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# Digital Readiness in the Central American Energy Sector

## Benchmarking and Preparing for a Digital Future

Executive Summary

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Digitalization is essential for enhancing variable renewable energies and energy efficiency measures in Central America in the future. Hence, the Renewable Energies and Energy Efficiency Program (4E) in Central America implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, on behalf of Federal Ministry for Economic Cooperation and Development (BMZ), initiated a digitalization process in order to leverage digitalization in the energy sector in Central America. This process initiated in late 2018 and consists of a series of regional actions on digital opportunities, such as a workshop on Blockchain for the electric sector, a study trip to Germany with high-level energy stakeholders from the region and eventually, a joint development of this study, “Digital Readiness in the Central American Energy Sector: Benchmarking and Preparing for a Digital Future” with the consulting firm Roland Berger GmbH.

## About this Report

“Digital Readiness in the Central American Energy Sector: Benchmarking and Preparing for a Digital Future” is a study of current conditions and the identification of digital opportunities in the energy sector of six Central American countries: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. It features input from almost 100 experts and data from extensive desk research.

The report can be used to identify and prioritize opportunities for different stakeholders, consumers, investors, and businesses that provide goods or services that can assist or benefit from Central America’s evolving energy industry. The information we gathered, analyzed, and synthesized provides insights on the current status quo and how to introduce digitalization into the daily business. In particular, the information we uncovered serves as a crucial entry point for the work that lies ahead to develop Central America’s energy sector, both within individual countries and more importantly, across the region.

## Digital Transformation of the Energy Industry

Throughout the world, digital transformation promises to optimize efficiency, to expand the reach of renewable energy, and to enhance economic growth in energy markets. In Central America, business leaders, government officials, and researchers are joining their peers around the globe in renewing the energy industry. This evolution comes at a time of sweeping megatrends that create new opportunities, as well as challenges.

## Four Key Energy Trends

Long-lasting megatrends such as climate change, increasing population, and globalization and future markets will shape the energy industry in fundamental ways. Within the broader view of

global megatrends and energy developments, our report identifies four trends specific (Figure 1) to the energy industry that impact Central America.

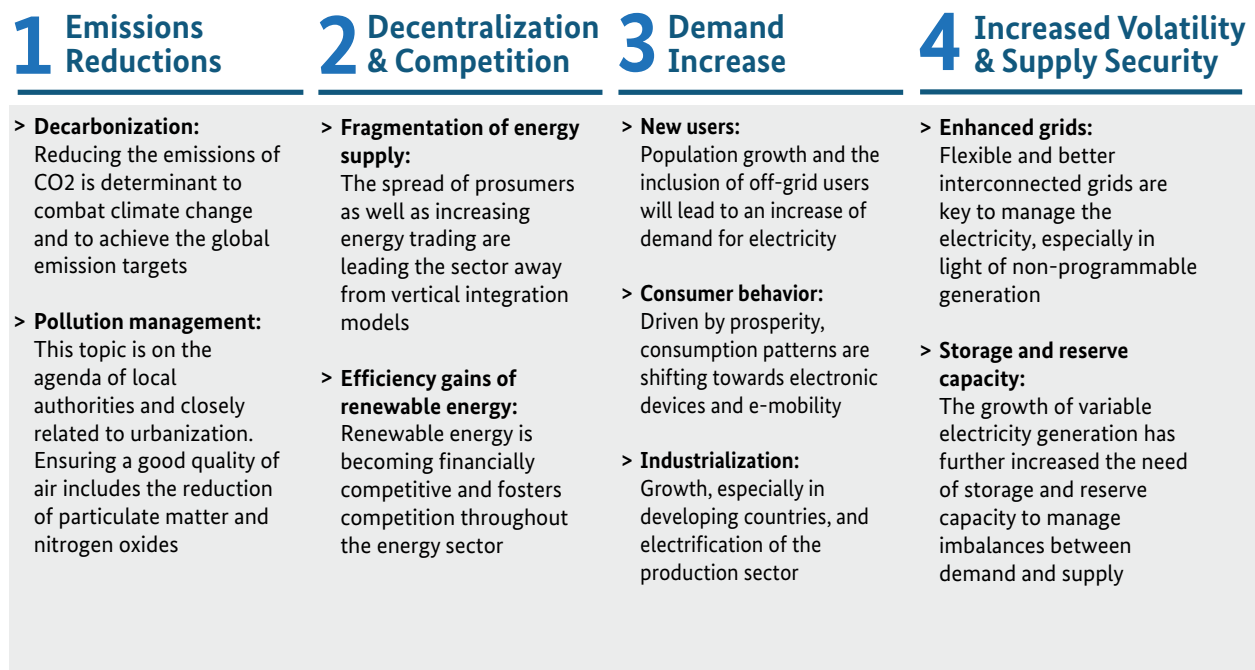


Figure 1. Determined Global Energy Trends

We consulted our experts to assess the impact that global energy trends will cause in the region over the next decade and the following trends have been identified:

**Increased Volatility and Supply Security** is considered the most impactful trend in the region. Challenges emerging from the trend involve the intermittent nature of the renewable energies. Seasonality (hydropower) and changing weather (solar, wind) can have a profound impact on the available generation capacity as well as the stability of the grid. All countries are impacted by electricity losses.

**Decentralization and Competition** is the second most impactful trend in the region. Self-sufficiency is growing, especially to increase access to electricity in remote areas. However, a share of current electricity company customers is also driven towards self-sufficiency, putting pressure on the energy companies as they need to recoup their investments over the electricity tariffs.

**Emissions Reductions** ranks as third most impactful trend in the region. Due to the geographical location all countries are vulnerable to climate change. The countries also face the issue of high emissions from the transport sector, that can be mitigated by electrifying the transportation sector. In terms of the addition of new renewable energy capacity, there is a big opportunity to implement new projects in some countries.

**Demand Increase** comes as fourth most impactful trend in the region. There is a general uncertainty about the future development of demand. On one hand, an increase in demand is driven by a shift to industrial production, urbanization and a growth of residential energy use. On the other hand, this increase could be slowed by higher energy efficiency as well as less energy demand resulting from an economic downturn.

## Technology and Digitalization

Over the next ten years, the Internet of Things (IoT), Advanced Analytics (AA), and the blockchain will advance digitalization. We describe them as follows in the Figure 2.

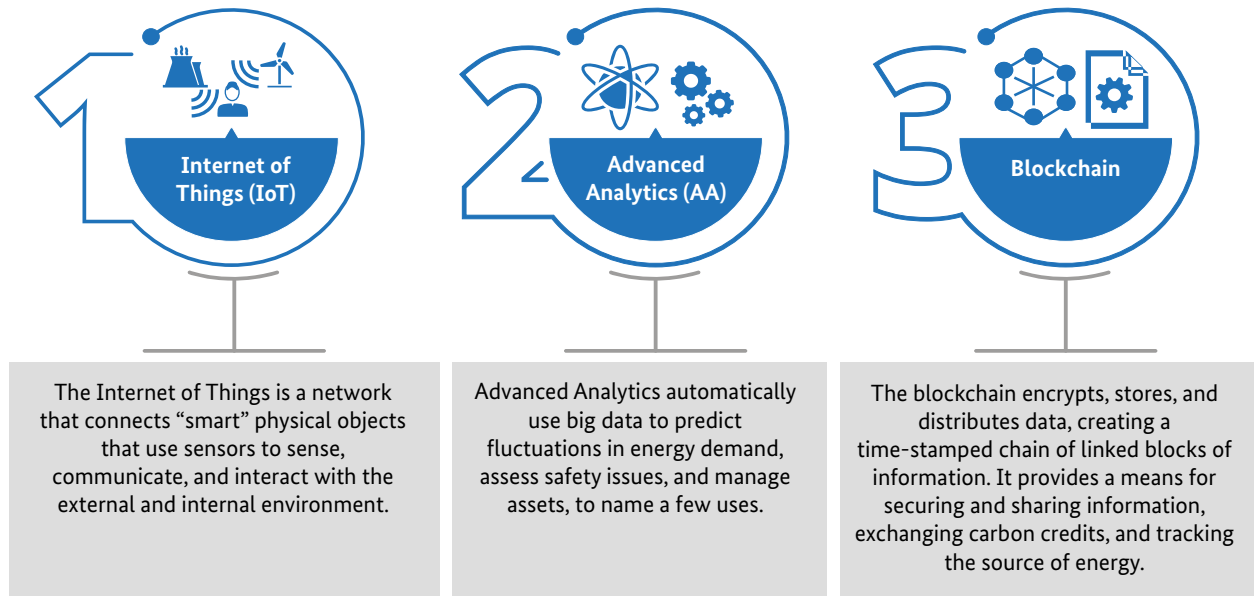


Figure 2. Digital core technology areas

## Conditions for Growth

Digitalization develops and expands via business, government, and social means – the conditions that enable change. Furthermore, a push from policy makers can often move things in the desired direction. Below we provide an overview of current conditions that promote growth.

There are varying degrees of readiness within the region. While some countries are ahead in general, each one tends to have specific strengths and also challenges. Figure 3 shows the results of the parameter-based digital readiness benchmark in Central America including two non-regional countries, Germany and Chile as comparators. Some remarks regarding these enabling conditions in the Central American’s countries are mentioned below:

- The improvement of **digital infrastructure** is needed in all six countries. Energy systems and their upgrades uniformly support digitalization across the region at a basic level.
- Digital know-how plays an obvious role in readiness. Costa Rica leads the region in **human capabilities**.

- An **organizational culture** is already open to innovation in the case of Costa Rica, Guatemala and Panama with businesses that have created digital plans with an eye to the future.
- **Capital and investment** underlies transitions. Panama shines here and Guatemala, and Honduras enjoy an optimistic amount of capital investment that can promote digitalization.
- Regulations impact the ability for businesses to update and grow. Supportive **institutions and governance** is essential. Costa Rica and Panama are ahead of the rest of the countries.

The stronger the improvements in these conditions, the more ready each country will be to implement digital technologies and use cases.

Additional to this analysis, the regional experts assessed each country's digital readiness. The results can be found in the complete document.

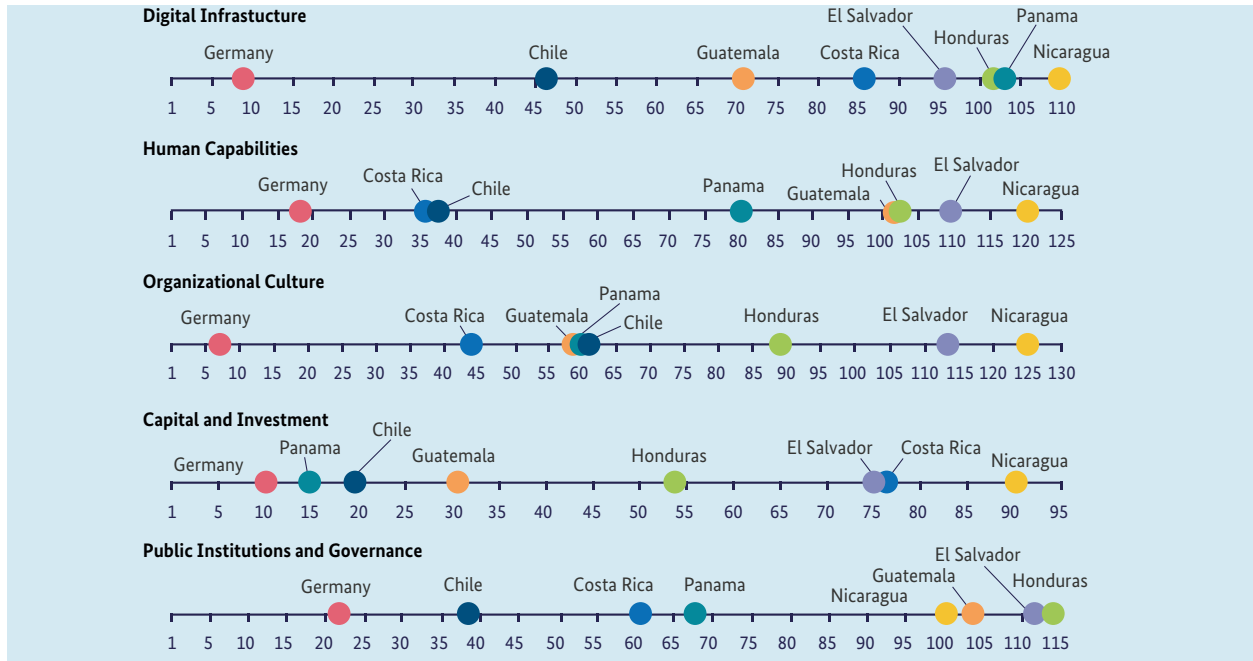


Figure 3. Parameter-based ranking of digital readiness

## Use Cases




To specify the way technology can be used, stakeholders turn to use cases. These are concrete examples where there is already an advanced degree of clarity of the steps- sets of actions- that need to be followed to achieve the implementation of a technology and thus test with results. In this way, it is possible to demonstrate and inspire others to implement and improve the case.












Based on 22 different use cases that can promote digitalization, we identified a set of 11 frequently mentioned and relevant use cases and prioritized the top 5 based on relevance for each country, that is shown in the Figure 4.

Use cases lead to digitalization opportunities for Central America’s local and regional energy sector. Stakeholders can implement them through supportive technology, infrastructure, equipment, personnel, political action, consumer demand, and governance.

## Use Cases for Quick Wins

Moreover, from a regional perspective, the experts addressed three use cases in five countries that seem to be an opportunity for a cross-value chain collaboration to be implemented in the short term, the so-called *quick wins*.

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**Intelligent energy consumption**, through the Internet of Things, is considered highly relevant for energy efficiency as well as relatively easy to implement. In Guatemala and Panama, relevant parties are testing pilot programs and services (e.g., in fast food chains).
  
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**Remote monitoring and grid management**, through interconnected devices (IoT), are considered highly relevant due to regionwide problems with high energy losses. Especially in Honduras, non-technical energy losses such as theft are prevalent. Pilot programs with supervisory control and data acquisition (SCADA) systems are already in place in Costa Rica, El Salvador, Guatemala, and Panama.
  
- 
**Output forecasting for renewable energies**, through advanced analytics, which has high relevance due to high shares of renewable energy sources (RES) generation across the region. While current forecasts lack in quality, pilot programs through cooperation with a German service supplier has begun in Nicaragua and El Salvador.

		Costa Rica	El Salvador	Guatemala	Honduras	Panama	Nicaragua	Regional relevance & frequency (sum)
	1					✓		1
	2	✓						1
	3		✓		✓		✓	3
	5		✓	✓	✓	✓	✓	5
	8	✓						1
	10		✓	✓	✓	✓		4
	13	✓	✓	✓		✓	✓	5
	14	✓						1
	15			✓	✓		✓	3
	17	✓	✓	✓	✓	✓		5
	22						✓	1

Blockchain
  Internet of Things
  Advanced Analytics

1) Use case is part of top 5 most frequent and relevant use cases in country

Figure 4. Top use cases per country by frequency and relevance<sup>1)</sup>

## Data Strategy

Digital technology and the proposed use cases need and produce data; therefore, the availability and quality of data is a key enabler for the digital transformation. However, some data-related issues have been identified, such as decentralized data storage, varying/old data formats and data loss. To address this regional challenge, local and regional institutions reported a strong need for the development of a collaborative **data strategy** that is of crucial importance for policy makers, regulators and operators alike.

## Regional Collaboration

Central American stakeholders share a sense of urgency in implementing digital technologies. They see digitalization as a way to address the challenges and opportunities of energy transition and GET. To support the stakeholders on the front lines of digitalization, we communicated with policy makers, regulators, operators, distributors and traders, who agreed to meet and create a mutual vision (Figure 5) for digitalization.

The stakeholder’s connection has resulted in a shared strategy, that considered regional differences and leveraged shared opportunities, through creating interdisciplinary, cross-value-chain, cross-institutional, and cross-country Networks of Expertise (NoE). NoEs will serve as institutional vehicles to implement digital technologies, use cases and data strategy.

Collaboration offers possibilities to exchange knowledge and best practices through diverging strengths and complementary knowledge. With data, structure, and support, collaborators from all six countries are now motivated and inspired to tackle the challenges of digitalization through sharing information, developing common strategies, and taking action to bring about change.

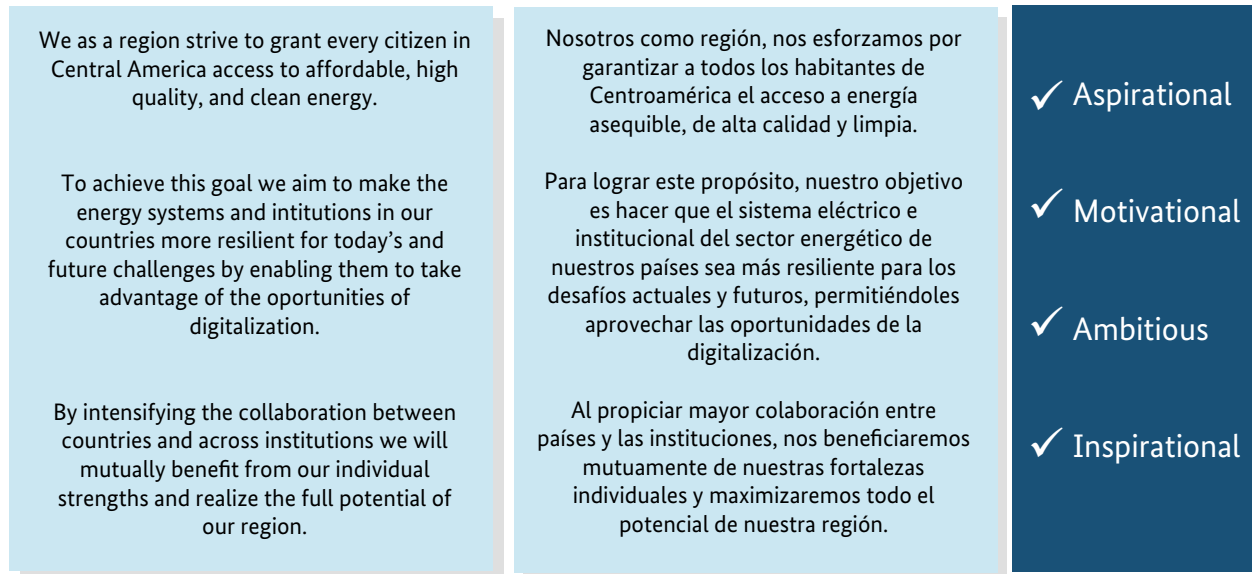


Figure 5. Aligned vision for collaboration in the digitalization of the energy sector in Central America

## Conclusions

The six Central American countries, either individually or as a region, vary in the level of digital readiness of the energy sector. Despite gaps in the framework conditions, stakeholders agree on the need for urgent implementation of digital technologies and use cases to address global energy trends as well as energy transition.

Stakeholders could invest unilaterally in necessary infrastructure. However, policy makers and regulators should analyze and foresee the advantages that digitalization entails and allow the recognition of these investments. In other words, enablers can be facilitators or decelerators for the advancement of the digitization of the sector. The world is living in an era in which information and data are increasingly relevant and can be great allies in decision-making, but the region is not being able to take advantage of them efficiently. Greater openness and transparency are required to share data in a timely manner in order to improve its quality.

In addition, it is imperative to continue strengthening individual capabilities across the region. Some stakeholders have already developed technological knowledge that should be shared with others. By focusing on synergies, the effects could bring a comparative advantage, as individual actions can be faster, but regional actions should go further.

Digital readiness has not yet been achieved in Central America as innovative approaches, such as output forecasting for renewable energies, remote monitoring and grid management, certification of energy products, among others, have only been implemented on a small scale so far. Hence, the Renewable Energies and Energy Efficiency Program (4E) in Central America continues to encourage stakeholders to provide innovative digital solutions for the regional energy market and urges stakeholders to consider the study as a guide and a basis for strategically addressing the digital path ahead.





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