/analysis/2017/08/23/a-new-era-of-shipping-traffic-on-the-northern-sea-route/

- ***China sends more than a dozen vessels through the Arctic Ocean*** (High North News, 2017). : http://www.highnorthnews.com/china-sends-more-than-a-dozen-vessels-through-the-arctic-ocean/?lipi=urn%3Ali%3Apage%3Ad_flagship3_detail_base%3BaIdidXJwQ72pyQh4rJhe9Q%3D%3D

- ***From London to Tokyo by TRAIN: Epic new 8,400 mile route will link the Trans-Siberian railway to Japan*** (Daily Mail Online, 2017): http://www.dailymail.co.uk/news/article-4862778/New-8-400-mile-route-link-London-Japan.html

- ***Increase in U.S. energy imports on table as Abe prepares to meet Trump*** (Japan Times, 2017): https://www.japantimes.co.jp/news/2017/02/05/national/increase-u-s-energy-imports-table-abe-prepares-meet-trump/#.Wg2zAbpFyM8

- ***Is U.S. LNG Too Expensive For Asian Markets?*** (Oilprice.com, 2017): https://oilprice.com/Energy/Gas-Prices/Is-US-LNG-Too-Expensive-For-Asian-Markets.html

- **Japan Agency for Natural Resources and Energy, Energy White Paper FY2016** (released in 2017): http://www.meti.go.jp/english/report/downloadfiles/2017_outline.pdf

- ***Japan and the Geopolitics of the Shale Revolution*** (Nippon.com, 2012): https://www.nippon.com/en/in-depth/a01601/

- ***Japanese market liberalization to impact LNG trade*** (special report by S&P Global Platts, 2017): https://www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/SR-japan-market-liberalization-lng-trade-042017.pdf

- ***Japan's Arctic Policy*** (The Headquarters for Ocean Policy, 2015): http://www.kantei.go.jp/jp/singi/kaiyou/arcticpolicy/jpn_arcticpolicy/Japans_Arctic_Policy[ENG].pdf

- **Observatory of Economic Complexity**, Japan country profile: https://atlas.media.mit.edu/en/profile/country/jpn/

- ***Rebuilding Japan's Energy Policy*** (The Tokyo Foundation, 2012). http://www.tokyofoundation.org/en/articles/2012/rebuilding-japans-energy-policy

- ***Russia, Japan deepen ties with agreements on upstream, LNG cooperation*** (S&P Global Platts, 2016): https://www.platts.com/latest-news/natural-gas/moscow/russia-japan-deepen-ties-with-agreements-on-upstream-27733406

- ***The Geopolitics of Shale Gas*** (report by The Hague Centre for Strategic Studies, 2014): https://hcss.nl/sites/default/files/files/reports/Shale_Gas_webversieSC.pdf

- ***The islands in the way of WW2 peace deal between Russia and Japan*** (BBC, 2016): http://www.bbc.com/news/world-asia-38311651

- ***Trump lashes out at 'unfair' Japan trade ties*** (BBC, 2017): http://www.bbc.com/news/business-41882482

- **US Energy Information Administration (EIA)**, Japan country profile: https://www.eia.gov/beta/international/analysis.cfm?iso=JPN

- ***U.S. irritated by Japan-Russia offshore exploration deal*** (OffshoreEnergyToday.com, 2017). See http://www.offshoreenergytoday.com/u-s-irritated-by-japan-russia-offshore-exploration-deal/

- ***U.S. shale gas alters Japan's energy plans*** (Japan Times, 2013): https://www.japantimes.co.jp/news/2013/05/20/business/u-s-shale-gas-alters-japans-energy-plans/#.Wg2zBLpFyM8

- **World Bank**, Japan data: https://data.worldbank.org/indicator/GC.DOD.TOTL.GD.ZS?locations=JP