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Assessing the West Bank and Gaza's Energy Reliability in the Face of Conflict: Looking Towards the Future and Developing Reliable Energy Sources

Intro

Palestine has been a hot topic of discussion for a lot of political debates or one that groups avoid talking about because of various views. The world has gotten wrapped up in the drama of conflict that they have forgotten about one very important thing, energy. This paper assesses energy reliability in Gaza and the West Bank in the face of conflict, and what they are doing to create a more reliable energy sector. We will look at the territory's energy mix, how conflict affects the energy sector, demand and supply, and finally renewable energy. Each section goes into various factors of energy reliability for the West Bank ad Gaza. Overall, findings conclude that rooftop solar energy is a key pathway for developing a reliable energy sector.

Energy Mix

Palestine, specifically the Gaza Strip, has a unique mix of energy that currently has a total supply of around 1,100 MW of electricity, where 80 MW is generated from renewable sources [1].

[1] "West Bank and Gaza - Energy." *International Trade Administration*, International Trade Administration, Aug. 2022, https://www.trade.gov/country-commercial-guides/west-bank-and-gaza-energy.

Palestine's energy mix is mainly dependent on neighboring countries, connections with other Palestinian territories, and renewable energy sources. "Unable to produce their energy due to conflict-related restrictions, Palestine currently relies heavily on Israel as a near sole supplier of electricity"[2]. Accordingly, "Jordan supplies 80 MW, and Israel supplies the remaining 940 MW" [3]. The Palestinian territories heavily rely on Israeli-based electricity to meet its energy demands, the West Bank imports 99% of the total supply and 64% of the total supply in Gaza [4]. To have a dependence on electricity puts a financial burden on the West Bank, totaling "approximately 400-500 million USD per year"[5]. This begs the question of why Palestine, specifically the West Bank, can not develop its electricity sources. There are five electric distribution companies in the West Bank: the Jerusalem District Electricity Company (JDECO), which serves Jerusalem, Jericho, Ramallah, and Bethlehem; the North Electricity Distribution Company (NEDCO) and Toubas Electricity Distribution Company (TEDCO), which serve the northern parts of the West Bank; and the Hebron Electric Power Company (HEPCO) and the Southern Electric Company (SELCO), which serve the southern parts of the West Bank[6]. The energy mix that is supplied in the West Bank is mainly generated from Israel's natural gas sector and transported through the West Bank's electric distribution network.

In assessing energy reliability in Gaza and the West Bank renewable energy is a source of power that is in its early stages of development, with a high capacity to grow. Due to its geographic location, the Palestinian territories utilize solar and wind energy. It was measured 1% of renewable energy was anticipated to be generated from wind energy, 96% from solar energy

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[2] Scippa, Dina, et al. "Palestine Renewable Energy Project ." *USAID*, USAID, June 2017, https://pdf.usaid.gov/pdf_docs/PA00TM16.pdf.
[3] "West Bank and Gaza - Energy." *International Trade Administration*, International Trade Administration, Aug. 2022, https://www.trade.gov/country-commercial-guides/west-bank-and-gaza-energy.
[4] "Securing Energy for Development in West Bank and Gaza." *World Bank*, World Bank Group, 20 Nov. 2017, https://www.worldbank.org/en/country/westbankandgaza/brief/securing-energy-for-development-in-west-bank-and-gaza-brief.
[5] Scippa, Dina, et al. "Palestine Renewable Energy Project ." *USAID*, USAID, June 2017, https://pdf.usaid.gov/pdf_docs/PA00TM16.pdf.
[6] "West Bank and Gaza - Energy." *International Trade Administration*, International Trade Administration, Aug. 2022, https://www.trade.gov/country-commercial-guides/west-bank-and-gaza-energy.

(large, medium, and small plants), and the rest 3% from biogas and hydroelectric[7]. The West Bank is operating on 7.2% renewable energy looking towards an increase in solar and wind energy[8]. Though a lot of West Bank's energy is unofficial because of the increasing use of unpermitted rooftop solar energy, subject to demolition. Due to its geographic location, the West bank has a high capacity for solar energy being an arid territory. Palestine receives solar radiation about 3000 hours annually, and the average solar radiation values range from 5.4 kWh/m2.day to 6.0 kWh/m2.day [9]. The mountainous terrain in the Southern portion of the West Bank means there is also a high capacity for wind energy[10]. In fact, if the renewable energy sector was scaled up, it could have huge returns for the Palestinian people.

Fossil Fuel based power is at roughly 90% in the West Bank and Gaza, with most of its sources coming from Israel, and some coal and diesel plants. The Gaza Power Plant generates 60MW domestically, which accounts for only a small portion of Palestine's energy demand. The 140 MW imported from Israel and Egypt is completely based on fossil fuels[11], mainly natural gas which is abundant in Israel. Palestine would be in control of its natural gas supplies but, Since the blockade of Gaza in 2007, the Israeli government has established de facto control over Gaza's offshore natural gas reserves[12]. Palestine could have a more reliant energy sector if they were able to switch to natural gas. The West Bank and Gaza could potentially be supplied with gas in connection with the Israeli gas transportation network. This would make it possible to

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[7] Salem, Hilmi S. "The Potential of Wind Energy in Palestine with Healthcare and Residential Examples with the West Bank and the Gaza and Strip." *Nature Science and Sustainable Technology*, vol. 13, no. 2, 2019.

[8] Salem, Hilmi S. "The Potential of Wind Energy in Palestine with Healthcare and Residential Examples with the West Bank and the Gaza and Strip." *Nature Science and Sustainable Technology*, vol. 13, no. 2, 2019.

[9] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.

[10] Salem, Hilmi S. "The Potential of Wind Energy in Palestine with Healthcare and Residential Examples with the West Bank and the Gaza and Strip." *Nature Science and Sustainable Technology*, vol. 13, no. 2, 2019.

[11] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.

[12] Elkhafif, Mahmoud. "Palestine's Forgotten Oil and Gas Resources." *Al Jazeera*, Al Jazeera, 21 June 2021, https://www.aljazeera.com/opinions/2021/6/21/palestines-forgotten-oil-and-gas-resources.

have a gas-fired power generation in the West Bank, allowing for a cost-effective domestic solution to energy reliability issues.

Conflict Affecting the Energy Sector

The conflict in the West Bank as well as Gaza has made the energy sector increasingly difficult to be reliable. The nexus between conflict and energy is a threat multiplier, meaning that it may exacerbate other threats to security[13]. Conflict may limit access to energy and limited access to energy may lead to conflict affecting other sectors in the process. The ongoing conflict between Israel and Palestine has led to suffering from both sides, though Palestine is disproportionately affected. Unfortunately, "electricity infrastructure is extremely vulnerable due to frequent armed conflict in Gaza. During the 2014 conflict, GPP and numerous power lines from Israel and Egypt were damaged, leaving hundreds of thousands of people, as well as critical facilities such as hospitals, without power"[14]. Just as the political ties between Israel and Palestine are vulnerable, the energy grid is also at risk of damage. Is it possible for these two issues to go hand in hand? Because of the inability to develop energy-related infrastructure the West Bank relies nearly solely on Israel to supply its energy needs[15]. Israel also controls access to build new energy sources in Palestine. For example, "Palestinian communities are also [98.5% of the time] denied permits to set up solar panels, a requirement for all buildings in Area C". This would leave hundreds of thousands without electricity and other sources of power. In turn, they often build solar installations without permits, and are exposed to subsequent confiscation and

[13] Werrell, Caitlin E, and Francesco Femia. "Climate Change as Threat Multiplier: Understanding the Broader Nature of the Risk." *The Center for Climate and Security*, 12 Feb. 2015.
[14] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.
[15] Scippa, Dina, et al. "Palestine Renewable Energy Project ." *USAID*, USAID, June 2017, https://pdf.usaid.gov/pdf_docs/PA00TM16.pdf.

demolitions[16]. Overall, conflict between the Occupied Palestinian Territories and Israel has made energy reliability an issue for Palestinans.

Gaza and the West Bank have also had issues based on their leadership that has resulted in electricity unreliability. The functioning of Gaza's sole power plant (GPP) is impaired, as a result of disputes between two Palestinian authorities in Gaza city (in the Gaza Strip) and in Ramallah city (in the West Bank)[17]. The GPP shut down after depleting its fuel supply in April 2017. The GPP got into this position because of the lack of funding and taxation, inadequate collection of bills, destruction of fuel tanks during Israeli strikes, and Israeli restrictions on imports of infrastructure due to security claims[18]. This was the fault of the West Bank towards Gaza. The reason for this was that the Ramallah-based Palestinian Government stopped its payments to Israel to supply power to Gaza[19]. As a result, Israel reduced its supply in June 2017 by 40%" Leadership within Palestinian territories is uncertain because of the dispersed territories [20]. In Gaza, Hamas has more or less seized control. While in the West bank the Palestinian Authority (PA) mainly has control[21]. The division of factions within Palestine created a disjunct leadership and lead to a lack of communication to maintain payments to Israel, as a consequence the GPP could no longer run. The lack of energy leads thousands to suffer in the Palestinian territories. That is why to combat the unreliability of electricity, the West Bank would find it beneficial to switch to renewable energy.

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[16] "COP26: Destruction of Solar Panels in Area C of the West Bank, an Attempt to Undermine Palestinian Development of Sustainable Energy." *Al Haq*, Al Haq, 4 Nov. 2021, https://www.alhaq.org/advocacy/19157.html.
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Demand and supply

The West Bank and Gaza have a demand for energy that is not being met by its current supply. This deficit is due to an increasing population, lack of infrastructure, and funding. Although international organizations are aiding in supplying more energy for Gaza and the West Bank to have its people achieve more stable livelihoods. Circling back, energy only is viable for up to 12 hours or less a day for the majority of the population in Gaza and the West Bank[22]. The two territories receive 1,1000 MW[23], though its demand is up to double that due to the fact they receive electricity for approximately half of the day. the cost of energy in Palestine is the highest in the region and the scarcity that growing demand has caused has had a devastating effect on the quality of life and poverty levels in the territories[24]. The electricity system requires substantial upgrading and expansion to meet current demand. The insufficient power supply is a serious impediment to Palestinian economic growth.

The increasing population has been a major struggle with supplying the West Bank and especially Gaza with reliable energy. In 2016, the population of the occupied Palestinian Territories was approximately 5.1 million and is presumably much higher now than it was then [25]. Focusing on the Gaza Strip, with a total area of 6,000 Km2, population density has reached 6,100 people/ Km2[26]. This would make Gaza one of the most densely populated areas in the developing world. This pertains to the issue of energy reliability because insufficient supply, increasing population, and high population density make it ever more difficult to generate

[22] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.
[23] "West Bank and Gaza - Energy." *International Trade Administration*, International Trade Administration, Aug. 2022, https://www.trade.gov/country-commercial-guides/west-bank-and-gaza-energy.
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[26] Salem, Hilmi S. "The Potential of Wind Energy in Palestine with Healthcare and Residential Examples with the West Bank and the Gaza and Strip." *Nature Science and Sustainable Technology*, vol. 13, no. 2, 2019.

enough electricity for the growing demand. To combat this issue residents are generating their electricity by installing rooftop solar panels for their households, though hospitals, shops, and other buildings utilize this solution as well[27]. Having reliable energy for the growing population of Gaza and the West bank will help citizens in the growing population of Palestine.

The lack of infrastructure is a supply and demand issue of Gaza and the West Bank's energy reliability. The territories are lacking the infrastructure for reliable electricity, through power plants, renewable energy sources, and the linkage to a stable energy grid. The sole power plant in the Occupied Palestinian Territories is the Gaza Power Plant (GPP)[28]. The GPP has been subject to shutting down and doesn't supply enough energy for its demand. The renewable energy infrastructure is still in its infancy in the West Bank and Gaza. There is a high capacity for the renewable energy sector to be scaled up through a lack of funding impedes that initiative. Developing renewable solar energy would heavily strengthen energy reliability and bring needed supply to the demand. The West Bank and Gaza are located in a region rich with the sun's energy and are ranked amongst the world's top locations for the construction of solar systems[29]. A future with more developed renewable energy infrastructure would greatly help energy security in Palestine. Additionally, Gaza and the West Bank are not connected to a stable energy grid, impeding reliable energy supply. The five electric distribution companies (JDECO, NEDCO, TEDCO, HEPCO, & SELCO) in the West Bank connect cities to an energy source[30]. The electricity infrastructure is extremely vulnerable due to frequent armed conflict in Gaza. In the 2014 conflict, hundreds of thousands of people, as well as critical facilities such as hospitals

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[30] "West Bank and Gaza - Energy." *International Trade Administration*, International Trade Administration, Aug. 2022, https://www.trade.gov/country-commercial-guides/west-bank-and-gaza-energy.

were without power[31]. Israel's 12-year-old blockade and asymmetrical wars left Gaza's infrastructure severely crippled and with a near-constant electricity shortage[32]. The lack of infrastructure in Palestine creating a supply and demand issue in Palestine has been a speed bump in the development of a reliable energy sector in Palestine.

Funding of energy resources in the Occupied Palestinian Territories has made supply difficult to bring reliable energy to people- international organizations have made a concerted effort to bring energy and funding to the area. Due to the conflict between Israel and Palestine and lack of resources/ access to resources, Gaza and the West Bank do not have the proper funding to scale up their energy resources to give their people the supply of reliable they need. The Palestinian territories on Israel's power won't help in developing their energy sector. USAID weights "By reducing dependency on energy imports and increasing utilization of renewable energy, ensuring resilient and sustainable energy supply, the Palestinian economy has an opportunity to produce up to 70% of its electricity needs domestically, with as much as 50% of production coming from renewable sources by 2030."[33]. It is apparent that Palestine has struggled to commit to developing its reliable energy supply because of a lack of funding, though international organizations have filled the gaps and aided in the progress of providing reliable energy to Palestinians. International organizations have been aiding in funding renewable energy in Palestine, mainly taking advantage of the high solar capacity and installing solar panels on rooftops of buildings. In fact, Between 2012 and 2014, 300 Kilowatts of solar rooftop installations were provided by donors and following 2014, this increased more than 10-fold to

[31] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.
[32] "Israel's Exploitation of Palestinian Resources Is Human Rights Violation." *OHCHR*, UN, 18 Mar. 2019, https://www.ohchr.org/en/news/2019/03/israels-exploitation-palestinian-resources-human-rights-violation-says-un-expert.
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over 3,500 Kilowatts[34]. As of 2017, approximately 310 Kilowatts of rooftop solar panels had been or were in the process of being installed on top of health facilities in Gaza[35]. The potential for continuing the initiative of solar roofing could bring 1MW of energy supply from a solar generation at 10 hospitals in Gaza for about 4 million US dollars. Alternatively, fuel supply to the same facilities at current prices would cost US$ 1 million every year[36]. The United Nations Office for Project Services (UNOPS) worked to install hybrid solar systems in Gaza, with a peak capacity of around 3 kilowatts (kW), on the rooftops of households[37]. The UNOPS in partnership with the government of Japan has worked to provide renewable energy for the European Gaza Hospital, by installing a 715 kW hybrid solar system[38]. This initiative will help to supply reliable energy for healthcare services for approximately 100,000 Palestinian patients living in Gaza. Overall, the funding for the West Bank and Gaza's energy sector has made supply access on an individual level slightly difficult, but organizations have helped to bring access to the Palestinian people.

Renewable Energy

Renewable energy in the West Bank and Gaza is the most reliable path that can be developed in the country, on top of that it will bring about returns for the Palestinian people. We will investigate Solar energy, with its capacity, application, and limitations. Solar energy can be

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[37] "Providing Reliable and Sustainable Energy to the People of Gaza - Occupied Palestinian Territory." *ReliefWeb*, UNOPS, 23 June 2020, https://reliefweb.int/report/occupied-palestinian-territory/providing-reliable-and-sustainable-energy-people-gaza.
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utilized in a household to an industrial level by installing solar panels on the tops of buildings. With high capacity, there can be lots of return on investment though the cost might be high for individuals. Also, there are limitations like conflict affecting infrastructure. Analyzing these factors will help us conclude the necessity for solar energy as a reliable energy source.

Solar energy in the West Bank and Gaza is one of the key ways to create dependable energy. The capacity for solar energy is high With eight and a half hours of sun every day on average, solar energy would generate reliable power[39]. Even in the winter months, the expected return of a PV solar system is 433 kWh, which would be sufficient for 1.6 households[40]. The West Bank and the Gaza Strip, have a minimum of 320 days of sunshine a year, making solar energy an ideal power source[41]. the average solar energy would supply 5.4 kWh/m2.day to 6.0 kWh/m2.day[42]. To compare, Madrid-Spain receives 4.88 kWh/m2.day, and Sydney-Australia 4.64 kWh/m2.day[43]. According to comprehensive cross-research, the Gaza Strip is considered the best for solar generation with PV panels, and Jericho is worst due to its high temperatures and aerosol air content. Generally, The Gaza Strip and Southern West Bank, around Hebron, have the highest potential for solar capacity[44]. A study that assessed the solar energy potential in the Gaza Strip, concluded that best case scenario, rooftop PV power could fulfill the needs of Gaza's electricity demand to be reliable[45]. Overall, Solar capacity in the Palestinian territories,

[39] "COP26: Destruction of Solar Panels in Area C of the West Bank, an Attempt to Undermine Palestinian Development of Sustainable Energy." *Al Haq*, Al Haq, 4 Nov. 2021, https://www.alhaq.org/advocacy/19157.html.
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especially Gaza, is high. Therefore reliable energy can be accessed by the Palestinian Territories through Solar energy.

The actual application of solar energy in the West Bank and Gaza is almost entirely made up of PV Pannels on roofs of buildings which supply reliant energy to people and institutions. With rooftop solar the people of the West Bank and Gaza only need to invest in installing the panels would make returns quickly rather than feed into the unreliable energy imported from Israel and other countries. solar energy has also become increasingly attractive as costs have dropped by 80 percent over the past 5 years driven by rapid technological chang[46]. The Gaza Electricity Distribution Company (GEDCO)'s new innovative solar program sells solar systems to residential and business consumers with payment in monthly installments over 18-24 months [47]. As noted before organizations, like UNOPS and GEDCO, have helped to fund the solar electrification of buildings in Gaza and the West bank. Even so, because of the state of Palestine, many of its citizens are impoverished and few can afford to pay the full upfront cost in one installment[48]. Hopefully, though more international investors will aid in bringing solar energy to the people and institutions of the Palestinian Territories. The addition of batteries to store the solar energy generated during the day could help the solar sector in Palestine become more robust. Furthering, when there are periods of no electricity, like in the case of conflict if the exporters of energy shut down that source, there will be self-reliance to obtain electricity. The capacity of solar energy in the West Bank and Gaza is optimal to develop the Solar energy sector and allow for the territories to be resiliant. In only a couple of years, the sector has grown, having only a few solar companies in 2014 to having over 20 in 2017 has been a great jump to

[46] "Securing Energy for Development in West Bank and Gaza." *World Bank*, World Bank Group, 20 Nov. 2017, https://www.worldbank.org/en/country/westbankandgaza/brief/securing-energy-for-development-in-west-bank-and-gaza-brief.
[47] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.
[48] Badiei, Sara. "Solar Energy." *World Bank Blogs*, World Bank, Aug. 2017, https://blogs.worldbank.org/arabvoices/solar-energy-putting-power-back-hands-ordinary-gazans.

the West Bank and Gaza[49]. Overall, the application of solar energy in Palestine is being done though in its infancy is not where it could be. Thanks to organizations international and internal to Palestine, the development of the Solar energy sector applications have helped the country access more reliable energy.

As great as solar energy could be for the West Bank and Gaza, some limitations make the infrastructure less reliable. In previous sections, we went into how conflict affects the energy sector. Poverty, lack of funding, conflict, and destruction of infrastructure is all wrapped up in the limitations of implementing solar energy in the Palestinian territories. Poverty and lack of funding go hand in hand because as Palestine does get help from international organizations, many of its people are still impoverished with low job opportunities[50]. Not everyone can pay the upfront costs that installing PV panels demands. It should be noted that scaling up the solar energy sector could help to revert that and bolster education as well. As of now though, poverty and lack of funding are impeding the energy sector from advancing to a point where Palestine could have solar energy reliance. Moving on, conflict and destruction of infrastructure limit solar energy reliability because of the conflict between Israel and Palestine. Palestinians tend to build unpermitted rooftop solar panels because of harsh regulations implemented by the occupying country. Therefore the solar systems which were supplying reliable energy are subject to destruction[51]. The political affairs around Palestine affect and limit the way it is seeking to develop its solar energy sector. To wrap up, solar energy has a bright future in the Palestinian territories, though limitations have slowed that progress, in a hopeful light, there is room to grow.

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[49] Scippa, Dina, et al. "Palestine Renewable Energy Project ." *USAID*, USAID, June 2017, https://pdf.usaid.gov/pdf_docs/PA00TM16.pdf.
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[51] "COP26: Destruction of Solar Panels in Area C of the West Bank, an Attempt to Undermine Palestinian Development of Sustainable Energy." *Al Haq*, Al Haq, 4 Nov. 2021, https://www.alhaq.org/advocacy/19157.html.

Discussion

I want to note, almost metaphorically, as energy can be unreliable in the Palestinian Territories, information can be too. It was hard to find parallel current information. I looked only for reliable sources, though even they showed differences in their information. This can be normal, but I speculate too as a result of war and conflict in the region it is hard to stay up to date with providing information on energy resources in Palestine. I wondered when researching this topic if a lot of the information I was collecting was biased because of the political implications of Israel-Palestine. It is even important to note that I have my own biases, growing up in an Arab country and hearing about these issues firsthand from Palestinian friends. I attempted to be as unbiased and not personal about the subject matter, though bias is implicit. I believe there is huge room for growth, especially in the solar energy sector in obtaining a more reliable energy system and not depending on neighboring countries. I genuinely hope in the future Palestinians can develop solar energy for themselves to be self-sufficient. I'm excited to see what the future holds.

Conclusion

The West Bank and Gaza could be heading toward a more reliable energy future with solar rooftops as the main goal. Palestine's energy sector has been slowed due to conflict with it and its surrounding counties, though investing in reliable energy could alleviate the threat multiplier that energy creates. By analyzing the energy mix, how conflict affects the energy sector, demand and supply, and finally renewable energy we can take away much more than we

came with. Hopefully now when discussing Palestine, people can think about energy reliability as a huge factor that affects the country.

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