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Energy Data Borders: Exploring Data Localization in the Energy Sector

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This study provides an overview of data localization laws and policies in the energy industry. Through literature and academic reports, it distinguishes between data localization and data residency, analyzes the challenges and benefits of data localization, and finally provides policy recommendations. Different countries often use data localization to protect the energy industry. Because the energy industry is one of the main drivers of economic, social and industrial development in countries, and many aspects of human life depend on it. Disruption in this industry has serious consequences, which is why countries view it as a matter of governance and state regulation. The question of this paper is how data localization laws and policies affect the energy industry. Although data localization policies protect sensitive data to some extent and enhance national security, they also bring disadvantages along with their benefits. They increase costs, reduce the effectiveness of industrial operations, and affect small companies. This research highlights the importance of creating adaptable data localization regulations to keep energy data secure while enabling collaboration and development of new technology and balancing security and progress in the energy industry worldwide. In other words, alongside data localization regulations to protect the industry, the transfer and sharing of useful data among industry stakeholders should be considered.

Keywords: *data localization, energy sector, data management, data protection.*

INTRODUCTION

The energy industry is a vital part of modern economies, just like capital, labour, and land. It fuels economic growth, strengthens public infrastructure, and enhances everyday life, shaping the progress of society. Because of its importance, the way energy data is stored and managed needs clear policies to guarantee security, efficiency, and continued innovation.[1] The energy industry is a key part of modern life and creates significant sensitive data. As the energy sector is crucial for society and is connected to national security, governments have made rules about how and where this data can be stored and generally prevent the sharing of energy data across borders. These rules help keep the industry safe and protect sensitive information. Since energy is a global business, it is important to understand data localisation policies and the challenges they bring.[2]

Research on energy data localization should be separate from general data localization rules. The energy industry is a big part of everyday life, and any issues can cause serious problems for businesses, people, and national security. Energy data includes a wide range of important details like energy production data, energy consumption data, energy transmission and distribution data, consumer behaviour data, and policy and regulatory data. Some parts of energy data need strong security to keep them safe. Therefore, it is different from other industries. With growing cyber-attacks and threats to energy systems, it is important to have proper regulations on where and how energy data is kept, ensuring energy systems stay safe and reliable for the future.

This study explores an important question: How do rules and policies of data localization and storing data in specific locations affect the energy industry? To find answers, it looks at research papers, industry reports, and government policies. It explains the difference between data localization and data residency. The research also examines the challenges and benefits of these rules and considers how they influence the operations of energy companies. Finally, it presents policy recommendations.

[1] Lijing Zhang et al., 'A Review of Energy Industry Chain and Energy Supply Chain' (2022) 15(23) Energies <https://doi.org/10.3390/en15239246> accessed 04 February 2025
[2] *Ibid*

DATA LOCALIZATION v DATA RESIDENCY: UNDERSTANDING THE DISTINCTION

Data localization can be understood in two main ways. The first is localized data hosting, where governments require companies to store user data on servers inside the country. This data can either be the only copy or a duplicate kept alongside storage in other countries. The second is localized data routing, which means that when people in the same country share data, it must stay within local networks. This rule prevents the data from travelling through international routes, keeping it within national borders.[3]

Data localization is broadly defined as the set of provisions that specifically encumber data transfer across national borders.[4] Some countries require businesses to store data within their borders, a rule known as data localization, which prevents companies from moving or processing that data internationally and makes cross-border sharing more difficult. In contrast, data residency is a choice—companies decide where to store their data based on factors like tax benefits business efficiency, or the company's policy. While localization is a strict legal requirement, residency is a strategic decision that allows businesses more flexibility in managing their data.[5]

Data localization rules do more than just keep data within a country. Some governments completely block data from leaving, while others require special permission before it can be shared across borders. Some demand that companies store data locally or add extra costs for moving data out of the country.[6]

Data localization can be categorized into three types based on the scope and storage requirements of personal data: broad localization, specific localization, and combined localization.

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[3] John Selby, 'Data Localization Laws: Trade Barriers or Legitimate Responses to Cybersecurity Risks, or Both?' (2017) 25(3) International Journal of Law and Information Technology <http://dx.doi.org/10.1093/ijlit/eax010> accessed 04 February 2025

[4] Samuele Fratini and Francesca Musiani, 'Data localization as contested and narrated security in the age of digital sovereignty: the case of Switzerland' (2024) 1(6) Information, Communication & Society <https://doi.org/10.1080/1369118X.2024.2362302> accessed 04 February 2025

[5] *Ibid*

[6] G. Mahith Vidyasagar, 'Does Data Localization Measures Really Enhance Law Enforcement?' (2021) 2(1) NyaayShastra Law Review <https://94ee8b88-9ce0-4866-a7e6-564fad3575e4.usrfiles.com/ugd/94ee8b_f41565c1fbc1488989df48677f6b5cbd.pdf> accessed 04 February 2025

- **Broad Localization:** It covers the personal data from a broad perspective which means it covers all the categories of personal data and it stores a copy of the data within the country.
- **Specific Localization:** It covers specific categories of personal data and it includes only a certain type of organization that must comply with it and the copy of the data must be stored locally.
- **Combined Localization:** It covers the specific categories of personal data, and further, this type of localisation does not require storing a copy of the data locally.[7]

Countries have various regulations and policies regarding data localization. Some apply these regulations to all industries, while others apply them only to some sectors, like energy, finance, or health.

DATA LOCALIZATION IN THE ENERGY SECTOR

In general, countries have rules that force energy companies to keep their data within national borders. Those include data like power plant details, electricity use, and customer information. The main reason is to keep the data safe and protect energy systems like power grids. Governments also want surveillance companies to follow and respect local laws. Keeping data in the country has many benefits, but it also comes with challenges that may affect the energy sector. Even though this can be a challenge, many governments think these rules are necessary to protect the energy industry and support the business.[8]

Because energy is so important, many countries have rules about where energy data is stored and how it is managed. The energy data includes the infrastructure data and also information regarding customers' energy use. As mentioned earlier, governments are applying data localization policies for many reasons, such as improving security, protecting people's privacy, and ensuring businesses follow national regulations. However, not all countries take the same approach. Some have strict rules across many industries, while others focus only on critical sectors like energy. The main reason for data localization in the energy sector is

[7] Jigyasa Singh, 'Data Localization' (2022) 3(2) Jus Corpus Law Journal <https://www.juscorpus.com/wp-content/uploads/2023/01/96.-Jigyasa-Singh.pdf> accessed 04 February 2025
[8] *Ibid*

security concerns. Some argue these laws help safety, while others believe they make it harder for businesses to cooperate and work together.[9]

Below are some key factors about the benefits and challenges of data localization in the energy sector.

THE PIVOTAL SIGNIFICANCE OF DATA LOCALIZATION IN THE ENERGY SECTOR

Governments set data localization policies and regulations for different reasons which mainly affect three groups: individuals, platforms, and data itself. These policies are commonly selected by policymakers for security reasons arising from national sovereignty, especially in the energy sector, alongside protecting personal data and enforcing companies to follow local laws.[10]

Data localization protects people's privacy by keeping their data inside the country to make it more difficult to misuse. For digital platforms, these rules support local businesses by reducing competition from foreign companies and helping domestic industries grow. From a data management perspective, keeping data within national borders makes it easier for governments to access important information. Therefore, data localization policies have an important role in improving security and protecting sensitive data, especially in significant industries like energy.[11] This means that when energy data is stored and processed domestically, government agencies and private companies can have better access to this information, conduct more detailed analyses of consumption patterns, optimize energy production and distribution, and help policymakers make more informed decisions about energy resource management.[12]

Also, when it is said that data localization helps the growth of domestic industries and supports local businesses, it is because this policy can lead to the development of the

[9] Bret Cohen et al., 'Data Localization Laws and Their Impact on Privacy, Data Security and the Global Economy' (2017) 32(1) Trade Journal <https://www.proquest.com/docview/2111097288?sourcetype=Trade%20Journals> accessed 04 February 2025

[10] Sanghyun Han, 'Data and Statecraft: Why and How States Localize Data' (2024) 26 Business and Politics <https://doi.org/10.1017/bap.2023.41> accessed 04 February 2025

[11] *Ibid*

[12] Pauline Henriot, 'Unleashing the Benefits of Data for Energy Systems' (*International Energy Agency*, 12 May 2023) <https://www.iea.org/commentaries/unleashing-the-benefits-of-data-for-energy-systems> accessed 04 February 2025

information technology industry in the country. With the increasing need for data storage and processing infrastructure, new job opportunities will be created in areas such as data management, cybersecurity, big data analysis, local software development, and other related jobs. This will not only create jobs but also strengthen national capacities in the field of technology and increase the competitiveness of domestic companies against international players.[13]

Many countries apply data localization to improve cybersecurity, prevent cyber threats, protect national security, limit foreign influence, and hinder spying on sensitive information. Supporters believe these rules help reduce cybercrime and keep personal information safe. Beyond security, data localization also gives governments more control over critical data and promotes fair competition. In the energy sector, these rules improve system operations, protect critical infrastructure, and strengthen national control over energy resources. They safeguard intellectual property, help law enforcement, and allow governments to manage proper policies for industry.[14]

In addition, data localization is crucial for domestic law enforcement and allows national authorities to access necessary data. It makes the data available for the requirements of domestic law enforcement. Since enforcement jurisdiction is primarily territorial, the location of assets or equipment can be justified to make it easier to enforce local law.[15]

The idea behind data localization is protecting crucial industries like energy by governments. If energy data is kept in another country, governments may not access it easily. Keeping energy data local helps prevent security risks and ensures that important information is available quickly and whenever needed. It ensures that governments manage and protect energy-sensitive data, reduce foreign influence, and keep critical infrastructure data secure. Currently, more countries are passing laws to keep data stored within their borders to protect their control over important energy data and ensure data stays safe and easy to access. Keeping data local helps prevent outside interference and allows quicker responses during emergencies like natural disasters or cyberattacks.[16]

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[13] Selby (n 3)
[14] *Ibid*
[15] Vidyasagar (n 6)
[16] Emily Wu, *Sovereignty and Data Localization* (2021)

Also, in emergencies such as widespread power outages, cyberattacks, or natural disasters, rapid access to data stored within a country can facilitate decision-making and response. This allows governments and energy companies to take necessary measures more quickly and reduce the negative impacts of crises. Data localization also allows governments to have greater control over energy-related data, which is crucial in times of international crises or geopolitical tensions. If dependent on foreign servers, countries may face restrictions on access to vital energy information in certain circumstances, such as sanctions or cyber warfare.[17]

DATA LOCALIZATION CHALLENGES IN THE ENERGY SECTOR: NAVIGATING COMPLEXITIES

Storing and keeping energy data locally within national borders creates many challenges. There are different rules and regulations globally. These laws and policies are shaped by governments' priorities. In democratic countries, leaders try to balance between business needs and security. They are concerned about privacy, human rights, and the transfer and sharing of data. Other governments, including authoritarian ones, emphasize strict data localization rules under the pretext of national security, fighting terrorism, and reducing foreign influence. However, these regulations can lead to more surveillance and control over personal data by governments. Different approaches make it harder to manage data and cooperate with stakeholders of the energy sector worldwide. These differences reduce the sharing and transferring of data, create barriers for businesses, and make it difficult to develop new ideas and innovations in the energy industry.[18]

Although keeping energy data within a country may help protect essential data like data related to the energy infrastructure, it also creates challenges. These rules are meant to keep data safe, but they can raise costs for businesses and slow down operations. Large companies might find ways to handle the extra expenses, and everything may run smoothly. However, smaller energy companies may struggle because setting up and maintaining local data systems is costly.

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[17] Han (n 10)

[18] Erol Yayboke et al., 'The Real National Security Concerns over Data Localization' (*Center for Strategic and International Studies*, 23 July 2021) <https://www.csis.org/analysis/real-national-security-concerns-over-data-localization> accessed 04 February 2025

This makes it harder for them to grow and compete with large multinational companies. When countries block data from moving across borders, businesses face problems, and supply chains can be affected. Different rules make things more confusing, especially for small businesses that don't have the capital or qualified personnel to deal with so many requirements. Also, these rules make it difficult for companies to compete with other corporations worldwide. They prevent businesses from using information exchange and hinder new ideas to solve the industry's problems.[19]

Therefore, data localization regulations not only create challenges for small energy companies and impose additional regulatory compliance costs on them but can also impact other industry players. These policies may create an obstacle to international coordination in the energy industry, especially for multinational companies, as companies can use predictive analytics based on the collected data to innovate their products and services. However, data localization and related constraints may prevent digital companies from engaging in such activities and limit access to useful information and data in the energy industry.[20]

Changing data localization rules makes it harder for companies to keep up. These rules not only increase costs for businesses but also can make it harder for them to share useful data information with other shareholders. Companies cannot then benefit from other companies' experiences on a global level, which poses a challenge to progress in the energy industry. These rules can negatively affect efficiency. Limiting data movement reduces the application of new technology and slows down innovation and competition. These rules can also damage the economy, especially in difficult times. The impact is even greater in developing countries, where there are not enough data centres to handle these requirements or funds to build the necessary infrastructure.[21] Because the implementation of data localization policies varies from country to country.

To successfully implement these policies, it is first necessary to assess whether the country in question has the necessary infrastructure to set up local data centres. The quality of the

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[19] *Ibid*

[20] Sai Rakshith Potluri et al., 'Effects of Data Localization on Digital Trade: An Agent-Based Modeling Approach' (2020) 44(9) Telecommunications Policy <https://doi.org/10.1016/j.telpol.2020.102022> accessed 04 February 2025

[21] *Conan French, 'Data Localization: Costs, Tradeoffs, and Impacts Across the Economy' (Institute of International Finance*, 22 December 2020) 4 <https://stagingnew.iif.com/portals/0/Files/content/Innovation/12_22_2020_data_localization.pdf> accessed 04 February 2025

infrastructure is also important. Data localization policies can help develop the domestic cloud computing industry, but this will only be successful if there are suitable local alternatives that can provide a similar level of service. In many cases, such facilities can only be provided by large international companies.[22] Furthermore, data localization may pose a barrier to scientific and academic research, as it limits access to data from jurisdictions that require local storage. While much of the data is useful for many research purposes and for optimizing the energy industry.[23]

Also, it should be noted that in conditions of geopolitical conflict, the accumulation of data in a region or country can increase the risks of physical attacks because in wartime conditions, if critical data related to the energy industry is stored on physical servers within the country, it is exposed to direct risk of disruption or destruction.[24] However, a detailed examination of these benefits and challenges is beyond the scope of this paper and could be studied more comprehensively in future research.

CONCLUSION

Opinions about data localization vary, and these differing opinions have led to different regulations and policies regarding data localization in different countries. Some countries have strict rules for important industries like energy. Generally, governments believe these rules help keep sensitive information safe and protect national security. While this may be true to some extent, they also create problems. Companies must follow complicated regulations and deal with restrictions on sharing information. These rules can make it harder for energy companies to fulfil their daily task, adjust to new changes, and consider other stakeholders' experiences.

The energy industry works across many countries, so it needs simple and fair rules. It is important to keep data safe while also allowing data exchange to receive new ideas and help the industry grow. With new tools like AI, blockchain, and smart grids becoming more common, it is a good time to review data localization rules. These rules should help energy companies move forward instead of creating barriers that slow progress.

[22] *Ibid*
[23] Potluri (n 20)
[24] *Ibid*

Governments and global organizations need to work together to create simple and flexible rules. These rules should make it easy to share data securely across borders while keeping important industry information safe. The energy sector can tackle data localization challenges by being open, working together with other countries, and using new technology to move forward.

It should also be noted that data security remains a complex and controversial issue. The question of whether data localization can fully ensure the security of the energy industry remains open. Given the complexities of technology and, in some cases, the recruitment of state-owned hackers and huge investments to carry out cyberattacks and damage the strategic infrastructure of other countries, it cannot be definitively claimed that data localization leads to an absolute increase in security. These challenges demonstrate that cybersecurity is influenced by a set of factors, and data localization is only one possible means to mitigate security threats, not a definitive and comprehensive solution.

In conclusion, it is important to keep data safe while also making sure the industry can grow. For the advancement and development of the energy sector, countries should accept the data exchange while they protect the sensitive energy data.

POLICY RECOMMENDATIONS

Governments should consider the following to balance data security, national sovereignty, and promoting global cooperation in the energy sector.

Harmonize Global Data Localization Regulations in the Energy Sector: Governments should cooperate and establish comprehensive international rules and regulations for data localization and managing energy data. Currently, every country has its own set of rules, which makes sharing data across borders very difficult. If countries could agree on common standards, it would help balance security with smooth operations. Having the same rules would protect sensitive energy data like infrastructure, usage, and network performance while allowing the transfer and sharing of useful information. A unified approach would make it easier to protect against cyber threats, encourage new ideas, and help countries collaborate more effectively in the energy sector.

Increase Public-Private Sector Collaboration: Governments should create data localization rules inside countries based on feedback from energy companies and industry experts. By building stronger partnerships between the public and private sectors in managing energy data, we can generate new ideas that make the energy industry more efficient overall.

Suitable and Secure Infrastructure for Sharing Useful Data: Governments should create secure mechanisms to share data and allow energy stakeholders to exchange valuable and useful data to improve energy efficiency while considering privacy and security. Adopting new technologies like Artificial Intelligence (AI), Internet of Things (IoT), and other technologies supporting growth in the energy sector. Access to data by other stakeholders could be beneficial and effective. For example, sharing data generated by AI and IoT regarding the performance of special devices may assist other energy companies in enhancing their efficiency and implementation while working in challenging conditions. They could function better based on previous experience. In addition, investment in infrastructure to facilitate data sharing could minimize financial costs, which are necessary for small and medium-sized enterprises (SMEs).

Promote Awareness and Education Regarding Data Localization: Understanding data localization regulations and policy across the energy sector is essential for energy stakeholders. Training programs for energy professionals and individuals will ensure that organizations comply with evolving laws and regulations. In addition, educational efforts should focus on the fact that while the energy industry contains sensitive data, sharing non-sensitive data and analyzing that data can develop the sector.

By adopting these recommendations, governments and stakeholders can effectively address data localization challenges, foster innovation, enhance security, and ensure the continued global competitiveness of the energy sector.