# Development Impact Study for Energía del Pacífico

## Report to Invenergy

AUGUST 2023

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# Acronyms and abbreviations

| | |
|---|---|
| **ADB** | Asian Development Bank |
| **AMP** | Autoridad Marítima Portuaria |
| **B&D** | B&D Servicios Técnicos |
| **CAESS** | Compañía de Alumbrado Eléctrico de San Salvador |
| **CAPEX** | Capital expenditure |
| **CEPA** | Comisión Ejecutiva Portuaria Autónoma |
| **CLESA** | Compañía de Luz Eléctrica de Santa Ana |
| **CMPV** | Municipal Committee for the Prevention of Violence |
| **COD** | Commercial Operation Date |
| **DELSUR** | Distribuidora de Electricidad Delsur |
| **DEUSEM** | Distribuidora Eléctrica de Oriente |
| **EDESAL** | Empresa Distribuidora Eléctrica Salvadoreña |
| **EEO** | Empresa Eléctrica de Oriente |
| **EIA** | United States Energy Information Agency |
| **EOR** | Ente Operador Regional |
| **EPA** | United States Environmental Protection Agency |
| **ESIA** | Environmental and Social Impact Assessment |
| **FSRU** | Floating Storage Regasification Unit |
| **GHG** | Greenhouse gas |
| **GW** | Gigawatt |
| **GWh** | Gigawatt hour |
| **HFO** | Heavy fuel oil |
| **IFC** | International Finance Corporation |
| **IRENA** | International Renewable Energy Agency |
| **LCOE** | Levelized cost of energy |
| **LNG** | Liquefied natural gas |

| | |
|---|---|
| **MER** | Mercado Eléctrico Regional |
| **MME** | Mercado Mayorista de Electricidad |
| **MRS** | Mercado Regulador del Sistema |
| **MW** | Megawatt |
| **MWh** | Megawatt hour |
| **NPV** | Net present value |
| **O&M** | Operations and maintenance |
| **OECD** | Organization for Economic Cooperation and Development |
| **PCR** | Polymerase chain reaction |
| **PPA** | Power purchase agreement |
| **PROESA** | Organismo Promotor de Exportaciones e Inversiones |
| **PV** | Photovoltaic |
| **SIEPAC** | Sistema de Interconexión Eléctrica de los Países de América Central |
| **SIGET** | Superintendencia General de Electricidad y Telecomunicaciones |
| **UN** | United Nations |
| **UNDP** | United National Development Programme |
| **UT** | Unidad de Transacciones |

# Executive summary

The Energía del Pacífico (EdP), the 380MW liquid natural gas (LNG) regasification facility and gas-fired power plant, is a transformational project for El Salvador and the region. The breadth of its impact is massive. It has:

- Proven a model for infrastructure and power project development in the region. Its scale, complexity, and the speed at which it was delivered has shown the market, including investors, lenders, developers, and local governments, what can be done. It is the largest ever foreign direct investment in El Salvador and the first integrated LNG-to-power plant on the Pacific coast of Central America. EdP has invested more than US$1 billion in El Salvador to date.[1]
- Brought together a consortium of lenders that includes the International Finance Corporation (IFC), the US International Development Finance Corporation, Inter-American Development Bank (IDB) Invest, Finnish Export Credit Ltd, and KfW IPEX-Bank with the Project's sponsor, Invenergy, that worked together to manage colossal risks and challenges to develop a successful project.
- Contributed to the improving political and social stabilization in El Salvador which has shouldered the burden of years of blackouts and economic uncertainty.[2] EdP has helped ensure a more stable and flexible energy supply since coming online in 2022.
- Strengthened the sector's ability to bear the impacts of the changing climate, building much needed resilience into a previously vulnerable sector. EdP currently meets 30 percent of total demand.[3] EdP has enabled El Salvador to keep the lights on in spite the reduction in rainfalls caused by El Niño, which started in June 2023[4] and has reduced water levels at hydropower facilities by 26 percent compared to the year before.[5,6]
- Made people's lives better by improving power services, reducing generation costs, and delivering cleaner and more flexible energy. The Project directly employed more than 2,000 people during construction.[7] Further, EdP continues to invest in the environment and the local communities, leading to a range of other benefits that El Salvador will realize for the length of the Project's term and beyond.

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1 Energía del Pacífico. https://www.energiadelpacifico.com/.

2 SIGET. "Government guarantees stable prices of electricity to the final consumer," 2023. https://www.siget.gob.sv/gobierno-garantiza-precios-estables-de-la-energia-electrica-al-consumidor-final/.

3 Energía del Pacífico. https://www.energiadelpacifico.com/.

4 ACAPS. "El Niño Overview: Anticipated Humanitarian Impact," 2023. https://www.acaps.org/fileadmin/Data_Product/Main_media/20230725_ACAPS_Thematic_report_El_Nino_overview_anticipated_humanitarian_impact_in_2023.pdf.

5 ES Euro. "Drought decreases electricity generation in El Salvador," 2023. https://euro.eseuro.com/world/856566.html.

6 El Salvador in English. "Stable Power Supply Highlighted by Industrialists in El Salvador." https://elsalvadorinenglish.com/2023/08/17/stable-power-supply-highlighted-by-industrialists-in-el-salvador/.

7 This employment figure does not include indirect jobs and other business.

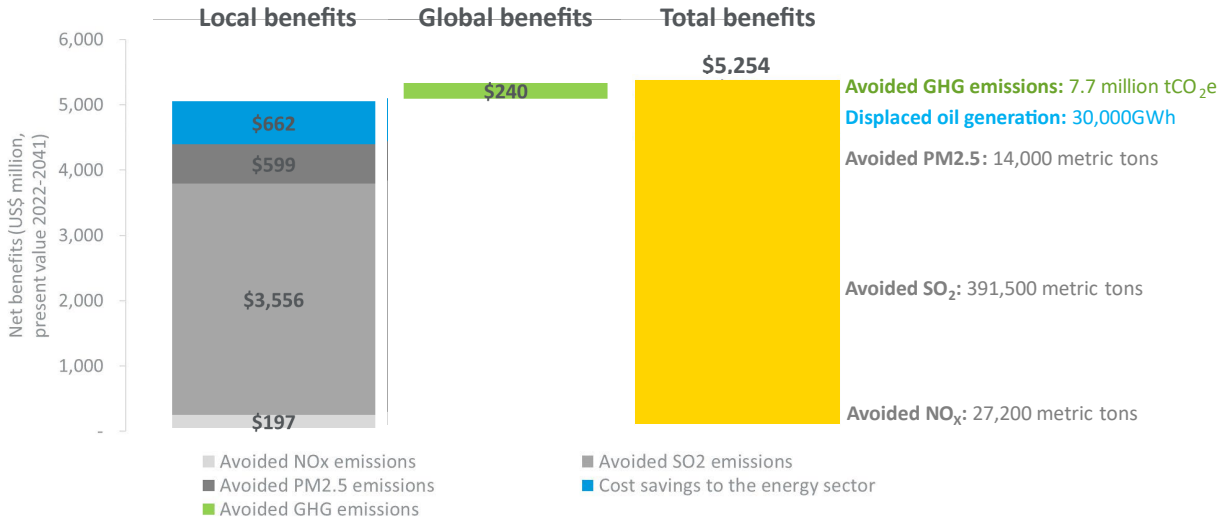
Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 6.

Most of this impact cannot be valued in monetary terms as the linkages between them, plus the second and third order effects make it nearly impossible to assign an accurate monetary value.

On top of the monumental changes EdP has produced are the real economic effects that can be valued for the people of El Salvador. EdP is saving the sector millions of dollars per year in generation costs. People can observe the effects of cleaner air when comparing the outputs from EdP to the oil-run plant nearby. This visible change is also directly impacting the lives of people through reductions in local pollutants and particulate matter, which cause sickness and damage health.

Over its expected 20-year lifetime,[8] EdP is expected to generate more than US$5.3 billion in net economic benefits, which include reduced generation costs, local pollutants, and greenhouse gas (GHG) emissions (see Figure 0.1).[9]

**Figure 0.1: Summary of global net economic benefits**




*Note: The figure above represents global net benefits as a result of EdP. Other quantified benefits attributable to El Salvador include the incremental tax benefits earned by the Government thanks to reduced imports and increased exports, and other benefits realized by other infrastructure projects such as new electricity connections and a wastewater treatment plant in Acajutla. The complete results of the analysis and assumptions used are described in Section 5.*

[8] This project lifetime is assumed to be equal to the term of the power purchase agreements signed by EdP and the offtakers. Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 15.

[9] Net economic benefits are expressed in present value terms, assuming a social discount rate of 9 percent. Asian Development Bank, "Guidelines for the Economic Development of Projects," 2017. Page 52-53, 136. https ://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf.

*EdP has delivered significant value to El Salvador's energy sector…*

By displacing generation from dirtier and more expensive thermal plants, EdP has had the following impacts:

- **Reduced generation costs:** EdP's average variable cost was US$93.6/MWh in its first year of operations.[10] This is 47 percent less than the average marginal cost of oil generation (US$177.1/MWh[11]) and 20 percent less than the average cost of imports (US$116.4/MWh as of June 2023[12]).
- **Substantial reductions in local pollutants emitted:** On average, EdP emits 70 percent less $NO_x$, 99 percent less $SO_2$, and 95 percent less PM2.5 per MWh compared to generation from plants running on heavy fuel oil (HFO).[13] These local air pollutants inflict massive negative health costs on people.[14] Holding all else constant, reducing yearly average concentrations of local air pollutants by one standard deviation, has been shown to reduce the local population's disease burden by approximately 4 percent.[15] In the United States, the switch from coal to gas generation has been shown to decrease national annual health damages by $20 – $50 billion annually due to the reduction in emissions.[16]
- **Energy security:** Diversifying the generation mix improves energy security by reducing dependence on a limited number of resources, mitigating price volatility, and enhancing resilience. From 2021 to 2022, the share of generation from oil and imports decreased from 13 to 7 percent and 19 to 6 percent, respectively (see Figure 5.5 and Figure 5.6). EdP has evolved El Salvador's role in the regional electricity market, making the country go from Central America's largest net importer[17] to a net exporter since May 2022.
- **Flexibility of the system:** EdP has ramp rates that are between 5 and 10 minutes, which is significantly faster than comparable thermal baseload plants in El Salvador with ramp rates closer to 30 minutes.[18] EdP's high ramp rates allows it to quickly respond to imbalances in supply and demand, including those resulting from the intermittency of renewables such as solar and wind.[19] Thus, EdP will complement the Government's objective to increase the

[10] Unidad de Transacciones. "Descarga Archivos Programacion diaria 2023," https://www.ut.com.sv/programacion-diaria1.

[11] Ibid.

[12] Ente Operador Regional. "Dashboard Comercial del MER 2023," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

[13] See Section 5.3.1 for the complete assumptions and results of the economic analysis.

[14] National Institute of Environmental Health Science. "Air Pollution and Your Health," https://www.niehs.nih.gov/health/topics/agents/air-pollution/index.cfm.

[15] Wiley. "A Bayesian localized conditional autoregressive model for estimating the health effects of air pollution," 2014. https://onlinelibrary.wiley.com/doi/full/10.1111/biom.12156

[16] Science Direct. "The climate and health effects of a USA switch from coal to gas electricity generation," 2016. https://www.sciencedirect.com/science/article/pii/S036054421630322X#sec3

[17] International Finance Corporation. "El Salvador Powers Up to Become More Competitive," 2020. https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/impact-stories/el-salvador-powers-up#:~:text=20in%202023.

[18] Communication with EdP. 18 May 2023.

[19] Wartsila. "Flexicycle power plants," 2019. https://www.wartsila.com/docs/default-source/energy-docs/technology-products/brochures/flexicycle-power-plants.pdf?sfvrsn=78d7f245_12. Page 4.

uptake of renewable energy in the future and smooth out variations in load caused by changes in season and time of day.

- **Reliability of the system:** The transmission line built to connect EdP to Ahuachapán closes the western loop of the national transmission grid, adding redundancy to the system, which can help to reduce transmission constraints and possible outages.
- **Reduced greenhouse gas emissions (GHGs):** On average, EdP emits about half of the GHG emissions per MWh compared to power plants running on HFO.[20] By displacing domestic oil generation, EdP reduces GHG emissions by nearly 400,000t$CO_2$e annually for the next 20 years, significantly contributing to the Government's pledge to reduce its annual energy sector emissions by 640,000t$CO_2$e by 2030 as part of its National Determined Contributions (NDCs).[21]

*The benefits of EdP extend beyond the energy sector, creating positive development impacts for the country broadly, and the local community as well…*

Outside of the energy sector, EdP provides the following benefits:

- **Increased tax revenue to the Government of El Salvador:** Although it is difficult to project regional trade flows in the long-term, El Salvador is expected to earn US$171 million (in present value terms) in incremental tax benefits.[22] Additional tax revenue is generated for the Government of El Salvador when EdP pays taxes on revenue it earns in El Salvador that would have otherwise been paid to another Government by a foreign generator and exported to El Salvador.
- **Social and economic infrastructure in the local community of Acajutla:** EdP has committed to investing approximately US$532,500 per year for up to 20 years on social and economic development projects in the Municipality of Acajutla, amounting to a total investment of US$10.7 million over the project lifetime.[23] As of June 2023, EdP has invested US$3.5 million in local infrastructure projects that have benefited more than 20,000 people.[24] These infrastructure projects not directly related to EdP's operations are estimated to generate between US$880,000 and US$5.3 million in net economic benefits to the local community.[25]
- **Employment:** During construction, EdP employed more than 2,000 people, 1,200 of which were citizens of El Salvador.[26] EdP continues to employ more than 70 full-time staff to maintain operations. In addition to direct employment, EdP's development led to growth

[20] See Section 5.3.2 for the complete assumptions and results of the economic analysis.

[21] United Nations Development Programme. "El Salvador," https://climatepromise.undp.org/what-we-do/where-we-work/el-salvador.

[22] Companies in El Salvador pay a 30 percent corporate income tax on taxable income.
PWC. "El Salvador, Corporate – Taxes on corporate income," https://taxsummaries.pwc.com/el-salvador/corporate/taxes-on-corporate-income#:~:text=The%20corporate%20income%20tax%20(CIT,USD)%20in%20the%20fiscal%20year.

[23] Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 39.

[24] EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Slide 17.

[25] The types of investment in social and economic infrastructure vary. See Section 5.4.5 for a complete description.

[26] Foreign employees were mostly from the Central American region.
Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 6.

in local supply chains that EdP depends on, leading to the creation of an additional 115 permanent operations jobs in El Salvador.[27]

*These benefits were not guaranteed, as EdP had to overcome unforeseeable challenges of delivering El Salvador's largest energy project during a global pandemic…*

Invenergy, along with its project partners and lenders, made critical choices while faced with unprecedented and unforeseeable uncertainty to deliver EdP only 4 months behind schedule. COVID-19 and the war in Ukraine caused markets to cease operating and supply chains to choke. Nearly all EdP's suppliers and contractors issued force majeure notices, amounting to more than 100 between March 2020 and mid-July 2021.[28] EdP incurred additional costs of nearly US$60 million to continue construction throughout the COVID-19 pandemic.[29]

Had the Project been delayed further, the economic benefits realized by the project would have been significantly reduced. Conservative estimates suggest that EdP would have faced almost 20 percent higher costs in raw materials, equipment, and labor had Invenergy paused construction until after the pandemic.[30] Delays in the project would have reduced the economic benefit realized by the project, as El Salvador would have continued bearing the cost of oil generation, rather than from natural gas. A scenario analysis was conducted to demonstrate what the foregone savings would have been had alternative scenarios occurred instead (see Appendix A).

[27] Invenergy. "Request for Information: Development Impact Report for EdP," Page 2.

[28] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 3.

[29] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 6.

[30] See Table A.1 for actual price quotes demonstrating the real price differences between Q1 2020 and Q4 2022/Q1 2023.

# 1 Introduction

Invenergy, the Project Sponsor, hired Castalia to analyze the development impact of the Energía del Pacífico (EdP) Project in El Salvador ("the Project"). The purpose of this assignment is to conduct third-party empirical analysis of EdP's direct and indirect impacts and to demonstrate how EdP has affected El Salvador's electricity sector and benefited the Salvadoran people. The output of this assignment includes an economic model, a written report (this document), and a supporting presentation.

This report quantifies and describes the development impact of EdP using both qualitative and quantitative economic analysis, as well as scenario and sensitivity analysis to test the robustness of the development case. In doing so, it aims to communicate the following:

- The EdP project has created real economic benefits for El Salvador. The costs and benefits have been identified, explained, and quantified where possible and necessary. These benefits include reduced generation costs, incremental tax benefits for the Government from displacing imports with domestic production and increasing exports, and avoided local pollutants and greenhouse gas (GHG) emissions.
- The benefits generated by EdP would not have been realized or would have been greatly reduced, had the COVID-19 pandemic delayed the Project, or, at worst, forced Invenergy to abandon it.
- The economic benefit generated by delivering the Project under these circumstances disproportionately exceeded the additional costs Invenergy bore during the pandemic.
- Invenergy's project team overcame nearly 100 force majeure events and other significant pandemic-related challenges to deliver a landmark investment in a globally challenging time.

The analysis draws from multiple sources, including:

- First-hand data and information from Invenergy;
- Reputable international studies on economic analysis, assessing electricity sectors, and impact of emissions from local pollutants and GHGs;
- Insight and data from consultations with local stakeholders. The list of stakeholders interviewed for this analysis is in Appendix B;
- The Project's financial model;[31]
- Historical and actual prices of metals and commodities from global markets, such as, the London Metal Exchange amongst others; and
- Project studies, contracts, and other relevant documents.

[31] The analysis uses the financial model provided by Invenergy titled: "1. Lakeshore Model Reconciliation_02.23.2023_v18_(Sent)."

The information and analysis presented in this report is structured as follows:

- Section 2 describes the Project's scope, including the infrastructure directly related to the project, other social and economic investments in the local community of Acajutla, and other environmental activities EdP is involved in;
- Section 3 describes El Salvador's wholesale electricity market and the regional market to provide context for EdP's role in the overall sector;
- Section 4 presents a timeline of the project, including the impact of COVID-19 and the decisions made by Invenergy to continue construction despite countless pandemic-related challenges and delays;
- Section 5 describes the development impact EdP has had on El Salvador and its people. When possible, the impacts are described and quantified using economic cost-benefit analysis. This section also presents a sensitivity analysis to test the robustness of the analysis and assess the individual effect cost drivers have on EdP's impact. The cost assumptions used in the analysis are in Appendix C;
- Appendix A presents the scenario analysis. The scenario analysis examines alternative scenarios that could have occurred had Invenergy made other decisions, such as delaying the project, and how these decisions would have changed the impact of the Project.

# 2 Scope of EdP

Invenergy developed Energía del Pacifico, a 380MW gas-fired power plant and liquid natural gas (LNG) regasification facility in Acajutla, El Salvador. In addition to the power plant and its supporting infrastructure (see Figure 2.1), EdP has also invested in other economic, social, and environmental activities and projects that are described in this section.

**Figure 2.1: EdP Infrastructure components**


1 Power Plant
2 Transmission lines and substations
3 Pipeline
4 Marine Infrastructure
5 Floating Storage Regasification Unit (FSRU)

*Source: Invenergy.*[32]

A description of each component of EdP, as numbered above, of EdP follows.

1. **Power plant:** The power plant has a net capacity of 380MW.[33] It is comprised of 19 engines (18.9MW each) that burn natural gas to produce electricity, and a 28MW steam turbine that spins using the waste heat from burning natural gas.[34,35]
2. **Transmission lines and substations:** A 44km double-circuit 230kV transmission line that connects to the Ahuachapán substation plus a 0.4km double-circuit 230kV underground transmission line that connects to Acajutla substation.[36,37] Double-circuit lines allow for greater reliability and capacity than single-circuit transmission lines[38] and provide the national grid with additional redundancy. The transmission lines that transport electricity generated by EdP to the electrical grid at the Ahuachapán substation connects to the national grid and the regional grid, Sistema de Interconexión Eléctrica de los Países de América Central (SIEPAC).[39, 40]

[32] EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 13.

[33] EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 14.

[34] Ibid.

[35] Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 10.

[36] EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 15.

[37] Invenergy. "Authorization - UG T-Line Apaneca," 4 October 2021. Page 1.

[38] Wijekoon et al. "Transient based faulted conductor selection method for double circuit lines," 2021. https://www.sciencedirect.com/science/article/abs/pii/S0378779621002376. Introduction.

[39] Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 12.

[40] EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 15.

3. **Pipeline**: The pipeline is 1.8km long[41] and transports gas from the Floating Storage Regasification Unit (FSRU) to the power plant. Approximately 1.3km is offshore, with the remaining 0.5km onshore.[42]
4. **Marine infrastructure:** The FSRU complex includes a mooring system, equipment to connect the FSRU to the 24-inch-pipeline, and tugboats to support the logistics of off-loading LNG shipments to the FSRU.[43,44]
5. **Floating storage regasification unit (FSRU):** The FSRU, BW Tatiana, is an offshore LNG tanker, where the LNG is received and converted from a liquid to a gas (regasification). It has a storage capacity of 137,000$m^3$, and a regasification capacity of 280 million square cubic feet (MMSCF) per day.[45] The FSRU is permanently moored 1.2km from shore and is completely self-contained.[46]

In addition to the power plant itself and the supporting infrastructure, EdP has made commitments as part of its corporate social responsibility activities. This includes investing approximately US$532,500 per year for up to 20 years on social and economic development projects in the Municipality of Acajutla.[47] In current US dollars, this amounts to a total investment of US$10.7 million over 20 years.

EdP signed a "Social investment agreement" with the Municipality of Acajutla and the Social Investment Fund for the Local Development in 2015 that complies with EdP's required investment in public works in Acajutla.[48] This agreement describes the process for selecting the investment projects. The Municipality of Acajutla prepares annual investment plans, including priority projects in the electricity, transport, water, and social services sectors.[49,50] Once these projects are identified, EdP funds the priority projects and follows up on their development.[51]

As of June 2023, EdP has invested close to US$3.5 million in these economic and social development projects. These projects are in Table 2.1 below.

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41 EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 17.

42 Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 10.

43 EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 18.

44 EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 17.

45 EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Page 16.

46 Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 10.

47 Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 39.

48 Invenergy. "Technical Cooperation Agreement Between The Municipality of Acajutla, The Social Investment Fund for Local Development (FISDL) and Energía Del Pacifico S.A de C.V (EDP)," 2015. Page 1.

49 Invenergy. "Technical Cooperation Agreement Between The Municipality of Acajutla, The Social Investment Fund for Local Development (FISDL) and Energía Del Pacifico S.A de C.V (EDP)," 2015. Page 6.

50 Municipio de Acajutla, Departamento de Sonsonate. "Plan Estratégico Participativo de Desarrollo del Municipio de Acajutla Con énfasis en Desarrollo económico del Territorio 2014-2020," 2014. http://www.acajutla.gob.sv/descargas/planes_municipales/PEP_ACAJUTLA_2014-2020.pdf

51 Invenergy. "Technical Cooperation Agreement Between The Municipality of Acajutla, The Social Investment Fund for Local Development (FISDL) and Energía Del Pacifico S.A de C.V (EDP)," 2015. Page 6.

**Table 2.1: EdP's economic and social development projects**

| Economic and social development projects | Number of beneficiaries | Investment (US$) | Year |
|---|---|---|---|
| Reconstructing the Benigno Carrera Street | 1,470 | 245,358 | 2015-2016 |
| Reconstructing the RASA Street | 735 | 169,215 | 2015-2016 |
| Renovating the Complejo Educativo Hacienda Metalío and adding a roof to the basketball court | 1,043 | 225,123 | 2016-2017 |
| Building new power lines to provide electricity to Caserío Los Abetos, Cantón El Suncita | 86* | 30,945 | 2016-2017 |
| Building new power lines to provide electricity to Caserío Miramar, Cantón Metalío | 64* | 29,353 | 2016-2017 |
| Improving the lighting and ornamentation of Boulevard 25 de Febrero | 1,250 | 76,431 | 2017-2018 |
| Building new power lines to provide electricity to Caserío El Porvenir | 133* | 49,665 | 2018-2019 |
| Construction of a sewage network and wastewater treatment plant in Cantón Metalío | 5,000 | 442,202 | 2018-2019 |
| Paving the street from Centro Escolar Lisandro Larín Zepeda, Colonia La Reina, to Ave. Pedro de Alvarado | 7,000 | 67,580 | 2018-2019 |
| Asphalt resurfacing of the street that goes from the post offices of El Salvador, intersection Pedro de Alvarado Avenue, to El Tanque Avenue, Colonia IVU | | 366,225 | 2019-2020 |
| Renovating the Casa Comunal Colonia IVU | 5,000 | 553,267 | 2020-2021 |
| Renovating and improving the infrastructure of the Julian Vasquez Rojas School | 650 | 166,946 | 2022-2023 |
| Renovating and improving the infrastructure of the Los Laureles Fe y Alegria School | 725 | 225,479 | 2022-2023 |
| Renovating and improving the infrastructure of the Fe y Alegria Barrio El Campamento | 315 | 246,938 | 2022-2023 |
| Renovating and improving the infrastructure of the Lisandro Larin Zepeda School | 445 | 319,569 | 2022-2023 |
| Renovating and improving the infrastructure of the Special Education School | 30 | 152,028 | 2022-2023 |
| Renovating and improving the infrastructure of the Cantón La Coquera School | 175 | 65,244 | 2022-2023 |
| Renovating and improving the infrastructure of the National Institute of Acajutla | 480 | 134,716 | 2022-2023 |
| **Total:** | **24,601** | **3,489,862** | |

**Note: The beneficiaries for certain projects were counted as households. For these projects, the values above assume there are 3.6 beneficiaries per household.*
*Source: Invenergy.[52] Data on average household size in El Salvador: ArcGIS.[53]*

In addition, EdP has made other investments in the environment. The Environmental and Social Impact Assessments (ESIAs) assessed EdP's unavoidable environmental and social impacts. The ESIAs identify mitigation, prevention, compensation, and monitoring measures to implement in response to the assessed impact on the environment.

Based on the findings of the ESIA, EdP has committed to funding approximately US$5.3 million for these environmental activities. As of June 2023, EdP has invested in the environmental activities listed in Table 2.2.

**Table 2.2: Environmental measures**

| Type of activity | Environmental measure | Investment (US$) | Result |
|---|---|---|---|
| ***Measures in response to impacts caused by the construction of the transmission line*** | | | |
| **Mitigation** | Implement measures to control soil erosion, stormwater management, and sedimentation | 206,000 | Minimal erosion and sediment containment within approved construction areas |
| | Relocate bird habitats in trees to be cut down | 6,000 | Prevention of bird deaths due to project activities |
| | Capture and relocate frog habitats in areas affected by the project | 5,000 | Prevention of direct mortality of frogs due to project activities |
| **Prevention** | Conduct black-eyed frog conservation campaigns and organic coffee cultivation campaigns in schools | 5,000 | Spread information about black-eyed frogs and the importance of organic coffee cultivation. |
| | Install 500 bird flight deterrents to prevent birds from colliding with transmission cables | 7,500 | No collision of birds with transmission cables |
| | Implement a fortuitous findings plan | 10,000 | Protect the county's cultural heritage |
| **Compensation** | Build water catchment basins for the reproduction of black-eyed frogs due to loss of habitat and setup informational banners | 1,600 | Development of appropriate sites for the reproduction of the black-eyed tree frogs |
| **Monitoring** | Terrestrial biodiversity monitoring (flora, mammals, birds, amphibians, and reptiles) | 441,370 | Avoid net loss of terrestrial biodiversity |
| ***Measures in response to impacts caused by operations of the transmission line*** | | | |
| **Prevention** | Maintain 500 bird flight deterrents that prevent birds from colliding with transmission cables | 2,000 | No collision of birds with transmission cables |
| **Compensation** | Reforestation programs of protected trees (threatened or endangered) at a rate of 25 trees planted per felled tree and 1 shrub planted per felled shrub | 21,280 | Net gain from trees planted |
| **Monitoring** | Monitor the effectiveness of deterrents to reduce bird and bat mortality during the 1st year and 2nd years of operations | 255,390 | No collision of birds or with transmission cables |

[52] Communication with EdP. File named: "Sistematizacion Proyectos Sociales – EDP," Spreadsheet labeled: "actividades sociales," 30 May 2023.

[53] ArcGIS. "Average Household Size in El Salvador," 2021. https://www.arcgis.com/home/item.html?id=9777a96fa9d14e56b2e6f47a1734829f#!#:~:text=This%20map%20shows%20the%20average%20household%20size%20in,by%20dividing%20the%20household%20population%20by%20total%20households.

| Type of activity | Environmental measure | Investment (US$) | Result |
|---|---|---|---|
| | Evaluate and seek to avoid a net loss of terrestrial biodiversity during the 1st and 2nd years of operations. | 358,610 | No net loss of terrestrial biodiversity (flora, mammals, birds, amphibians, and reptiles) |
| ***Measures in response to impacts caused by the construction of the power plant and marine terminal*** | | | |
| **Mitigation** | Relocate terrestrial fauna | 6,200 | Reduce the mortality and migration of fauna in Acajutla |
| | Install a marine fauna rescue center | 60,000 | Assist stranded or sick animals and minimize disturbance to marine habitats |
| | Install an anti-turbidity curtain in the Port of Acajutla | 1,000,000 | Reduction of turbidity levels and suspended sediments. |
| **Prevention** | Implement a dust management plan | 54,010 | Prevent short-term dust increases close to the construction of the power plant |
| **Compensation** | Reforestation program to plant 20,787 trees to compensate for the loss of habitats | 211,470 | Compensate for the trees cut down during construction |
| | Reforestation campaign in five schools in Acajutla to plant 100 trees | 760 | Improve the natural habitat in schools |
| | Install 150 artificial reefs | 308,110 | Improve the livelihood of 155 fishermen |
| **Monitoring** | Marine biodiversity monitoring (water quality, marine turtles, marine mammals, fish, benthos, and plankton) | 512,520 | Avoid net loss of marine biodiversity |
| ***Measures in response to impacts caused by operations of the power plant and marine terminal*** | | | |
| **Mitigation** | Reconstruct and improve a building to convert it into a fi | 100,000 | Assist stranded or sick animals and minimize disturbance to marine habitats |
| **Prevention** | Monitor emissions for the first 3 years of operations and install a predictive emissions monitoring system | 33,000 | Emissions are below reference standards |
| | Noise and vibration monitoring | 15,000 | Ensure the noise of the power plant does not affect residential areas |
| | Monitoring effluents | 110,000 | Prevent, detect, and reduce water contamination from the power plant |
| | Install two continuous monitors for ozone and $NO_2$ to evaluate air quality | 160,000 | Prevent, detect, and reduce air contamination from the power plant |
| **Compensation** | Reforestation program to plant 546 trees | 703,110 | Restore habitats |
| | Improve fishing and marketing conditions for fishermen in Acajutla | 200,000 | Improve the quality of life and security of fishermen |

| Type of activity | Environmental measure | Investment (US$) | Result |
|---|---|---|---|
| **Monitoring** | Marine biodiversity monitoring (water quality, marine turtles, marine mammals, fish, benthos, and plankton) during the 1st and 2nd years of operations | 546,910 | Avoid net loss of marine biodiversity |
| **Total** | | **5,341,000** | |

*Source: EdP.*[54,55]

# 3 Overview of the sector and EDP's role in the sector

El Salvador's wholesale electricity market (Mercado Mayorista de Electricidad—MME) is a net pool. In a net pool, most power trade occurs through bilateral contracts between generators and wholesale buyers. Net pools also include a balancing mechanism, or spot market, in which the system operator resolves short-term imbalances. In El Salvador, about 75 to 80 percent of wholesale electricity traded is based on bilateral contracts.[56,57,58] The spot market (Mercado Regulador del Sistema—MRS) is operated by the Unidad de Transacciones (UT). In 2022, total energy demand on the MRS reached 1,551GWh.[59]

EdP has power purchase agreements (PPAs) with seven distribution companies. Combined, these PPAs contract out 355MW of EdP's capacity, as shown in Table 3.1.

**Table 3.1: Contracted capacities between EdP and distribution companies**

| Distribution company | Contracted capacity, Block 1 (MW) | Contracted capacity, Block 2 (MW) | Total contracted capacity (MW) |
|---|---|---|---|
| **Compañía de Alumbrado Eléctrico de San Salvador (CAESS)** | 111.7 | 44.6 | **156.3** |
| **Distribuidora de Electricidad Delsur (DELSUR)** | 60.8 | 24.2 | **85.0** |
| **Compañía de Alumbrado Eléctrico de Santa Ana (CLESA)** | 40.5 | 16.2 | **56.7** |
| **Empresa Eléctrica de Oriente (EEO)** | 26.8 | 10.7 | **37.6** |
| **Distribuidora Eléctrica de Oriente (DEUSEM)** | 6.7 | 2.7 | **9.4** |

54 Communication with EdP. File named: "Actividades ambientales Castalia Power Plant 2023," 12 June 2023.

55 Communication with EdP. File named: "Actividades ambientales TL Castalia," 12 June 2023.

56 Meeting with Unidad de Transacciones, 17 May 2023.

57 Unidad de Transacciones. "Estadístico Anual Enero a Diciembre 2022," https://www.ut.com.sv/anual. Cuadro No. 8: Demanda de energía en el Mercado de Contratos (Libre Concurrencia).

58 Unidad de Transacciones. "Estadístico Anual Enero a Diciembre 2022," https://www.ut.com.sv/anual. Cuadro No. 9: Demanda de energía en el Mercado Regulador del Sistema.

59 Unidad de Transacciones. "Estadístico Anual Enero a Diciembre 2022," https://www.ut.com.sv/anual. Cuadro No. 9: Demanda de energía en el Mercado Regulador del Sistema.

| Distribution company | Contracted capacity, Block 1 (MW) | Contracted capacity, Block 2 (MW) | Total contracted capacity (MW) |
|---|---|---|---|
| **B&D Servicios Tecnicos (B&D)** | 2.2 | 0.9 | **3.0** |
| **Empresa Distribuidora Eléctrica Salvadoreña (EDESAL)** | 3.7 | 3.2 | **7.0** |
| **Total contracted capacity** | **252.5** | **102.5** | **355.0** |

*Note: The values above are rounded to the nearest tenth.*
*Source: EdP.*[60]

The tariff under the PPAs is based on:

- A fixed charge, for committed capacity; and
- A variable charge, which is a function of the price of natural gas, non-fuel variable O&M costs, and a premium.[61]

Distribution companies pay EdP a fixed charge for committed capacity, which is set at a price of US$8,800 per MW per month, and adjusted annually for inflation.[62,63]

The variable charge (monthly contracted energy price) is calculated using the following formula:[64]

$$PEC_{(m)} = C_{ESP} * \left[CCom_{(m)}\right] + O\&M * \frac{IPC_{(a)}}{IPC_{(o)}} + Premium * \frac{CPIU_{(a)}}{CPIU_{(o)}}$$

Where:

- **a:** the second month preceding the month in which the contract was signed for a given year.
- **m:** Each of the calendar months in the supply period.
- **o:** The month of June 2013.
- **$C_{ESP}$:** Net specific consumption – higher heating value of the machines of EdP.
- **$CCom_{(m)}$:** Total price of fuel acquisition for EdP, expressed in US$/MMBtu.
- **O&M:** Noncombustible variable cost of EdP, as indicated in EdP's economic proposal.
- **Premium:** Premium corresponding to investment costs, fixed costs, utility, and any other charges not recovered through the power prices, indicated by EdP in the economic proposal.
- **CPIU:** Consumer Price Index for all urban consumers of the United States.

[60] PPAs signed between EdP and each distribution company. Other than the amount of capacity contracted, all PPAs are on the same terms.

[61] The formula for the variable charge is in section 6.2.1: Price of Associated Energy Contracted in the PPAs signed between EdP and the distribution companies.

[62] The formula for the capacity charge in section 6.1. Price of Contracted Power in the PPAs signed between EdP and the distribution companies. The initial price of contracted power is based on the price submitted in EdP's economic proposal to SIGET, adjusted for inflation.

[63] EdP. "EDP Information Memorandum_Feb 2017_final," 2017. Page 39.

[64] Invenergy. "PPA translated CAESS-01 (ENGLISH)," Page 19.

- **IPC:** Consumer Price Index of El Salvador.[65]

The variable price of power sold under bilateral contracts was approximately US$121.1 per MWh in 2022 and US$155.6 per MWh in 2023.[66]

El Salvador is also part of the regional market (Mercado Eléctrico Regional—MER), where participants can sell and purchase power internationally.[67] The MER interconnects Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.[68] In 2022, 3,109GWh of power was traded on the MER.[69] In the same year, El Salvador exported about 905GWh and imported 1,270GWh to and from the MER.[70] The impact of EdP on El Salvador's role in the regional market is described in more detail in Section 5.4.1.

# 4 Project development

Invenergy, along with its project partners and lenders, made critical choices while faced with unprecedented and unforeseeable uncertainty to deliver EdP successfully, against most odds. The global pandemic and Russia's unprovoked war in Ukraine caused markets to cease operating and supply chains to choke. Nearly all EdP's suppliers and contractors issued force majeure notices due to the pandemic, amounting to more than 100, and causing regular delays, between March 2020 and mid-July 2021.[71] In spite of these challenges, EdP began commercial operations only 4 months behind schedule.

Construction of EdP began on schedule in January 2020, with Invenergy anticipating a commercial operation date in January 2022.[72] The total project cost was expected to be US$856 million.[73] However, construction was forced to stop in March 2020 for the first of several occasions because of uncertainty around lockdowns and the risk of COVID-19. On 11 March 2020, El Salvador began to take steps to implement one of the strictest lockdown measures of any country.[74]

Over the coming weeks, the Government closed the international airport, stores and public transportation shut down, and only essential stores were permitted to stay open.[75] Other than "essential workers," the Government required citizens to stay at home except for grocery and

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65 As published by the Banco Central de Reserva de El Salvador.

66 These are the values calculated in: Invenergy. "1. Lakeshore Model Reconciliation_02.23.2023_v18_(Sent)."

67 Comisión Regional de Interconexión Eléctrica. "What is the MER?," https://crie.org.gt/mer/.

68 Ibid.

69 Comisión Regional de Interconexión Eléctrica. "Transacciones del MER," https://crie.org.gt/mer/.

70 Ente Operador Regional. "MER Commercial Dashboard 2021- 2022 and MER Commercial Dashboard 2022-2023," 2023. https://www.enteoperador.org/dashboards/dashboard-informacion-comercial-del-mer-2022/.

71 Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 3.

72 Ibid.

73 Total project cost includes costs associated with development of the power plant, marine works, interconnection, commissioning/pre-PPA start, construction services and owner's engineer, insurance, taxes during construction, cash contingencies and development fees at risk, cash collateral for securities, transaction costs, financing costs, reserves, working capital, and debt service reserve.

These values are in: Invenergy. "20191120Financial model EdP_ClosingvF_A1," 2019.

74 London School of Economics. "El Salvador's Covid-19 response is stirring up health and economic problems for the worse off," 2020. https://blogs.lse.ac.uk/latamcaribbean/2020/10/16/el-salvadors-covid-19-response-is-storing-up-health-and-economic-problems-for-the-worse-off/.

75 Ibid.

medical shopping.[76] Though meant to last 1 month, these lockdown measures lasted 5 months until August,[77] creating labor shortages and delays for EdP.[78] Supply chain disruptions due to lockdowns in El Salvador and worldwide further compounded the challenge of labor shortages.[79]

The Government of El Salvador designated projects in the generation sector as strategic to national interests, enabling EdP to continue construction.[80] In response, EdP implemented its *Strategic Preparedness and Response Plan for Novel Coronavirus* to comply with the Government's requirements.[81] Nonetheless, the strict quarantine included suspensions of all international flights and closed borders,[82] which made it almost impossible for EdP to attract and employ international workers. In response, Invenergy bore additional costs to charter private planes that could bring skilled essential workers to El Salvador. Because the only international commercial airport in El Salvador was closed, EdP used the military airport instead, estimated to cost at least US$500,000 for more than 10 trips.[83]

EdP set up a medical clinic in June 2020 where workers received testing and treatment for COVID-19. The clinic provided treatment for the workforce, which included treatment provided to over 100 workers during certain months.[84] It began vaccinating its workforce when vaccines became widely available,[85] only 3 months after the first vaccines arrived in El Salvador in February.[86] By September of that year, 97 percent of its workforce had been vaccinated,[87] nearly twice the national average.[88]

In total, EdP incurred additional costs of nearly US$60 million to continue construction throughout the COVID-19 pandemic. This was thanks to work-arounds to keep the Project on schedule which, otherwise, would have paralyzed all construction activities and led to severe extra costs.[89] The remainder of this section illustrates the timeline, including the major events that transpired, and describes the response and impact of these events on EdP.

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[76] Ibid.

[77] Despite removing domestic lockdown measures, the international airport remained closed. Communication with Invenergy. 22 June 2023.

[78] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 3.

[79] Ibid.

[80] Invenergy. "Environmental and Social Compliance and Performance Report, January – March of 2020," 2020. Page 10.

[81] Invenergy. "EdP-ESMS-PLN-029 Strategic preparedness and response plan for novel coronavirus (COVID-19)_Rev.0," Page 6.

[82] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 3.

[83] Communication with Invenergy. 22 June 2023.

[84] Invenergy. "1.1 consultas FEBRUARY 2021," 2021. Page 16.

[85] Communication with Invenergy. 15 June 2023.

[86] Invenergy. "EdP Environmental and Social Compliance Report Q1-2021," Page 13.

[87] Invenergy. "EdP Environmental and Social Compliance Report Q3-2021," Page 31.

[88] At this time, El Salvador had vaccinated 49 percent of its population. Invenergy. "EdP Environmental and Social Compliance Report Q3-2021," Page 31.

[89] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 6.

## 28-Feb-2020

**Issue**

- Contractors sent the first Force Majeure notices due to the lockdown in China, notifying EdP of possible events.
- The notices began with the FSRU, followed by Boskalis, Wartsila, Elecnor, BWO, and Saam Towage.

**Impact on EdP**

- The notices were too early to have any real effect, but the amount of notices indicated that EdP would need to stay abreast of future developments.

## 11-Mar-2020

**Issue**

- The WHO declared COVID-19 a pandemic.
- Decree #12 was approved by the Minister Council, declaring the State of National Emergency due to COVID-19.
- Decree #13 was approved, enforcing a 30-day quarantine.
- Decree #14 was approved which asked citizens, companies, and institutions to collaborate with the authorities.

**Impact on EdP**

- As soon as the pandemic was declared, all contractors had the right to seek compensation and claim Force Majeure. This kicked off the more than 100 Force Majeure letters.
- The change in law entitled contractors to seek compensation locally.
- Work stopped due to the change in law.
- The population did not entirely follow the new rules, leading Government to increase enforcement and to implement stricter measures.

## 14-Mar-2020

**Issue**

- Decree #593 was approved by Congress, declaring the State of National Emergency. This Decree ratified the Government's declaration and demonstrated congressional approval of presidential decisions.
- Decree #594 was approved by Congress, which restricted the constitutional rights of the population.

**Impact on EdP**

- This limited the population from gathering in groups and from working together onsite as a team. EdP was forced to shut down work at the site for several days until it secured the waivers from the Government.
- The freedom to gather in communities was limited.

## 15-Mar-2020

**Issue**

- EdP issued the Strategic Preparedness and Response Plan for Novel Coronavirus (COVID-19) and a business continuity plan during temporary restrictions.

**Impact on EdP**

- These actions entitled contractors to seek further compensation as EdP instructed contractors to do things they had not planned for.

## 18-Mar-2020

**Issue**

- El Salvador's international airport shut down, meaning no one could enter or leave the country.

**Impact on EdP**

- International workers could not enter the country, leaving EdP with a lack of site supervision from European contractors.
- The most critical contractor at this stage, Boskalis, was unable to mobilize in Q1 2020. Its services sat on the critical path of the whole project. All works on the pipeline and marine works stopped for months.
- Wartsila and Elecnor were already on site by the time the pandemic was declared.
- Both contractors continued performing with the workers they had on site at that time.
- Boskalis could not mobilize to El Salvador to work on site due to the closed borders.
- EdP began exploring alternative construction techniques and methodologies that would keep the project on schedule. EDP negotiated and motivated on-site contractors to keep progressing during lockdowns. EDP and Boskalis agreed to get Boskalis on site as soon as practically possible.

## 21-Mar-2020

**Issue**

- Executive Decree #12 was approved by the President, implementing sanitary controls.
- Decrees #19 and 22 extended the Executive Decree.

**Impact on EdP**

- This marks the start of the full lockdown with police and army on the streets controlling the population in El Salvador.
- Containment centers were created and people had to quarantine in place for 30 days.

## 26-Mar-2020

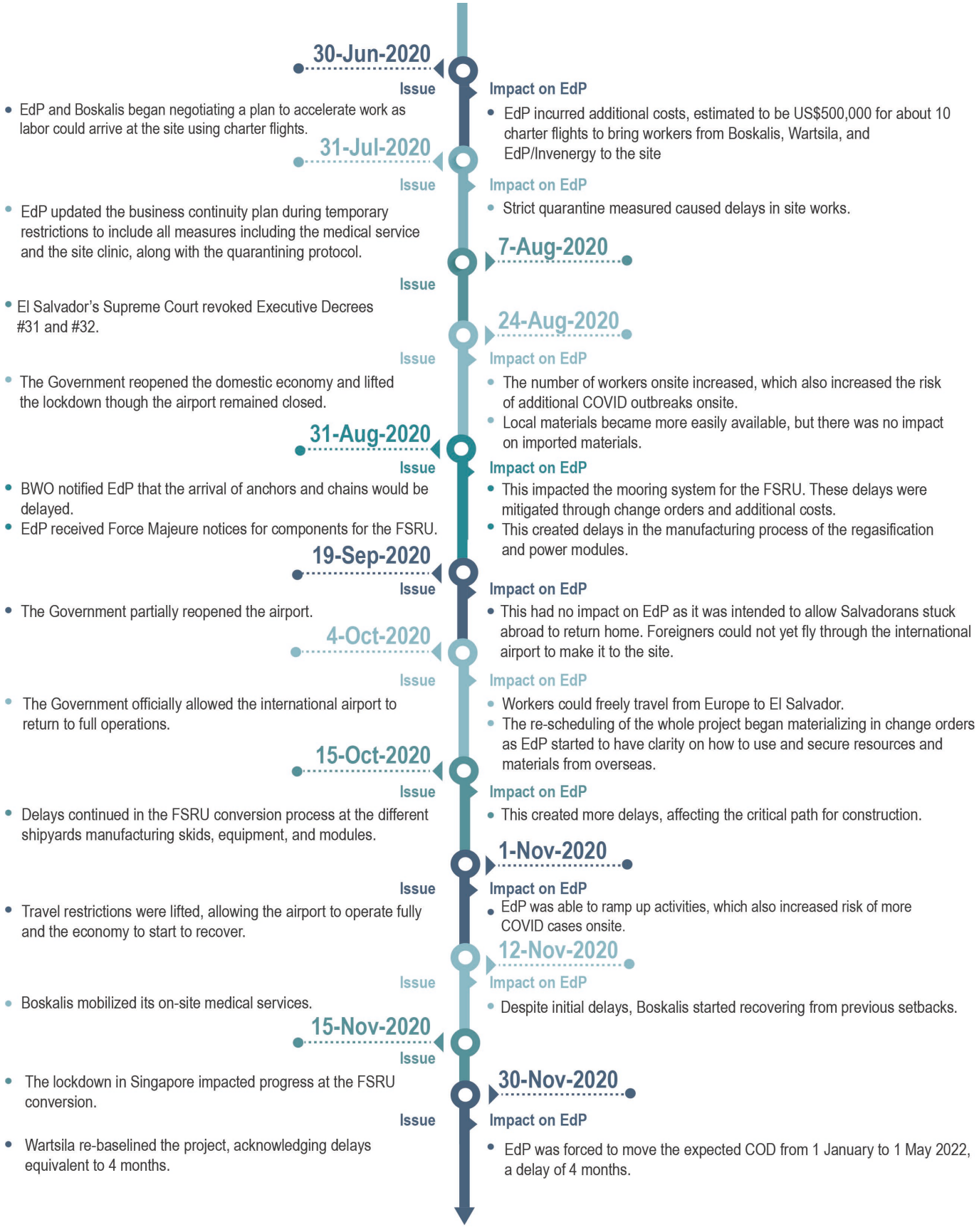
**Issue**

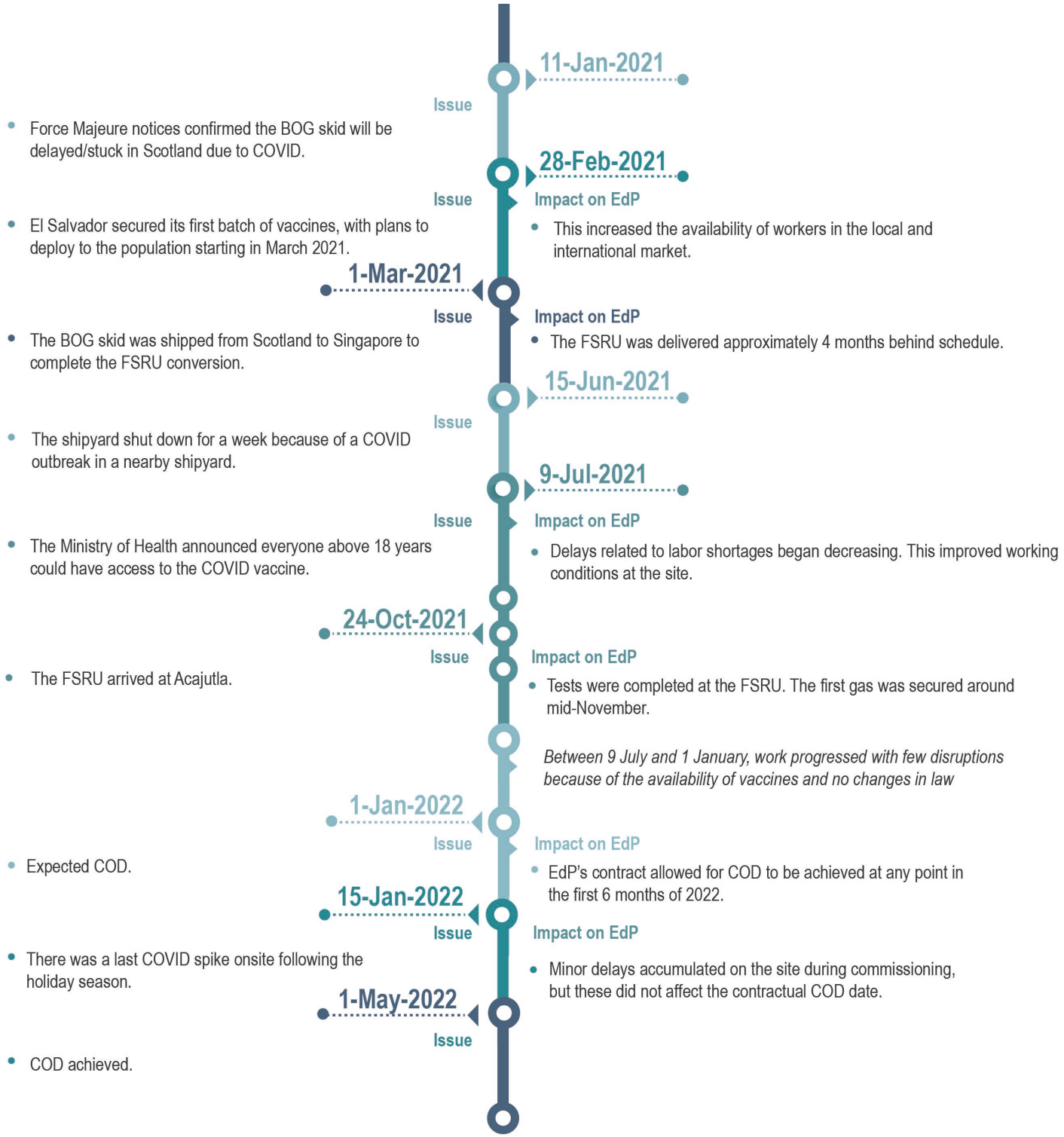
- Executive Decree #15 was approved by the President to continue supplying electricity and fuel during the national emergency.

**Impact on EdP**

- This Decree allowed EdP to continue work with workers returning to the site 1 to 2 days after its issuance.
- EdP issued letters in coordination with CNE and SIGET to support the continuity of the main energy project.
- It was difficult to get personnel on site due to police patrols and stops.
- EdP organized buses to transport all personnel to and from the site. These dedicated transports represented extra costs that resulted in change orders with Wartsila and Boskalis.


16-Apr-2020
Issue
Legislative Decree #622 was approved by Congress extending the term of Decree #593.
1-May-2020
Issue
Legislative Decree #631 was approved by Congress extending the term of Decree #593.
5-May-2020
Issue
Government allowed a partial lockdown 5 May 2020, following Italy's relaxation of its lockdown.
Legislative Decree #639 was approved by Congress, allowing Government to regulate isolation, quarantine, observation, and surveillance due to COVID-19.
Impact on EdP
The manufacturing and refurbishment of the concrete modules and tunneling boring machine for the gas pipeline in Italy resumed after Italy lifted its restrictions. Boskalis began to progress on site.
The recovery plan negotiated during this period resulted in several change orders with Boskalis.
6-May-2020
Issue
Executive Decree #22, based on Legislative Decree #639, was executed and later updated by Decree #24 on 9 May 2020.
Impact on EdP
Decree #22 limited the industries that could operate, creating scarcity in the market for raw materials.
Changes in Decree #24 allowed more refining activities that enabled work to continue, in part, by lifting bans to power generators.
EdP secured approvals which categorized it as a power generator, although still under construction, which enabled workers to freely go to work from 26 March 2020.
16-May-2020
Issue
Legislative Decree #634 was approved by Congress, extending the term of Decree #593.
22-May-2020
Issue
Keppel informed that the Singaporean government issued strict regulations to control the population and there was a shortage of workers.
Impact on EdP
This led to delays in the FSRU conversion.
26-May-2020
Issue
The FSRU begins experiencing shortages from suppliers.
Impact on EdP
EdP experienced delays in the manufacturing of equipment and modules for the FSRU conversion at the shipyards in China and Scotland.
2-Jun-2020
Issue
Executive Decree #29 was approved by Government, implementing sanitary controls. This Decree superseded Executive Decrees #26, #27, and #28.
6-Jun-2020
Issue
Executive Decree #26 was approved by Government and superseded the Executive Decree #24.
Impact on EdP
These changes relaxed restrictions, which allowed work to continue slowly under certain conditions influenced by strict health and safety protocols.
9-Jun-2020
Issue
EdP began to charter flights to bring international workers to the site so they could continue overseeing work and to make up for the lack of qualified and skilled local labor.
Impact on EdP
Work was able to continue at a significant cost to EdP and Invenergy.
12-Jun-2020
Issue
The first COVID case on site is confirmed.
Impact on EdP
Safety protocols increased on the site. EdP began preparing to open the on-site medical services and facility began.
20-Jun-2020
Issue
EdP deployed the medical service onsite, which continued uninterrupted until 30 June 2022.
Impact on EdP
Many workers had to quarantine due to the potential exposure to COVID-19.
Constructions was significantly delayed onsite due to quarantines and social distancing.
EdP began to incur the US$1.7 million in costs required to provide onsite medical services, the clinic, and to purchase medicines, COVID test kits, and other needed goods.


30-Jun-2020
Issue
EdP and Boskalis began negotiating a plan to accelerate work as labor could arrive at the site using charter flights.
Impact on EdP
EdP incurred additional costs, estimated to be US$500,000 for about 10 charter flights to bring workers from Boskalis, Wartsila, and EdP/Invenergy to the site
31-Jul-2020
Issue
EdP updated the business continuity plan during temporary restrictions to include all measures including the medical service and the site clinic, along with the quarantining protocol.
Impact on EdP
Strict quarantine measured caused delays in site works.
7-Aug-2020
Issue
El Salvador's Supreme Court revoked Executive Decrees #31 and #32.
24-Aug-2020
Issue
The Government reopened the domestic economy and lifted the lockdown though the airport remained closed.
Impact on EdP
The number of workers onsite increased, which also increased the risk of additional COVID outbreaks onsite.
Local materials became more easily available, but there was no impact on imported materials.
31-Aug-2020
Issue
BWO notified EdP that the arrival of anchors and chains would be delayed.
EdP received Force Majeure notices for components for the FSRU.
Impact on EdP
This impacted the mooring system for the FSRU. These delays were mitigated through change orders and additional costs.
This created delays in the manufacturing process of the regasification and power modules.
19-Sep-2020
Issue
The Government partially reopened the airport.
Impact on EdP
This had no impact on EdP as it was intended to allow Salvadorans stuck abroad to return home. Foreigners could not yet fly through the international airport to make it to the site.
4-Oct-2020
Issue
The Government officially allowed the international airport to return to full operations.
Impact on EdP
Workers could freely travel from Europe to El Salvador.
The re-scheduling of the whole project began materializing in change orders as EdP started to have clarity on how to use and secure resources and materials from overseas.
15-Oct-2020
Issue
Delays continued in the FSRU conversion process at the different shipyards manufacturing skids, equipment, and modules.
Impact on EdP
This created more delays, affecting the critical path for construction.
1-Nov-2020
Issue
Travel restrictions were lifted, allowing the airport to operate fully and the economy to start to recover.
Impact on EdP
EdP was able to ramp up activities, which also increased risk of more COVID cases onsite.
12-Nov-2020
Issue
Boskalis mobilized its on-site medical services.
Impact on EdP
Despite initial delays, Boskalis started recovering from previous setbacks.
15-Nov-2020
Issue
The lockdown in Singapore impacted progress at the FSRU conversion.
30-Nov-2020
Issue
Wartsila re-baselined the project, acknowledging delays equivalent to 4 months.
Impact on EdP
EdP was forced to move the expected COD from 1 January to 1 May 2022, a delay of 4 months.


11-Jan-2021
Issue
Force Majeure notices confirmed the BOG skid will be delayed/stuck in Scotland due to COVID.
28-Feb-2021
Issue
El Salvador secured its first batch of vaccines, with plans to deploy to the population starting in March 2021.
Impact on EdP
This increased the availability of workers in the local and international market.
1-Mar-2021
Issue
The BOG skid was shipped from Scotland to Singapore to complete the FSRU conversion.
Impact on EdP
The FSRU was delivered approximately 4 months behind schedule.
15-Jun-2021
Issue
The shipyard shut down for a week because of a COVID outbreak in a nearby shipyard.
9-Jul-2021
Issue
The Ministry of Health announced everyone above 18 years could have access to the COVID vaccine.
Impact on EdP
Delays related to labor shortages began decreasing. This improved working conditions at the site.
24-Oct-2021
Issue
The FSRU arrived at Acajutla.
Impact on EdP
Tests were completed at the FSRU. The first gas was secured around mid-November.
Between 9 July and 1 January, work progressed with few disruptions because of the availability of vaccines and no changes in law
1-Jan-2022
Issue
Expected COD.
Impact on EdP
EdP's contract allowed for COD to be achieved at any point in the first 6 months of 2022.
15-Jan-2022
Issue
There was a last COVID spike onsite following the holiday season.
Impact on EdP
Minor delays accumulated on the site during commissioning, but these did not affect the contractual COD date.
1-May-2022
Issue
COD achieved.

# 5 Development impact

EdP is a transformational project for El Salvador and the region. The breadth of its impact is massive. It has:

- Proven a model for infrastructure and power project development in the region. Its scale, complexity, and the speed at which it was delivered has shown the market, including investors, lenders, developers, and local governments, what can be done. It is the largest ever foreign direct investment in El Salvador and the first integrated LNG-to-power plant on the Pacific coast of Central America. EdP has invested more than US$1 billion in El Salvador to date.[90]
- Brought together a consortium of lenders that includes the International Finance Corporation, the US International Development Finance Corporation, Inter-American Development Bank (IDB) Invest, Finnish Export Credit Ltd, and KfW IPEX-Bank with the Project's sponsor, Invenergy, that worked together to manage colossal risks and challenges to develop a successful project.
- Contributed to the improving political and social stabilization in El Salvador which has shouldered the burden of years of blackouts and economic uncertainty.[91] EdP has helped ensure a more stable and flexible energy supply since coming online in 2022.
- Strengthened the sector's ability to bear the impacts of the changing climate, building much needed resilience into a previously vulnerable sector. EdP has enabled El Salvador to keep the lights on in spite the reduction in rainfalls caused by El Niño, which started in June 2023[92] and has reduced water levels at hydropower facilities by 26 percent compared to the year before.[93,94]
- Made people's lives better by improving power services, reducing generation costs, and delivering cleaner and more flexible energy. The Project directly employed more than 2,000 people during construction.[95] Further, EdP continues to invest in the environment and the local communities, leading to a range of other benefits that El Salvador will realize for the length of the Project's term and beyond.

Despite these impacts being plainly visible, proving them requires analysis of the situation now and in the past to affirm what is observed. Some of these effects can be shown to have real

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90 Energía del Pacífico. https://www.energiadelpacifico.com/

91 SIGET. "Government guarantees stable prices of electricity to the final consumer," 2023. https://www.siget.gob.sv/gobierno-garantiza-precios-estables-de-la-energia-electrica-al-consumidor-final/

92 ACAPS. "El Niño Overview: Anticipated Humanitarian Impact," 2023. https://www.acaps.org/fileadmin/Data_Product/Main_media/20230725_ACAPS_Thematic_report_El_Nino_overview_anticipated_humanitarian_impact_in_2023.pdf

93 ES Euro. "Drought decreases electricity generation in El Salvador," 2023. https://euro.eseuro.com/world/856566.html

94 El Salvador in English. "Stable Power Supply Highlighted by Industrialists in El Salvador." https://elsalvadorinenglish.com/2023/08/17/stable-power-supply-highlighted-by-industrialists-in-el-salvador/

95 This employment figure does not include indirect jobs and other business.

Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 6.

economic value that can be expressed in monetary terms. Most of the impact cannot be valued in such a way as the linkages between them, plus the second and third order effects, make it impossible to value accurately.

This section seeks to describe the development impact of EdP for the effects that can be isolated and explained clearly, and where causality is clear. Development impact assessments are meant to evaluate the social, economic, and environmental effects of a project and the affected communities—both the positive and negative effects. Developers, investors, and other stakeholders hope projects will have a positive impact. Various analytic techniques can be used to assess the type of impact projects have had, including economic analysis. Economic analyses complement development impact assessments by quantifying and valuing a project's economic benefits, taking into account costs, benefits, and risks.

The analysis in this section proves that the benefits anticipated from the development of EdP actually occurred and are being realized (see sections 5.1 and 5.2 for the explanation of the approach used). Using both quantitative and qualitative approaches enables a complete picture of the Project's economic and development impacts. Quantitative analysis forms the foundation of the assessment (Section 5.3). Qualitative analysis completes the picture and is used to describe the additional impacts EdP has that cannot be fully valued (Section 5.4).

## 5.1 Explanation of the cost-benefit analysis

Economic cost-benefit analysis quantifies the net economic benefits and costs created by an intervention. The technique is used to calculate the impact an intervention has by comparing it against a counterfactual,[96] which is explained by a "With Project" scenario (the intervention) against a "Without Project" scenario (the counterfactual).

To calculate the benefits realized, the analysis takes the difference of the costs and benefits between the two scenarios and discounts them to calculate the economic net present value of incremental benefits (or costs).[97] A social discount rate is used to account for the time-value of money. A positive economic net present value indicates that the intervention is in the interest of society.[98]

**Box 5.1: Considerations when selecting a social discount rate**

The costs and benefits accrued from power generation projects often occur at different times, with investment costs occurring at the beginning of project life and operations costs and benefits occurring incrementally over the course of a project's life. Given the time-value of money, these costs and benefits in time impact their present value, which must be calculated using a social discount rate.

A global consensus on what is appropriate as a social discount rate does not exist. Development agencies and governments have various views. The Asian Development Bank (ADB) offers the following perspective on ways to consider social discount rates.

[96] Asian Development Bank. "Guidelines for the Economic Analysis of Projects," 2017. Page 27. https://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf.

[97] Ibid.

[98] Asian Development Bank. "Guidelines for the Economic Analysis of Projects," 2017. Page 61. https://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf.

- The **demand price** considers the perspective of investors, who will consider the opportunity cost of the investment. Following this concept, a social discount rate should be the marginal rate of return on private investment.
- The **supply price** considers the perspective of savers and assumes that savers would prefer to consume now rather than in the future. Following this concept, a social discount rate should be the marginal social rate of time preference.

In the same book, the ADB suggests a social discount rate of 9 percent for hard infrastructure projects, like power generation and roads projects, and a discount rate of 6 percent for projects in social sectors like health and housing. This analysis follows the ADB guidelines and applies a discount rate of 9 percent.

*Source: Asian Development Bank, "Guidelines for the Economic Development of Projects," 2017. Page 52-53, 136. https ://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf.*

## 5.2 Explanation of scenarios

The cost-benefit analysis compares two scenarios:

- **The "With Project" scenario** represents the current situation in which EdP has been developed and operates. Under this scenario, EdP displaces generation from oil plants and cross-border imports resulting in net economic benefits for El Salvador and globally through reduced GHG emissions; and
- **The "Without Project" scenario** represents a case where EdP was never developed, and its costs and benefits were never realized. This scenario assumes that El Salvador did not develop EdP, nor an alternative to EdP. Under this scenario, El Salvador continues using oil-fired generation and imports to meet the demand that is now being met by EdP. As of 2023, El Salvador has enough installed capacity to meet its demand and is expected to continue to over the next 20 years. In 2022, the total installed capacity was 2,363MW (excluding EdP), more than double peak demand of 1,026MW.[99] Dispatchable[100] generation sources make up 70 percent of total installed capacity (1,858MW),[101] meaning El Salvador has a reserve margin of more than 80 percent, which is well above the industry standard of 15 percent to 30 percent to ensure the reliability of the power supply.[102,103]

[99] The annual peak demand occurred at 7pm in April 2022. This is calculated based on average hourly load each month.

Unidad de Transacciones, "Boletín Estadístico Anual 2022," Cuadro No. 23. https://www.ut.com.sv/anual/-/document_library/bzl1AYPUYG6R/view_file/1784178?_com_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R_redirect=https%3A%2F%2Fwww.ut.com.sv%2Fanual%2F-%2Fdocument_library%2Fbzl1AYPUYG6R%2Fview%2F279981.

[100] The analysis categorizes hydro, geothermal, thermal, and biomass as dispatchable sources. It is worth noting though that hydro and biomass are both seasonal, which may cause fluctuations in the available capacity depending on the time of year.

[101] Communication with EdP. File named: "20230413 Wholesale electricity market," 13 April 2023. Slide 3.

[102] U.S. Energy Information Administration. "Reserve electric generating capacity helps keep the lights on," 2012. https://www.eia.gov/todayinenergy/detail.php?id=6510.

[103] Despite having an adequate reserve margin, El Salvador trades in the regional market when prices in the MER are lower cost than domestic oil generation. Trade is limited by the transmission capacity of the SIEPAC line in El Salvador which is 300MW. The analysis assumes the transmission capacity of the line is increased to 600MW in 2030.

GME. "El Salvador: market Prospective - Final Report." June 2022.

Both scenarios examine a 20-year period, equal to the economic useful life of EdP and to its PPA term.[104] Other than the differences described above, variables on the supply and demand side are the same in both scenarios. Demand is projected to grow 2 percent annually.[105]

On the supply side, current generation assets (see Table 5.1) continue to operate through the 20-year period, assuming these generation assets do not reach the end of their economic lives or are refurbished to continue operations.

**Table 5.1: El Salvador's current generation assets (excluding EdP)**

| Generation technology | Installed capacity (MW) |
|---|---|
| **Geothermal** | 212 |
| **Solar PV** | 451 |
| **Biofuel** | 301 |
| **Wind** | 54 |
| **Hydropower** | 574 |
| **Thermal** | 771 |
| **Total** | **2,363** |

*Note: Values include utility-scale and distributed generation assets.*
*Source: Invenergy[106]*

Besides EdP, both scenarios assume that future new capacity is the same. The analysis projects generation over the next 20 years, assuming El Salvador develops new generation assets as presented in the expansion plan, 2019-2035 Prospectiva Energética.[107] The plan projects 877MW of new capacity to be built through 2035, the majority of which is expected to come from solar PV (469MW),[108] as shown in Table 5.2.

[104] Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 15.

[105] Expected demand growth is calculated based on historical data from 2017 to 2021. Between 2017 and 2021, demand grew an average of 2 percent annually, excluding change in demand from 2019 to 2020. The change in demand from 2019 to 2020 was excluded from the average as it is an outlier due to COVID-19's impact on electricity consumption.

Unidad de Transacciones. "Memoria de Labores," https://www.ut.com.sv/memoria-de-labores.

[106] Communication with EdP. File named: "20230413 Wholesale electricity market," 13 April 2023. Slide 3.

[107] Consejo Nacional de Energía. "Prospectiva Energética 2019-2035," Page 35.

[108] Ibid.

**Table 5.2: Future new generation assets, 2023-2035**

| Type | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Geothermal** | | | | | 35 | | 45 | | | | | | |
| **Hydro** | 67 | | | | | | | | | | | | |
| **Biogas** | | | 5 | | | 2 | | | 3 | | | | |
| **LNG** | | | 100 | | | | | | | | | | |
| **Solar PV** | 4 | 6 | 9 | 113 | 17 | 21 | 223 | 22 | 19 | 14 | 10 | 7 | 4 |
| **Total** | **71** | **6** | **114** | **113** | **52** | **23** | **268** | **22** | **22** | **14** | **10** | **7** | **4** |

*Source: Consejo Nacional de Energía, Prospectiva Energética 2019-2035*[109]

These factors have impacted the merit order and overall generation mix in El Salvador. This impact is evident at the daily level (Figure 5.1) and at the annual level (Figure 5.2).

Figure 5.1 shows the hourly demand and generation profile of an actual day in El Salvador (30 November 2022) in the "With Project" scenario compared to an alternative "Without Project" scenario, which shows what hourly dispatch would look like if EdP were not operating.

On average, El Salvador has an hourly load of 790MW, with a peak of 973MW at 7pm.[110] Generation sources dispatch according to their marginal costs based on a merit order—power plants with lower marginal costs are dispatched first until demand is met. As an exception to a purely economic merit order, geothermal is considered "must-run" in El Salvador, given its high availability and reliability, as well as the technical constraints related to ramping up and down production.

As described in Section 5.1, EdP's variable cost averaged US$93.6/MWh in its first year of operations,[111] almost half of the average marginal cost of oil generation (US$177.1/MWh[112]) in 2022 and 20 percent less than the average cost of imports (US$116.4/MWh in 2023, as of June[113]). Figure 5.1 shows how this causes the merit order to shift in the With Project scenario, with EdP displacing oil generation and imports.

[109] Consejo Nacional de Energía. "Prospectiva Energética 2019-2035," Page 35.

[110] Unidad de Transacciones, "Boletín Estadístico Anual 2022," Cuadro No. 23. https://www.ut.com.sv/anual/-/document_library/bzl1AYPUYG6R/view_file/1784178?_com_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R_redirect=https%3A%2F%2Fwww.ut.com.sv%2Fanual%2F-%2Fdocument_library%2FbzI1AYPUYG6R%2Fview%2F279981.

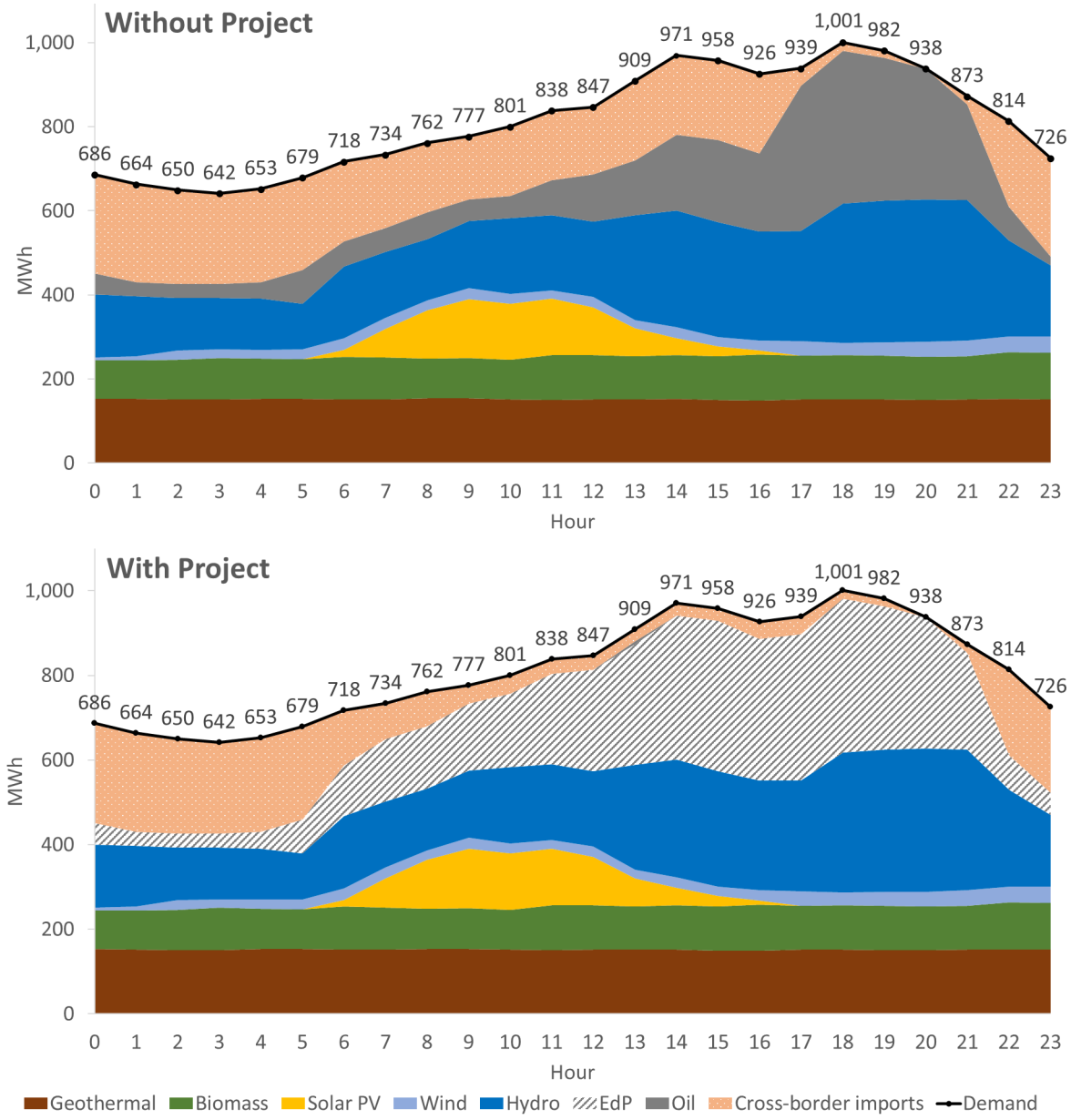
[111] Represents the average in 2022.

Communication with EdP. File named: "20230413 EDP IMPACT," 13 April 2023.

[112] Communication with EdP. File named: "20230413 EDP IMPACT," 13 April 2023.

[113] Ente Operador Regional. "Dashboard Comercial del MER 2023," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

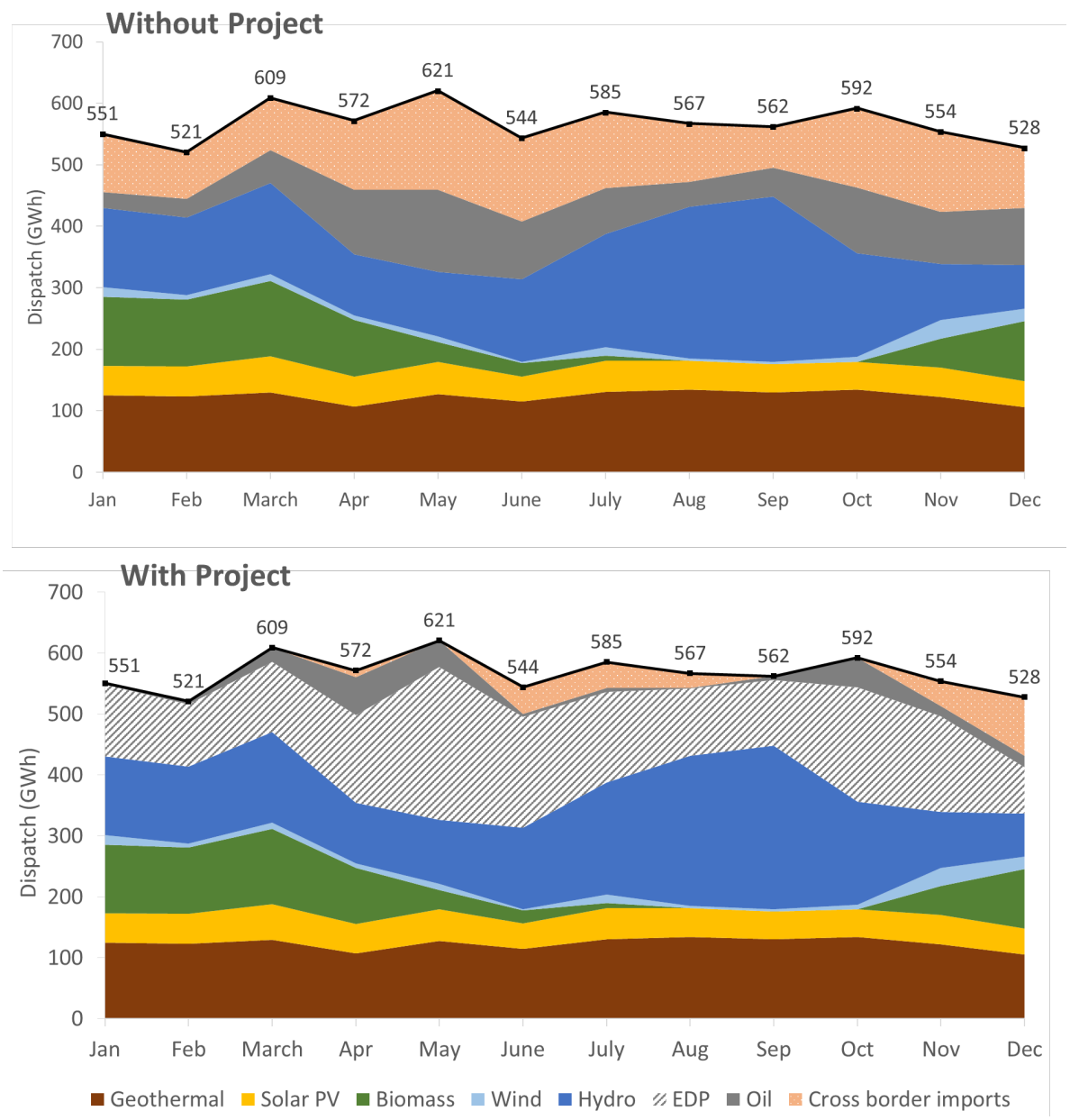
**Figure 5.1: Daily load curve, Without and With Project**




*Note: Load and dispatch vary throughout the year depending on consumption patterns and the availability of generation sources due to seasonality, which is particularly relevant for hydro and biomass in El Salvador. This figure shows only one specific day (30 November 2022) in El Salvador, but does not represent an average.*
*Source: Unidad de Transacciones;[114] EIA.[115]*

Figure 5.2 below illustrates the impact of EdP at the annual level by comparing the "With Project" and "Without Project" scenarios. EdP is expected to displace about 1,300GWh of cross-border imports and oil generation in 2023.

**Figure 5.2: Annual dispatch, Without Project and With Project**




*Note: This figure is illustrative only and does not show dispatch for any given year.*

By displacing oil generation and cross-border imports, EdP has the following impact on the sector:

[114] Unidad de Transacciones. "Boletin estadistico Anual 2022," https://www.ut.com.sv/anual/-/document_library/bzl1AYPUYG6R/view_file/1704123?_com_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R_redirect=https%3A%2F%2Fwww.ut.com.sv%2Fanual%3Fp_p_id%3Dcom_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview. Cuadro No. 4.

[115] EIA. "Capacity Factors for Utility Scale Generators Primarily Using Fossil Fuels," https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a.

- **Reduced generation costs:** The average variable cost of EdP is US$93.6/MWh,[116] 47 percent less than the average marginal cost of oil generation (US$177.1/MWh[117]) and 20 percent less than the average cost of imports (US$116.4/MWh as of June 2023[118]). EdP's levelized cost of electricity (LCOE) is 37 percent lower than the estimated LCOE for power plants running on oil—US$141.6/MWh compared to US$225.0/MWh.[119]
- **Less local pollutants emitted:** Local air pollutants, such as nitrogen oxides ($NO_x$), sulfur dioxide ($SO_2$) and particulate matter 2.5 microns in size or less (PM2.5), have negative effects on the population's health. These can cause cancer, cardiovascular disease, respiratory diseases, and reproductive, neurological, and immune system disorders.[120] On average, EdP emits 70 percent less $NO_x$, 99 percent less $SO_2$, and 95 percent less PM2.5 per MWh compared to generation from plants running on heavy fuel oil (HFO).[121]
- **Reduced greenhouse gas emissions (GHGs):** On average, EdP emits about half of the GHG emissions per MWh compared to power plants running on HFO.[122] By displacing domestic oil generation, EdP reduces GHG emissions by an average of nearly 400,000t$CO_2$e annually for the next 20 years.
- **Increased tax revenue to the Government of El Salvador:** El Salvador's corporate income tax rate, which is paid on the total amount of a company's revenues, is 30 percent.[123] Additional tax revenue is generated for the Government of El Salvador when EdP pays taxes on the revenue it earns in El Salvador that would have otherwise been paid to another Government by a foreign generator and exported to El Salvador.

## 5.3 Results of the analysis

The economic analysis shows that EdP delivers real economic benefits for El Salvador (Section 5.3.1). Over 20 years, the combination of avoided generation costs, increased tax revenue to the Government as a result of increased cross-border exports and reduced imports, and reduced local pollutants[124] generates an estimated US$5.3 billion (in present value terms) in economic benefits to El Salvador. Additionally, other infrastructure projects not directly related to EdP's operations, but developed by EdP in Acajutla, are estimated to generate between US$880,000 and US$5.3 million in net economic benefits to the local community.

EdP also creates global economic benefits by reducing GHG emissions[125] from oil generation (Section 5.3.2). An additional US$240 million (in present value terms) in global economic benefits is expected from avoided GHG emissions over the next 20 years.

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[116] Communication with EdP. File named: "20230413 EDP IMPACT," 13 April 2023.

[117] Ibid.

[118] Ente Operador Regional. "Dashboard Comercial del MER 2023," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

[119] See Appendix C for the cost assumptions used to calculate the LCOEs of thermal generation in El Salvador.

[120] National Institute of Environmental Health Science. "Air Pollution and Your Health," https://www.niehs.nih.gov/health/topics/agents/air-pollution/index.cfm.

[121] See Section 5.3.1 for the complete assumptions and results of the economic analysis.

[122] See Section 5.3.2 for the complete assumptions and results of the economic analysis.

[123] PWC. "El Salvador, Corporate – Taxes on corporate income," https://taxsummaries.pwc.com/el-salvador/corporate/taxes-on-corporate-income#:~:text=The%20corporate%20income%20tax%20(CIT,USD)%20in%20the%20fiscal%20year.

[124] Local pollutants include nitrogen oxides (NOx), sulfur dioxide ($SO_2$), and particulate matter (PM).

[125] GHGs include $CO_2$ (carbon dioxide), $CH_4$ (methane), and $N_2O$ (nitrous oxide).

The total net economic benefits resulting from EdP are forecast to exceed US$6 billion between 2022 and 2041. Net economic benefits are expressed in present value terms, assuming a social discount rate of 9 percent.[126]

### 5.3.1 Net economic benefits for El Salvador

EdP is expected to generate an estimated US$5.2 billion attributable to El Salvador through reduced costs of electricity and avoided costs of local pollutants, and increased tax revenue to the Government. Further, other investments in smaller infrastructure projects create economic benefits. These benefits and how they are quantified are described below.

*Reduced generation costs*

The cost-benefit analysis suggests that El Salvador will save US$662 million in generation costs from 2022 to 2041 by displacing oil generation and cross-border imports. EdP saved El Salvador an estimated US$86 million in 2022. In 2023 alone, EdP is expected to decrease total annual generation costs by US$110 million compared to a scenario without EdP.

From the system perspective, EdP is expected to reduce the overall cost of generation by up to 10 percent by the end of 2023. At the system level, EdP is relatively cheaper on an LCOE basis than power plants that run on HFO and bunker fuel, or cross-border imports. Comparing different generation options using the LCOE allows for a standardized metric to assess the cost-effectiveness of different technologies over plants' lifetimes. EdP's LCOE is an estimated US$141.6/MWh, 37 percent lower than the estimated LCOE for oil generation in El Salvador, about US$225.0/MWh.[127]

The variable cost of EdP and oil power plants, comprised mostly of the fuel cost, makes up about 66 percent and 79 percent of the total LCOE, respectively. Table 5.3 shows how the EdP's variable cost compares to the generation sources it will displace in El Salvador.

**Table 5.3: Average variable O&M costs**

| Generation type | Variable cost (US$/MWh) |
|---|---|
| **EdP** | 93.6 |
| **Oil** | 177.1 |
| **Cross-border imports** | 116.4 |

*Note: The values above represent averages. EdP's variable costs ranged from US$81.6/MWh to US$98.6/MWh between May 2022 and March 2023.[128] The variable cost of oil generation above is the average marginal cost for all oil-run power plants in 2022. The value above for the cost of cross-border imports is the average daily price in 2023, as of 1 June 2023.*
*Source: Unidad de Transacciones;[129] Ente Operador Regional.[130]*

[126] For simplicity, this social discount rate is applied uniformly to all generation sources in the analysis. See Box 5.1 above for an explanation of the considerations taken when applying a social discount rate.

Asian Development Bank, "Guidelines for the Economic Development of Projects," 2017. Page 52. https://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf.

[127] See Appendix C for the cost assumptions used to calculate the LCOEs of thermal generation in El Salvador.

[128] Unidad de Transacciones. "Descarga Archivos Programacion diaria 2023," https://www.ut.com.sv/programacion-diaria1.

[129] Ibid.

[130] Ente Operador Regional. "Dashboard Comercial del MER 2023," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

*Increased tax revenue for the Government*

Since EdP became operational, El Salvador has gone from being a net importer to being a net exporter (see Section 5.4.1). This change in trade flows has an impact on the Government's tax revenue as EdP pays taxes on the revenue generated in El Salvador that would have otherwise been paid to another Government by a generator in that country and exported to El Salvador.

Although it is difficult to project regional trade flows in the long-term, El Salvador is expected to earn US$171 million (in present value terms) in incremental tax benefits.[131] In the With Project scenario, the incremental tax benefit comes from taxes paid on electricity that is generated in El Salvador and exported elsewhere and taxes paid on the electricity generated domestically that would have otherwise been imported in a scenario without EdP.

*Reduced emissions of local pollutants*

Displacing generation from oil will also reduce emissions of local pollutants. Over 20 years, EdP is expected to reduce emissions of $NO_X$, $SO_2$, and particulate matter by a cumulative 432,700 metric tons compared to the scenario without EdP. The avoided cost of local air pollution amounts to about US$4.4 billion (in present value terms). Table 5.4 shows the impact EdP is projected to have on local pollutants in El Salvador over the next 20 years.

**Table 5.4: Avoided emissions of local pollutants (2022-2041)**

| Type of local pollutant | Avoided emissions (metric tons) | Avoided cost of emissions (US$ |
|---|---|---|
| **$NO_X$** | 27,5171 | 197 |
| **$SO_2$** | 391,469 | 3,556 |
| **PM2.5** | 14,024 | 599 |
| **Total** | **432,664** | **4,352** |

*Note: The avoided costs of emissions are presented in present value terms, assuming a social discount rate of 9 percent.*

Generation from oil HFO emits about 30 times more local pollutants compared to generation from natural gas. EdP emits less than one-third of the $NO_X$ per GWh compared to oil, and negligible amounts of $SO_2$ and PM2.5. Table 5.5 shows how the emissions factor of generation from natural gas and HFO compare on a per GWh basis.

[131] Companies in El Salvador pay a 30 percent corporate income tax on revenue.
PWC. "El Salvador, Corporate – Taxes on corporate income," https://taxsummaries.pwc.com/el-salvador/corporate/taxes-on-corporate-income#:~:text=The%20corporate%20income%20tax%20(CIT,USD)%20in%20the%20fiscal%20year.

**Table 5.5: Emission factors of local pollutants by type of generation**

| Type of local pollutant | Natural gas (metric ton/GWh) | Heavy fuel oil (metric ton/GWh) |
|---|---|---|
| $NO_X$ | 0.485 | 1.600 |
| $SO_2$ | 0.002 | 13.362 |
| PM2.5 | 0.026 | 0.515 |

*Source: South Carolina Department of Health and Environmental Control.*[132]

Local air pollutants have adverse effects on the environment and health of the local population exposed to them. Table 5.6 shows the social cost per metric ton of each local pollutant assessed in the analysis.

**Table 5.6: Social cost of local pollutants (2023 US$)**

| Type of local pollutant | Social cost (US$/metric ton) |
|---|---|
| NOx | 13,086 |
| $SO_2$ | 17,235 |
| PM2.5 | 80,591 |

*Note: The social cost of local pollutants depends on levels of exposure, local incomes, vulnerability, and climate. To estimate the social costs specific to El Salvador, the analysis begins with cost estimates for the European Union and adjusts them based on the value of a statistical life and income elasticity in El Salvador. Income elasticities greater than 1 are recommended when transferring the value of a statistical life from higher-income to lower-income regions.*[133, 134] *This analysis assumes an income elasticity of the value per statistical life of 1.3 to convert social costs in the European Union to El Salvador.*
*Source: IRENA;*[135] *OECD.*[136]

### 5.3.2 Global benefits

EdP is expected to reduce GHG emissions by a cumulative 7.7 million metric tons of $CO_2$ equivalent ($tCO_2e$) over the next 20 years. In the same period, the avoided cost of the externalities of GHG emissions amount to an estimated US$240 million (in present value terms). In 2023 alone, EdP is projected to displace 560,000$tCO_2e$, the equivalent of US$28.5 million by the end of the year.

[132] South Carolina Department of Health and Environmental Control. "Guidance & Emission Calculators for Air Permits – Fuel Combustion Calculator," https://scdhec.gov/environment/air-quality/guidance-emission-calculators-air-permits.

[133] Organisation for Economic Co-operation and Development. "Mortality Risk Valuation in Environment, Health and Transport Policies," https://read.oecd-ilibrary.org/environment/mortality-risk-valuation-in-environment-health-and-transport-policies_9789264130807-en#page15. Page 15.

[134] Hammitt and Robinson. "The Income Elasticity of the Value per Statistical Life: Transferring Estimates between High- and Low-Income Populations," 2011. https://www.researchgate.net/publication/227378612_The_Income_Elasticity_of_the_Value_per_Statistical_Life_Transferring_Estimates_between_High_and_Low_Income_Populations. Page 1.

[135] International Renewable Energy Agency. "The true cost of fossil fuels: Externality cost assessment methodology," 2010. https://www.irena.org/-/media/Irena/Files/REmap/IRENA_REmap_externality_methodology_2016.pdf?rev=f8f2045a8ee74e9a96144366ba73b62d&hash=574C67113520F78875BD494D218AC9C5. Page 5.

[136] Organisation for Economic Co-operation and Development. "Mortality Risk Valuation in Environment, Health and Transport Policies," https://read.oecd-ilibrary.org/environment/mortality-risk-valuation-in-environment-health-and-transport-policies_9789264130807-en#page15. Page 15.

The analysis considers the social cost of GHGs to be US$51 per metric ton of $tCO_2e$.[137] The social cost represents an estimate of the long-term economic impact associated with each unit of $tCO_2e$. Estimates of social cost can vary widely due to different methodologies adopted, assumptions, uncertainties in climate change impact and magnitude, and variations in discount rates.[138]

The analysis assesses EdP's impact on GHG emissions using a common metric of $tCO_2e$. GHGs include carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). Expected $CH_4$ and $N_2O$ emissions are converted to the equivalent amount of $CO_2$ using their global warming potential.

GHGs absorb different quantities of solar radiation (and as a result, heat) because of their differing chemical properties.[139] Global warming potential is a measure of the strength of that greenhouse gas, expressed as a factor of the strength of $CO_2$.[140] For example, methane has a global warming potential of 28, meaning that emissions of 1 million metric tons of methane are equal to 28 million metric tons of $CO_2$.[141] Nitrous oxide has a global warming potential of 265.[142]

On a per MWh basis, generation from HFO emits ($0.83tCO_2e$ per MWh) almost double the GHGs compared to generation from natural gas ($0.42tCO_2e$ per MWh), as shown in Table 5.7. Every MWh generated from EdP displaces about $0.43tCO_2e$ by displacing generation from dirtier fuels such as HFO.

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[137] The US Government issued Executive Order 13990, which included a review of the social cost of GHGs. The values arrived at in the review are used by federal agencies in the US when quantifying the cost of GHGs. The US$51 per $tCO_2e$ value used in this analysis assumes a 3 percent discount rate.

United States Government – Interagency Working Group on Social Cost of Greenhouse Gases, "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under EO 13990," https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf Page 6.

[138] Ibid.

[139] Environmental Protection Agency. "Understanding Global Warming Potentials," https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

[140] Ibid.

[141] Greenhouse Gas Protocol. "Global Warming Potential Values," https://ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf.

[142] Ibid.

**Table 5.7: Emissions factor for thermal generation in El Salvador**

| Item | Emissions factor (g/MMBtu) |
|---|---|
| ***Oil*** | |
| **Carbon dioxide ($CO_2$)** | 75,100.00 |
| **Methane ($CH_4$)** | 3.00 |
| **Nitrous oxide ($N_2O$)** | 0.60 |
| ***Natural Gas*** | |
| **Carbon dioxide ($CO_2$)** | 53,060.00 |
| **Methane ($CH_4$)** | 1.00 |
| **Nitrous oxide ($N_2O$)** | 0.10 |

*Source: EPA*[143]
*Note: The values above for oil generation represent assumptions for HFO (residual fuel oil No. 6).*

The emissions factors in the table above are calculated using the heat rates of thermal units in El Salvador. The heat rate of a thermal power plant is the amount of heat energy (measured in MMBtu) needed to produce a unit of electricity (in MWh). A lower heat rate indicates higher thermal efficiency, which translates to less fuel consumption and, thus, fewer emissions.

EdP's heat rate of 7.92MMBtu/MWh[144] allows for a thermal efficiency of 43 percent compared to an average of 30 percent for El Salvador's oil-fired power plants (11.23MMBtu/MWh).[145]

### *EdP supports El Salvador in achieving its emissions reduction targets*

El Salvador has pledged to reduce its annual energy sector emissions by 640,000t$CO_2$e by 2030 as part of its National Determined Contributions (NDCs).[146] EdP has supported the Government's goals by displacing generation from power plants running on dirtier fuel.

Since beginning operations, EdP has already displaced an estimated 440,000t$CO_2$e. Until 2025, EdP alone is expected to displace an average of 590,000t$CO_2$e annually, almost single-handedly enabling the Government to achieve its emissions reduction target for the next 3 years.

[143] Environmental Protection Agency. "GHG Emissions Factors Hub," https://www.epa.gov/system/files/documents/2023-03/ghg_emission_factors_hub.pdf.

[144] This value is from: Invenergy. "1. Lakeshore Model Reconciliation_02.23.2023_v18_(sent)."

[145] Communication with EdP. 23 May 2023.

This value represents the average heat rate of all power plants in El Salvador that run on oil. Heat rates for oil power plants in El Salvador range from 8.4MMBtu/MWh to 14.7MMBtu/MWh.

These values are consistent with data from the U.S. Energy Information Administration. "Average Operating Heat Rate for Selected Energy Sources." https://www.eia.gov/electricity/annual/html/epa_08_01.html.

[146] United Nations Development Programme. "El Salvador," https://climatepromise.undp.org/what-we-do/where-we-work/el-salvador.

### 5.3.3 Sensitivity analysis

Conducting a sensitivity analysis tests the robustness of the findings. The sensitivity analysis shows how individual cost drivers affect the benefits realized by EdP.[147] This section describes the outcomes of the sensitivity analysis on the "With Project" scenario as a base case, which yielded total net benefits from reduced generation costs of US$662 million (in present value terms over 20 years).[148]

The sensitivity analysis compares the impact of these benefits by changing one variable at a time, keeping all else equal. The analysis assesses the impact of changes in CAPEX, variable O&M cost (which reflects mostly fuel cost), fixed O&M cost (which reflects mostly fixed labor costs), and energy output from EdP on the benefits realized. Table 5.8 shows the assumptions in the base case scenario that are adjusted in the analysis and the range that is tested.

**Table 5.8: Base case assumptions in the With Project scenario**

| Assumption | Value in base case With Project scenario | Low end tested in sensitivity analysis | High end tested in sensitivity analysis |
|---|---|---|---|
| **CAPEX (US$ million)** | 628 | 502 | 754 |
| **Variable O&M cost (US$/MWh)** | 94 | 75 | 112 |
| **Fixed O&M cost (US$ million/MW-year)** | 112,900 | 90,320 | 135,480 |
| **Discount rate (%)** | 9.0 | 7.2 | 10.8 |

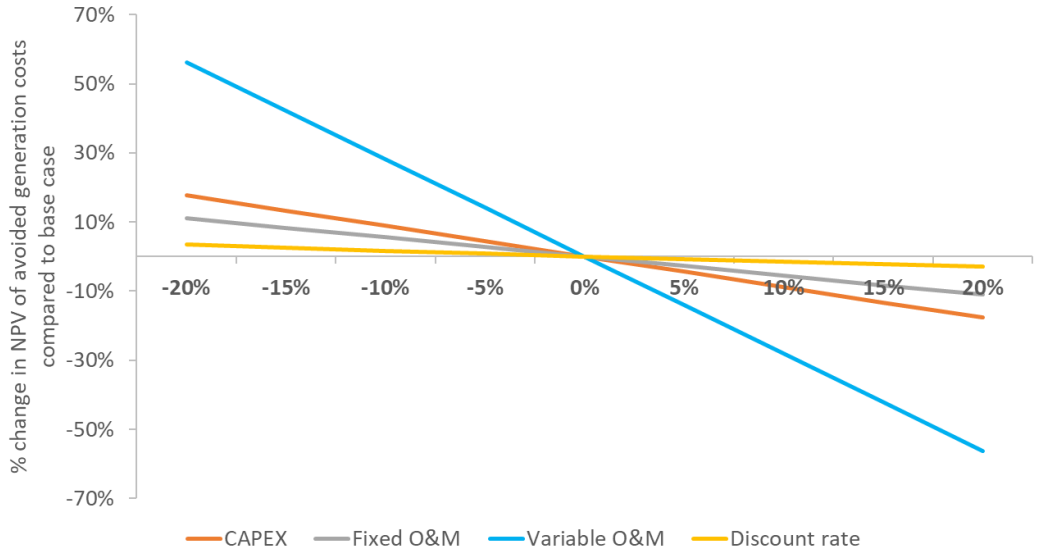
*Note: CAPEX includes costs associated with development, the power plant, marine works, interconnection, commissioning, and cargo acquisition.*
*Source: See Appendix C for a complete list of assumptions used and sources.*

Figure 5.3 shows the results of the sensitivity analysis of total net economic benefits generated by EdP. The x-axis represents the percent change in each of the variables in Table 5.8, and the y-axis represents the percent change on the result of the cost-benefit analysis compared to the base case presented in Section 5.3.1.

[147] The sensitivity analysis presented in this section is different than the scenario analysis presented in Appendix A. The scenario analysis helps us understand what would have happened in a different reality than what is the present situation, while the sensitivity analysis tests how individual variables impact the overall impact.

[148] See Section 5.3.1 for the results of the cost benefit analysis under the base case With Project scenario.

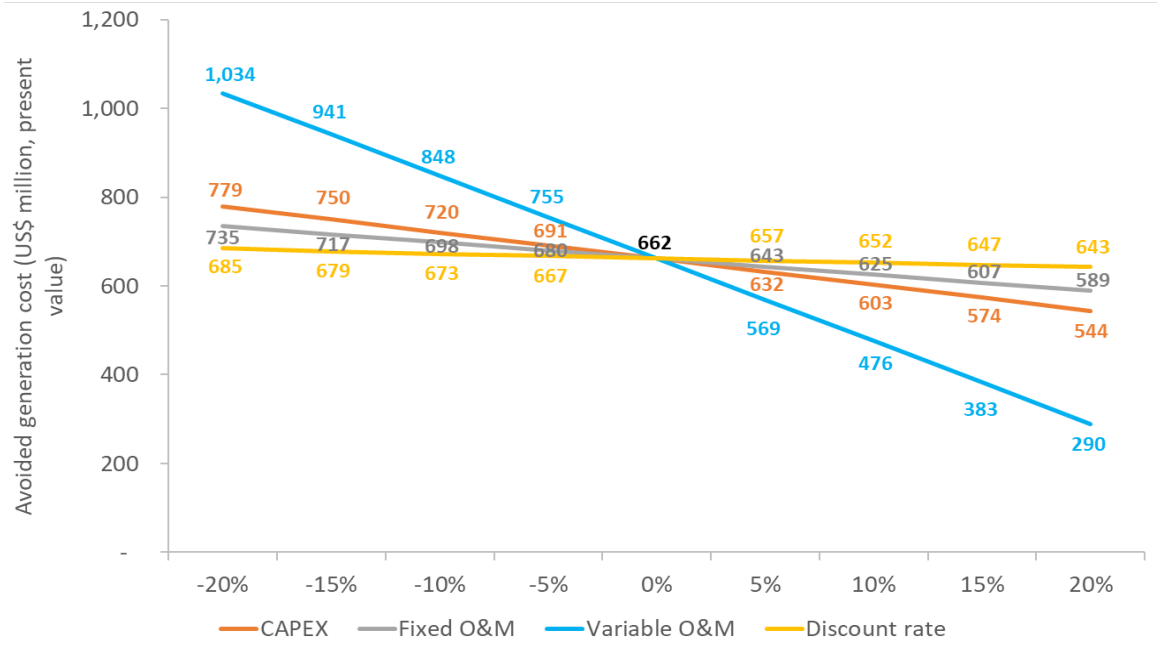
**Figure 5.3: Sensitivity analysis on reduced generation costs, measured by percent change from base case**




As shown above, avoided generation costs are most sensitive to changes in the variable O&M costs. The variable O&M costs make up approximately 66 percent of the estimated LCOE for EdP, making it a key cost driver for EdP. Changes in fuel costs could significantly alter the impact EdP has on the overall system's cost of generation. The analysis suggests that a sustained 20 percent increase in the variable O&M cost could reduce benefits by 56 percent to US$290 million (in present value terms) compared to the base case. On the other hand, even a 10 percent reduction in variable O&M costs could increase the benefits realized by 28 percent to US$848 million (in present value terms). Changes in CAPEX and fixed O&M costs have a similar effect on the impact of EdP, though to a lesser extent. Changing these variables by 20 percent reduces or increases the benefit by 18 percent and 11 percent, respectively, depending on whether costs are increasing or decreasing.

Figure 5.4 shows the sensitivity analysis as described, measured as the projected net present value (NPV) of avoided generation costs over 20 years.

**Figure 5.4: Sensitivity analysis on reduced generation costs, measured in NPV of avoided cost (2022-2041)**




## 5.4 Additional impacts of EdP

In addition to the direct, observable, and measurable impacts EdP's operations in the power sector have generated, it has also had a positive effect on other areas of El Salvador's economy and its people's lives. From reducing dependence on foreign energy sources to building institutional capacity and supporting infrastructure development in local communities, the Project has created many additional benefits, some of which cannot be quantified completely with the data available. Nonetheless, the areas described below intend to complete the picture of the total impact EdP has had on El Salvador on top of its primary activity of generating and selling power.

### 5.4.1 Energy security

EdP has improved El Salvador's energy independence by diversifying its generation mix and reducing reliance on higher cost imports.

*EdP has diversified El Salvador's generation mix and improved its energy independence*

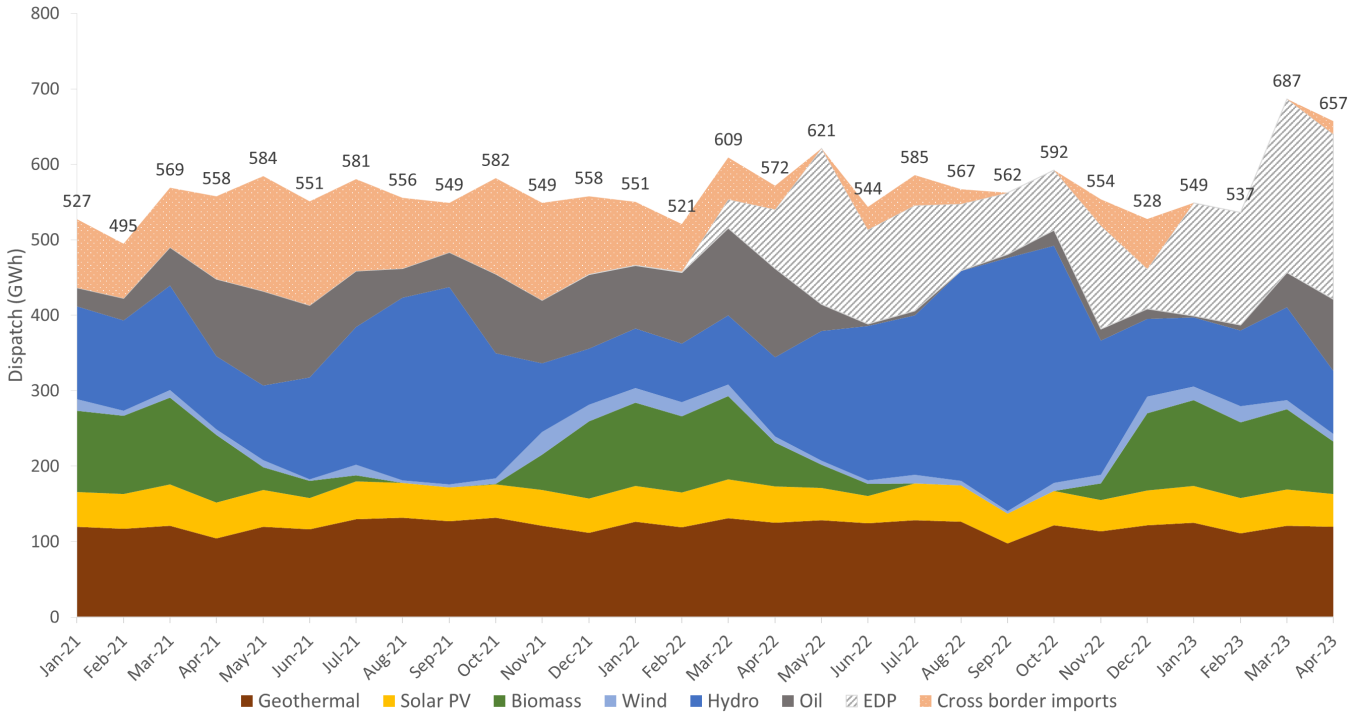
Diversifying the generation mix improves energy security by reducing dependence on a limited number of resources, mitigating price volatility, and enhancing resilience.

EdP meets 30 percent of total demand in El Salvador.[149] In its first year of operation, EdP generated 1,659GWh of electricity, accounting for roughly 24 percent of El Salvador's demand in

[149] Energía del Pacífico. https://www.energiadelpacifico.com/.

that period.[150] Figure 5.5 shows how EdP has impacted dispatch starting in May 2022 when it became operational, displacing generation from oil and imports.

**Figure 5.5: Dispatch (January 2021-April 2023)**




*Source: Unidad de Transacciones.*[151]

As the figure shows, EdP has displaced generation from oil and cross-border imports. From 2021 to 2022, the share of generation from oil and cross-border imports decreased from 13 to 7 percent and 19 to 6 percent, respectively (see Figure 5.6).

[150] The first 12 months of EdP's operations are May 2022 to April 2023.

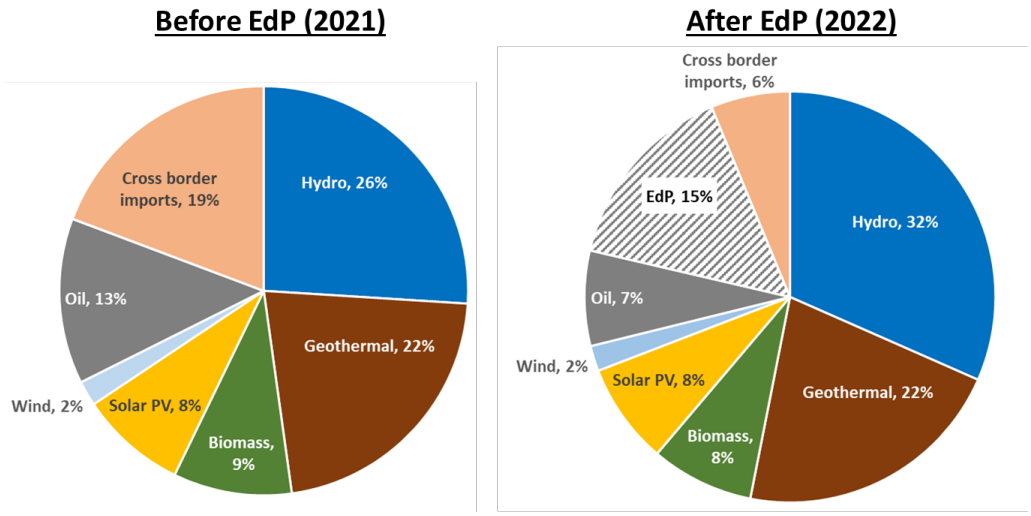
Communication with EdP. File named: "20230413 EDP IMPACT," 13 April 2023.

[151] Unidad de Transacciones. "Boletin estadistico Anual 2021," https://www.ut.com.sv/anual/-/document_library/bzl1AYPUYG6R/view_file/1364865?_com_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R_redirect=https%3A%2F%2Fwww.ut.com.sv%2Fanual%2F-%2Fdocument_library%2Fbzl1AYPUYG6R%2Fview%2F279981. Cuadro No. 3.

Unidad de Transacciones. "Boletin estadistico Anual 2022," https://www.ut.com.sv/anual/-/document_library/bzl1AYPUYG6R/view_file/1704123?_com_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYP.UYG6R_redirect=https%3A%2F%2Fwww.ut.com.sv%2Fanual%3Fp_p_id%3Dcom_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview. Cuadro No. 3.

Unidad de Transacciones. "Boletines estadisticos mensuales," https://www.ut.com.sv/estadistico-mensual/-/document_library/bzl1AYPUYG6R/view/1806738?_com_liferay_document_library_web_portlet_DLPortlet_INSTANCE_bzl1AYPUYG6R_redirect=%2Festadistico-mensual. Page 4.

**Figure 5.6: El Salvador's generation mix, before and after EdP**




*Note: EdP was only operational from May to December 2022. Therefore, the generation mix above does not reflect a full year of EdP's impact on the overall generation mix.*

### *Since EdP came online, El Salvador has become a net exporter on the regional market rather than a net importer*

As Figure 5.6 shows, 19 percent of El Salvador's electricity demand in 2021 was met by imports. El Salvador was the largest net importer of electricity in Central America[152] before EdP.[153] El Salvador became a net exporter in May 2022, going from net imports of 1,164GWh in the year before EdP became operational to net exports of 59GWh over the first year of EdP's operations.[154] Figure 5.7 shows how regional trade flows have changed since EdP came online. In addition to the impact on trade flows, the average price on the MER has slightly decreased since May 2022, going from US$97/MWh to US$96/MWh.[155]

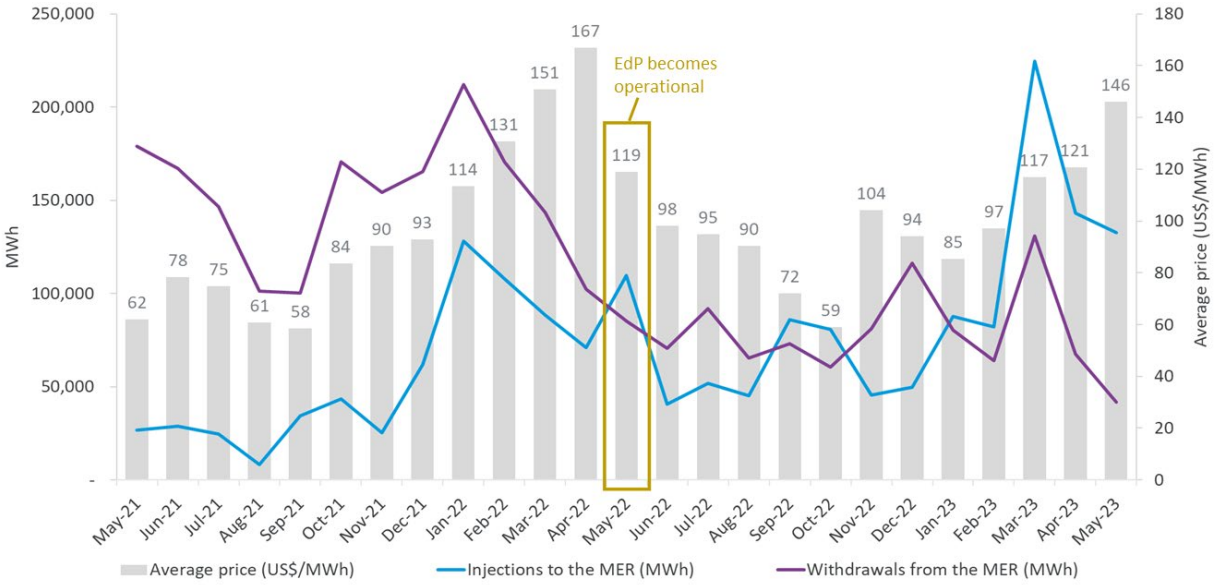
[152] International Finance Corporation. "El Salvador Powers Up to Become More Competitive," 2020. https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/impact-stories/el-salvador-powers-up#:~:text=20in%202023.

[153] Meeting with Ente Operador Regional, 16 May 2023.

[154] Ente Operador Regional. "MER Commercial Dashboard 2021- 2022 and MER Commercial Dashboard 2022-2023," 2023. https://www.enteoperador.org/dashboards/dashboard-informacion-comercial-del-mer-2022/.

[155] Ibid.

**Figure 5.7: Regional trade flows on the MER, before and after EdP**




*Source: Ente Operador Regional.*[156]

## 5.4.2 Flexibility of the system

EdP allows for greater flexibility of the system and higher levels of renewable energy in the future. EdP has a cold ramp rate of around 10 minutes and a warm ramp rate of around 5 minutes, compared to roughly 30 minutes for comparable oil-fired power plants in El Salvador.[157] EdP's high ramp rates allows it to quickly respond to fluctuations and imbalances in supply and demand, including those resulting from the intermittency of renewables such as solar and wind.[158] This flexibility in baseload generation complements Government goals to increase the uptake of renewables, particularly as it plans to invest in an additional 469MW of solar PV capacity before 2035.[159]

Further, EdP also helps to smooth out the impact of seasonality on El Salvador's generation mix, as shown in Figure 5.5. Hydropower generation fluctuates according to seasonal rainfall, with higher output occurring during the wet season from May to October and lower output occurring in the dry season of November to April.[160] Rainfall also varies by year— El Nino and La Nina events, in particular, can cause notable variations.[161] Biomass generation is fueled using agricultural crop

[156] Ente Operador Regional. "MER Commercial Dashboard 2021- 2022 and MER Commercial Dashboard 2022-2023," 2023. https://www.enteoperador.org/dashboards/dashboard-informacion-comercial-del-mer-2022/.

[157] Communication with EdP. May 18 2023.

[158] Wartsila. "Flexicycle power plants," 2019. https://www.wartsila.com/docs/default-source/energy-docs/technology-products/brochures/flexicycle-power-plants.pdf?sfvrsn=78d7f245_12. Page 4.

[159] Ibid.

[160] World Bank. "El Salvador," https://climateknowledgeportal.worldbank.org/country/el-salvador/climate-data-historical#:~:text=The%20country's%20tropical%20climate%20has,areas%20receive%20approximately%201%2C700%20mm.

[161] Food and Agriculture Organization. "El Nino to return in 2023 following a three-year La Nina phase," 2023. https://www.fao.org/3/cc5749en/cc5749en.pdf.

residues, and therefore fluctuates based on the seasonal harvesting of crops. Generation from EdP can help to adjust imbalances in production caused by seasonal changes.

These impacts are possible because of the plant's technical design. EdP uses Flexicycle technology[162] to generate electricity from 19 separate 18V50SG natural gas-powered reciprocating engines (each rated at 18.9MW) and one 28MW steam turbine powered by steam produced from the heat recovered from the engines' exhaust.[163] EdP's two-in-one technical configuration allows for faster synchronization and ramp times and more flexibility given that the individual engines can be turned on independently.[164]

### 5.4.3 Employment

During construction, EdP employed more than 2,000 people, 1,200 of which were citizens of El Salvador.[165] As of January 2023, EdP continues to employ more than 70 full-time staff to maintain operations. Of these full-time staff, 26 are local employees.[166] In addition to direct employment, EdP's development led to growth in local supply chains that EdP depends on, leading to the creation of an additional 115 permanent operations jobs in El Salvador.[167]

EdP has prioritized hiring residents of local municipalities, while residents of local departments have been given the second highest priority. Citizens and residents of El Salvador[168] were given preference over non-residents.[169] EdP also put measures in place to ensure that people who moved to the area recently in anticipation of seeking employment did not get hired before longtime residents.[170]

EdP developed a local hiring management plan to manage the process of hiring applicants based on their proximity to EdP.[171] It collaborated with local communities to ensure community members were aware of and had access to employment opportunities. It also took measures to ensure that the hiring process was simple and accessible as well, allowing applicants to send resumes via a central WhatsApp number as a PDF, Word file, or as photograph.[172]

EdP also developed plans to help demobilized construction workers secure new jobs after the Project was complete. It trained former employees on how to attract the attention of recruiters and communicate the skills gained while working at EdP. During the trainings, workers prepared professional resumes and received support to apply for a job vacancy they wanted. Over 30 demobilized workers attended these trainings.[173]

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[162] Wartsila. "Flexicycle power plants," 2019. https://www.wartsila.com/docs/default-source/energy-docs/technology-products/brochures/flexicycle-power-plants.pdf?sfvrsn=78d7f245_12. Page 3.

[163] Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 11.

[164] Meeting with Unidad de Transacciones, 17 May 2023.

[165] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 6.

[166] Invenergy. "EdP Environmental and Social Compliance Report Ago 2022 – Jan 2023," Page 214.

[167] Invenergy. "Request for Information: Development Impact Report for EdP," Page 2.

[168] Invenergy. "EdP Environmental and Social Compliance Report Q1-2020," Page 90.

[169] Ibid.

[170] Ibid.

[171] Invenergy. "EdP Environmental and Social Compliance Report Q4-2021," Page 152.

[172] Ibid.

[173] Ibid.

*EdP promoted career development opportunities for its female employees*

EdP conducted specific trainings for its female employees. These trainings were conducted to improve employment outcomes for women and to ensure they had access to skill-building workshops. Many women that started as project assistants received technical training, and were promoted to become carpenters, electricians, and machine operators.[174]

### 5.4.4 COVID-19 response

As described in Section 4, EdP had to choose between delaying the Project or investing in the health of its employees to continue construction, amongst many other choices. Its choice to continue added an additional US$1.7 million in healthcare-related costs[175] but delivered significant positive health impacts to its employees and the surrounding communities, in addition to allowing construction to complete only 4 months behind schedule.

EdP developed and implemented a COVID-19 response plan. Its efforts to contain COVID-19 helped reduce the transmission of the virus in Acajutla during construction. The Sonsonate department, which Acajutla is part of, had significantly lower confirmed daily cases of COVID-19 compared to the national average.[176,177] Between March 2020 and April 2021, the Sonsonate department recorded an average of four new confirmed cases per day, while other departments[178] in El Salvador were averaging three times as many confirmed cases per day in the same period.[179]

To maintain strict COVID-19 safety protocols, EdP:

- Followed COVID-19 Response Plans and National Public Health Measures;
- Provided personal protective equipment to safeguard workers' health;
- Implemented strict safety and preventative measures and protocols;
- Provided monitoring medical assistance for workers that tested positive;
- Promoted COVID-19 vaccination among workers; and
- Supported local companies and businesses negatively affected by COVID-19

The measures EdP took to do the above are described in more detail below.

*EdP followed national COVID-19 response plans and public health measures*

EdP enacted the following plans which complied with the national public health measures to continue construction:[180]

[174] International Finance Corporation. "Case Study: Exploring Client Approaches to Gender-Based Violence Prevention and Response, Energia del Pacifico – Acajutla LNG Project Energy, El Salvador," 2022. Page 11.

[175] These costs are associated with setting up the health clinic and providing COVID tests to workers, which cost US$450,000 and US$1.2 million, respectively.

Communication with EdP. 14 June 2023.

[176] Municipios de El Salvador. "Acajutla," 2023. https://www.municipiosdeelsalvador.com/sonsonate/acajutla.

[177] This is calculated for the period between March 2020 to April 2021. Data is only available through 22 April 2021.

Gobierno de El Salvador. "Datos Diarios de COVID 19 en El Salvador," 2021. https://covid19.gob.sv/diario/.

[178] There are 14 departments in El Salvador.

[179] Gobierno de El Salvador. "Datos Diarios de COVID 19 en El Salvador," 2021. https://covid19.gob.sv/diario/.

[180] Invenergy. "Environmental and Social Compliance and Performance Report, January – March of 2020," 2020. Page 10.

- Strategic Preparedness and Response Plan for COVID-19, which outlined the safety measures to prepare, prevent, and respond to the pandemic; [181]
- Business Continuity Management Plan for the Novel COVID-19 Outbreak, which addressed how to keep the construction and essential business functions of EdP ongoing even if several employees, contractors, and suppliers went absent;[182] and
- Business Continuity Plan during Temporary Restrictions to Contain the Novel COVID-19, which provided regulations for the transportation of workers to the construction site, working hours, and measures to prevent infections in the workplace.[183]

*EdP provided personal protective equipment for COVID-19*

EdP provided personal protective equipment for COVID-19 to workers, contractors, and staff at the Project's sites and offices. During construction, EdP gave workers facemasks, gloves, thermometers, disinfecting spray, and sanitizing wipes to avoid infections in the workplace.[184]

*EdP implemented strict safety and preventative measures and protocols*

EdP implemented social distancing guidelines and disinfection routines during construction. Workers followed strict social distancing guidelines of at least 1 square meter during transportation to the sites, construction work, lunchtime, breaks, and meetings.[185] Disinfecting routines were implemented twice a day in the offices and construction sites to ensure the workplace was clean.

EdP provided daily medical monitoring services and COVID-19 awareness training to protect the health of its workers, staff, contractors, and the local community. EdP workers were evaluated before going to construction sites and offices, which included taking their temperatures and filling out a symptom questionnaire.[186] Anyone with symptoms or a temperature of 37.5°C or above was not allowed in the workplace.[187]

EdP signed an agreement with Servicios Profesionales de Medicina to train EdP workers on the prevention of COVID-19 and the spread of infections.[188] Approximately 1,700 workers received COVID-19 awareness toolbox talks.[189] Servicios Profesionales de Medicina also conducted inspections on the construction site and offices to ensure safety in the workplace.[190]

EdP installed clinics and hired a private laboratory to perform COVID-19 tests on the worksite, prevent infections from spreading, and determine quarantine needs.[191] In June 2020, EdP began COVID-19 testing programs to prevent infections and ensure workers were healthy, while still earning a salary.[192] From October 2020 to March 2022, EdP performed PCR Tests once a week and

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[181] Invenergy. "Strategic preparedness and response plan for the novel Coronavirus (COVID-19)," 2020. Page 6.

[182] Invenergy. "Business Continuity Management Plan for the Novel COVID-19 Outbreak," 2020.

[183] Invenergy. "Business Continuity Plan during temporary restrictions to contain novel COVID-19," 2020.

[184] Ibid.

[185] Ibid.

[186] Ibid.

[187] Ibid.

[188] Invenergy. "Environmental and Social Compliance Project Report – Second Quarter 2020," 2020. Page 12.

[189] Invenergy. "Environmental and Social Compliance Project Report – Fourth Quarter 2020," 2021. Page 16.

[190] Invenergy. "Environmental and Social Compliance Project Report – Second Quarter 2020," 2020. Page 12.

[191] Invenergy. "Environmental and Social Compliance Project Report – Fourth Quarter 2020," 2021. Page 14.

[192] Invenergy. "Environmental and Social Compliance Project Report – Third Quarter 2020," 2020. Page 16.

twice a week during new waves of COVID-19,[193] delivering more than 7,000 PCR tests.[194] Additionally, EdP performed Rapid Tests daily, delivering over 200,000 rapid tests from October 2020 to March 2022.[195]

The average daily tests per capita, [196] which measures how many people have access to testing, was 2.1 percent, over five times higher than El Salvador's average of 0.04 percent between October 2020 and March 2022.[197]

*EdP provided medical assistance for workers that tested positive*

The doctors at EdP's clinics determined quarantine needs and provided medical support to the workers and staff that tested positive.[198] Medical personnel followed up daily with workers in quarantine to check that symptoms were controlled. Before returning to work, personnel conducted medical evaluations to determine whether workers were healthy and could work.[199]

*EdP promoted COVID-19 vaccination among workers*

EdP promoted COVID-19 vaccination among workers, which outpaced El Salvador's vaccination rates. EdP implemented vaccination promotion programs and campaigns at the project's sites and offices organized by EdP and El Salvador's Ministry of Health.[200]

By July 2021, 23 percent of EdP workers were vaccinated[201] and by mid-September, vaccination rates amongst EdP workers reached 97 percent.[202] Nationally, approximately 20 percent of the population was vaccinated by mid-July of 2021[203] and 49 percent by mid-September.[204]

*EdP developed the Pa'Servirle platform to support local companies and businesses negatively affected by COVID-19*

EdP partnered with the International Finance Corporation (IFC) to create Pa'Servirle, an online platform that supports local companies negatively affected by the COVID-19 lockdown.[205]

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[193] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2022," 2022. Page 23.

[194] Ibid.

[195] This number was obtained by multiplying the days in this period (543) by the average number of EdP workers per day.
Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2022," 2022. Page 23.

[196] Test per capita is calculated by dividing the total number of tests a place has given by the number of people who work/live in that place.
Nebraska Medicine. "How to calculate COVID-19 stats for your area," 2020. https://www.nebraskamed.com/COVID/how-to-calculate-covid-19-stats-for-your-area.

[197] From October 2020 to March 2022, EdP conducted approximately 15 PCR tests per day and employed approximately 700 workers per day. Over the same period, at the national-level, El Salvador conducted an average of 2,400 PCR tests per day and had a population of approximately 6.3 million.
Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2022," 2022. Page 23.
Gobierno de El Salvador. "Situación Nacional Covid-19," 2022. https://covid19.gob.sv/.

[198] Invenergy. "Environmental and Social Compliance & Performance Report – Second Quarter 2021," 2021. Page 22.

[199] Ibid.

[200] Invenergy. "Environmental and Social Compliance & Performance Report – Third Quarter 2021," 2021. Page 29.

[201] Invenergy. "Environmental and Social Compliance & Performance Report – Second Quarter 2021," 2021. Page 28.

[202] Invenergy. "Environmental and Social Compliance & Performance Report – Third Quarter 2021," 2021. Page 31.

[203] Gobierno de El Salvador. "Para ingresar a estadios, teatros, museos, parques arqueológicos, entre otros, se exigirá la doble dosis de la vacuna contra COVID-19," 2021. https://www.presidencia.gob.sv/para-ingresar-a-estadios-teatros-museos-parques-arqueologicos-entre-otros-se-exigira-la-doble-dosis-de-la-vacuna-contra-covid-19/.

[204] Gobierno de El Salvador. "El Salvador se acerca a los 7 millones de dosis de la vacuna anti-COVID-19 aplicadas," 2021. https://www.presidencia.gob.sv/el-salvador-se-acerca-a-los-7-millones-de-dosis-de-la-vacuna-anti-covid-19-aplicadas/.

[205] Invenergy. "Environmental and Social Compliance & Performance Report – First E&S Operations Report," 2022. Page 217.

Pa'Servirle is the first online platform in El Salvador that supports micro, small, and medium-sized businesses in selling their products and services in Acajutla, Sonsonate, Santo Domingo de Guzman, San Pedro de Puxtla, Apaneca, and Ahuachapán.[206] Local businesses can register for free on the platform, and buyers can access the platform freely from any mobile phone or computer.

Pa'Servirle encourages local internal commerce by connecting buyers with businesses from different municipalities. On the platform, buyers can easily access the information of registered businesses, which facilitates ordering the goods and services offered, even if the businesses are located in different municipalities.[207]

As of June 2023, Pa'Servirle works with 25 business categories ranging from restaurants, bookstores, supermarkets, veterinaries, and clothing stores, and has 117 registered businesses.[208]

### 5.4.5 Infrastructure development

As part of its agreement to support communities surrounding the Project, EdP has invested more than US$3.5 million in local infrastructure projects that have benefited more than 20,000 people.[209] Over the next 12 years, EdP has committed to investing US$532,000 per year in similar projects across the municipality.[210] The process for selecting and funding these programs is set out in the "Social investment agreement" between EdP, the Municipal City Hall of Acajutla, and the Social Investment Fund for Local Development.[211,212]

*EdP improved school infrastructure in Acajutla*

EdP aims to reduce the number of school dropouts caused by inadequate and deteriorated infrastructure in schools.[213] To date, EdP has improved and repaired the infrastructure of seven schools in Acajutla, which currently benefits over 2,600 students and will continue to benefit future students. Between 2021 and 2023, EdP invested over US$1.3 million in these projects,[214] which are described in Table 5.9 below.

**Table 5.9: Schools that benefited from EdP's infrastructure development projects**

| Name of school | Description | Number of students affected | Progress of project |
|---|---|---|---|
| **Centro Escolar Julian Vazquez Rojas** | Replaced roofs, built new infrastructure, improved electrical systems, and repaired drinking water and sewage pipes | 547 | 70% |

[206] EdP. "Pa'Servirle," 2023. https://pa-servirle.com/#/weare.

[207] Ibid.

[208] Ibid.

[209] EdP. "Clean, Safe and Sustainable Energy to El Salvador," 2022. Slide 17.

[210] The "Social Investment Agreement" was signed in 2015 and is valid for 20 years.

Invenergy. "Technical Cooperation Agreement Between The Municipality of Acajutla, The Social Investment Fund for Local Development (FISDL) and Energia Del Pacifico S.A de C.V (EDP)," 2015. Page 6.

[211] Invenergy. "Technical Cooperation Agreement Between The Municipality of Acajutla, The Social Investment Fund for Local Development (FISDL) and Energia Del Pacifico S.A de C.V (EDP)," 2015. Page 1.

[212] Meetings with the Municipality of Acajutla and the Ministry of Education, 16 and 18 May 2023.

[213] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2022," 2022. Page 220.

[214] Invenergy. "Environmental and Social Compliance & Performance Report – Semiannual 2023," 2023. Page 239-240.

| Name of school | Description | Number of students affected | Progress of project |
|---|---|---|---|
| **Instituto Nacional De Acajutla** | Built and equipped new classrooms and a library, improved workshops, and installed a new electrical system | 501 | 70% |
| **Complejo Educativo Fe y Alegria Los Laureles** | Renovated classrooms, repaired damaged infrastructure, and installed a new electrical system | 680 | 100% |
| **Centro Escolar Barrio del Campamento Fe y Alegria** | Replaced roofs and floors, improved electrical system, and reconstructed walls and kitchen area | 262 | 97% |
| **Lizandro Larin Zepeda** | Replaced roofs, remodeled bathrooms and kitchen area, replaced the water pump, and repaired damaged infrastructure | 433 | 5% |
| **Escuela De Educación Especial de Acajutla** | Replaced roofs and floors, installed a new electrical system, and repaired bathrooms for children with special abilities | 24 | Began January 2023 |
| **Centro Escolar Canton La Coquera** | Repaired drainage system, replaced roofs, installed a new electrical system, and remodeled bathrooms | 165 | Began January 2023 |

*Source: Invenergy*[215]

In addition to investing in physical infrastructure, EdP has funded educational programs and workshops to promote children's education, rights, and health. As part of a program to encourage reading and strengthen students' capacities in Acajutla, EdP equipped libraries in the seven schools above.[216] EdP also developed sensory gardens in two special education schools to stimulate learning.[217]

### *EdP improved the condition of roads in Acajutla*

The community of Acajutla will benefit from improvements to roads. Paving roads reduces dust, noise, and vehicle operating costs, and allows for safer travel. Additionally, because these are free access roads, which by nature are non-excludable, everyone who uses them will benefit from the improvements, even people from outside the community of Acajutla. EdP's road improvement projects include works to:

- Pave the Benigno Carrera Street, RASA Street, and Main Street in Acajutla with concrete surfaces;[218,219]
- Repair the street from the Lisandro Larin Zepada School Center to the Pedro de Alvarado Avenue;[220] and

[215] Invenergy. "Environmental and Social Compliance & Performance Report – Semiannual 2023," 2023. Page 239-240.

[216] Invenergy. "Environmental and Social Compliance & Performance Report – First E&S Operations Report," 2022. Page 215.

[217] Invenergy. "Environmental and Social Compliance & Performance Report – Semiannual 2023," 2023. Page 239.

[218] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2020," 2020. Page 104.

[219] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2021," 2021. Page 182.

[220] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2020," 2020. Page 108.

- Improve the lighting of the Boulevard 25 de Febrero by installing luminaires, constructing rest areas, and painting the obelisk.[221]

*EdP built new power lines to provide electricity to areas previously not connected to the grid*

EdP constructed new power lines in rural areas to connect people to the grid that had not had a connection previously. New connections were made to approximately 80 households to benefit around 290 people in the local community.[222]

It is widely accepted that electrical grid access, or access to electricity when no prior access was available, brings positive economic results to communities. The quantum of the benefits people receive from this new access varies depending on several demographic and socioeconomic factors. There is consensus, though, that providing this access generates positive but moderate outcomes.[223] For each individual that gains access to electricity, there is an expected increase in their educational attainment, household welfare, and health levels, all else equal. The expected benefits for people receiving access to electricity are described below, with each additional connection having the following per person impact:[224]

- Educational attainment increases by approximately 0.06 standard deviations.[225,226] The impact of electricity access on educational improvements measures the average effect in the following sub-categories: higher enrollment in school, study time, grade progression, years of schooling, and literacy rates.[227]
- Household welfare increases by approximately 0.04 standard deviations.[228,229] The impact of electricity access on household welfare measures the average effect in the following

[221] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2020," 2020. Page 107.

[222] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2020," 2020. Page 104-108.

[223] Asian Development Bank and International Initiative for Impact Evaluation. "Effects of Access to Electricity Interventions on Socioeconomic Outcomes in Low- and Middle-Income Countries," 2020. https://www.adb.org/sites/default/files/evaluation-document/515326/files/in242-20.pdf Page 29.

[224] The source compiles and analyzes 126 comprehensive studies in over 50 countries and includes the study of the effects of electrification in El Salvador. To be able to calculate the total benefits requires data that is not available, but the general benefits are given in the bullets that follow.

Asian Development Bank and International Initiative for Impact Evaluation. "Effects of Access to Electricity Interventions on Socioeconomic Outcomes in Low- and Middle-Income Countries," 2020. https://www.adb.org/sites/default/files/evaluation-document/515326/files/in242-20.pdf

[225] A random effects model is used to calculate standardized effect sizes, which is used to assess changes to socioeconomic welfare, on average. The standardized mean difference, which quantifies the size of an effect of an intervention relative to the variability observed in that country. The standardized mean difference is interpreted as the change in a certain type of outcome attributable to the intervention (in this case, access to electricity), measured in the terms of standard deviation.

Asian Development Bank and International Initiative for Impact Evaluation. "Effects of Access to Electricity Interventions on Socioeconomic Outcomes in Low- and Middle-Income Countries," 2020. https://www.adb.org/sites/default/files/evaluation-document/515326/files/in242-20.pdf Pages 12-14.

[226] Asian Development Bank and International Initiative for Impact Evaluation. "Effects of Access to Electricity Interventions on Socioeconomic Outcomes in Low- and Middle-Income Countries," 2020. Page 29.

[227] Ibid, page 24.

[228] The standardized mean difference is interpreted as the change in household welfare attributable to the electricity access, measured in terms of standard deviations.

Asian Development Bank and International Initiative for Impact Evaluation. "Effects of Access to Electricity Interventions on Socioeconomic Outcomes in Low- and Middle-Income Countries," 2020. Page 14.

[229] Ibid, page 29.

sub-categories: household assets, consumption, poverty levels, income, and source of employment.[230]

- Health levels increase by approximately 0.10 standard deviations.[231,232] The impact of electricity access on health levels measures the average effect in the following sub-categories: the use of contraceptives and the social benefit from lower fertility, access to health information, and positive health outcomes, including increased life expectancy and decreased mortality rates.[233]
- Positive environmental outcomes increase by approximately 0.03 standard deviations[234] due to reduced use of other energy sources such as kerosene and wood fire.[235]

Table 5.10 lists the communities to which EdP provided new electricity connections.

**Table 5.10: EdP's electrification projects in Acajutla**

| Community | Project description | Number of beneficiaries | Investment (US$) |
|---|---|---|---|
| **Caserío Los Abetos, Cantón El Suncita** | Construction of a medium and low-voltage electricity grid for the electrification of Los Abetos community. The electrical installation was 400 meters long | 86* | 30,945 |
| **Caserío Miramar, Cantón Metalío** | Construction of a medium and low-voltage electricity grid for the electrification of the Miramar community. The electrical installation was 560 meters long. | 65* | 48,550 |
| **Caserío El Porvenir, Cantón Metalío** | Construction of a medium and low-voltage electricity grid for the electrification of El Porvenir community. The electrical installation was 1,950 meters long. | 135 | 46,665 |

**Note: The beneficiaries for certain projects were counted as households. For these projects, the values above assume there are 3.6 beneficiaries per household.*
*In El Salvador, a Caserío is a village or rural settlement.*
*Source: Invenergy[236] Data on average household size in El Salvador: ArcGIS.[237]*

### *EdP improved other public infrastructure*

EdP constructed other public health infrastructure, community centers, and the local municipal market to contribute to the well-being of the local community. EdP constructed a sewage system

[230] Ibid, page 25.

[231] The standardized mean difference is interpreted as the change in health levels attributable to the electricity access, measured in terms of standard deviations.

Ibid, page 14.

[232] Ibid, page 29.

[233] Ibid, page 27.

[234] The standardized mean difference is interpreted as the change in positive environmental outcomes attributable to the electricity access, measured in terms of standard deviations.

Ibid, page 14.

[235] Ibid, page 28-29.

[236] Communication with EdP. File named: "Sistematización Proyectos Sociales – EDP," 30 May 2023.

[237] ArcGIS. "Average Household Size in El Salvador," 2021. https://www.arcgis.com/home/item.html?id=9777a96fa9d14e56b2e6f47a1734829f#!#:~:text=This%20map%20shows%20the%20average%20household%20size%20in,by%20dividing%20the%20household%20population%20by%20total%20households.

and wastewater treatment plant in Cantón Metalío.[238] The sewage network was 1,000 meters long and benefitted over 5,000 inhabitants, which previously did not have a connection to piped-sewerage.[239]

Interventions in the water and sanitation sector are cost-beneficial in all developing world sub-regions.[240] Providing access to improved sanitation or water sources through piped water and sewer connections yields a return between US$2 and US$12 per US$1 invested.[241] The direct economic benefits of these water and sanitation interventions are the avoided costs of water borne diseases, including the costs of treating the diseases, transport costs to health services, the opportunity costs of time, and other expenses.[242] For the types of interventions EdP has funded in El Salvador, the expected economic return on investment is expected to deliver between US$880,000 and US$5.3 million in net benefits.[243]

Additionally, EdP constructed the Colonia IVU Community Center, improved the conditions of the basketball court of the COED Metalío by adding a roof and a perimeter wall, and reconstructed the Casa Capricho Professional Training Center, among other community center and local market improvements.[244,245]

### 5.4.6 Social programs

In addition to the infrastructure that supports EdP's operations, EdP has also funded social programs that include trainings, workshops, and strategies on topics such as:

- Gender-based violence prevention and elimination;
- Acajutla violence prevention;
- Support to local companies and businesses negatively affected by COVID-19; and
- Enhancing professional skills of the population.

The benefits of these social programs are summarized in more detail below.

*EdP raises awareness about gender-based violence prevention*

A strong "culture of male privilege" often affects the safety and rights of women in El Salvador.[246] Despite alarming statistics, many people in the country do not see gender-based violence as a significant problem. Around 67 percent of women in El Salvador experienced violence in their lifetime, and only 6 percent reported incidents of violence.[247]

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[238] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2020," 15 April 2020. Page 107.

[239] Communication with EdP. File named: "Sistematización Proyectos Sociales – EDP," 30 May 2023.

[240] Journal of Water and Health. "Global cost-benefit analysis of water supply and sanitation interventions," 2007. Page 481.

[241] Journal of Water and Health. "Global cost-benefit analysis of water supply and sanitation interventions," 2007. Page 495.

[242] Journal of Water and Health. "Global cost-benefit analysis of water supply and sanitation interventions," 2007. Page 485.

[243] This was calculated by multiplying EdP's investment to construct the sewage system and wastewater treatment plant (US$442,202) by the smallest (US$2) and largest (US$12) values of the return of investment range.

[244] Invenergy. "Acta de Proyectos 2015-2016," 2019. Page 1.

[245] Ibid.

[246] International Finance Corporation. "Case Study: Exploring Client Approaches to Gender-Based Violence Prevention and Response, Energia del Pacifico – Acajutla LNG Project Energy, El Salvador," 2022. Pages 3-5.

[247] Ibid.

EdP implemented a "Gender-based Violence Risk Management Plan" to prevent and respond to all acts of gender-based violence. Over 700 EdP staff and contractors were trained to identify signs of violence and help stop gender-based violence incidents on time.[248]

Additionally, EdP has also worked with partners to raise awareness of gender-based violence by:

- Working with the United National Development Programme (UNDP) and UN Women to commemorate "International Women's Day" and "International Day of Elimination of Violence against Women." Together, EdP and UNDP hosted plays and events to give information about organizations and hotlines that can help women who experience violence.[249] The plays and events reached more than 15 communities in Acajutla.[250]
- Developing the book "Structural Violence Against Women, because they are women," with the help of a local Salvadoran company specializing in educational materials. The book explains the inequality and violence women face.[251] EdP delivered 1,500 copies of this book to staff completing the gender-based violence training and to the local community.[252]
- Supporting the Government's "Ciudad Mujer Comunitaria Program."[253] This Program offers training on economic autonomy and health for women.[254] Women also get free clinical examinations and services, including breast cancer screenings and mammography exams.[255] EdP supported modules for over 150 women and helped transport over 40 women from their local communities to clinics for medical examinations.[256]

*EdP helps prevent violence in Acajutla*

EdP collaborated with the Municipal Committee for the Prevention of Violence (CMPV) in Acajutla to implement activities, workshops, and trainings to help prevent violence in the community.[257] EdP donated funds and met with representatives from over 11 local communities to advance the Committee's Strategic Plan, which aims to fight organized crime, gender-based violence, property crimes, and crimes against Salvadoran people.[258] Following the Committee's recommendation, EdP invested in building perimeter walls around the schools mentioned in Table 5.9 because they are in areas that have high crime rates.[259]

[248] International Finance Corporation. "Case Study: Exploring Client Approaches to Gender-Based Violence Prevention and Response, Energia del Pacifico – Acajutla LNG Project Energy, El Salvador," 2022. Page 11.

[249] International Finance Corporation. "Case Study: Exploring Client Approaches to Gender-Based Violence Prevention and Response, Energia del Pacifico – Acajutla LNG Project Energy, El Salvador," 2022. Page 8.

[250] Ibid.

[251] Invenergy. "Environmental and Social Compliance & Performance Report – Second Quarter 2021," 2021. Pages 213-214.

[252] Ibid.

[253] Invenergy. "Environmental and Social Compliance & Performance Report – First E&S Operations Report," 2022. Page 201.

[254] Invenergy. "Environmental and Social Compliance & Performance Report – First E&S Operations Report," 2022. Page 203.

[255] Invenergy. "Environmental and Social Compliance & Performance Report – First E&S Operations Report," 2022. Page 204.

[256] Invenergy. "Environmental and Social Compliance & Performance Report – Semiannual 2023," 2023. Page 232.

[257] Invenergy. "Environmental and Social Compliance & Performance Report – First Quarter 2020," 2020. Page 99.

[258] Invenergy. "Environmental and Social Compliance & Performance Report – Third Quarter 2020," 2020. Page 128.

[259] Invenergy. "Proyectos Sociales – Propuesta de Inversión para el Periodo 2021-2022," 2022. Page 7.

*EdP provides job training for youth*

EdP partnered with the Fundacion Callejas[260] to implement the "Youth in Progress" program in November and December of 2020 to prepare the young population in Acajutla for future work opportunities.[261] This Program provides training to strengthen:

- Soft skills to perform in the commerce sector;
- Technical skills to work in the trade sector; and
- Practical experience in the hiring process.[262]

Approximately 30 young adults from 10 different communities received this training. Of these people, over 70 percent of the participants are already employed, as of February 2023.[263]

EdP also implemented an employability program to help deliver specialized training to local workers to be hired at the Salvadoran supermarket chain "Super Selectos."[264] 30 people went through the program, made up of mostly former employees from EdP's construction and relatives of current and past employees.[265]

### 5.4.7 Institutional capacity building

Prior to EdP, El Salvador had limited experience with privately financed infrastructure projects of the scale of EdP. Given the absence of similar projects, stakeholders had little experience or capacity to negotiate contracts, facilitate inter-sector coordination, communicate impacts, and deliver on its commitments. Throughout the development process, Invenergy and EdP staff worked closely with the authorities of the Salvadoran Government to help accelerate the permitting, authorization, and concession processes, all while adhering to the Law and complying with all regulations.[266]

EdP and the Organismo Promotor de Exportaciones e Inversiones (PROESA) determined and formalized a clear process to navigate the regulatory, legal, and permitting frameworks for EdP.[267] This process facilitated inter-sector coordination between different Government entities and helped integrate a more streamlined approach to permitting.[268] To strengthen institutional coordination and development, EdP and PROESA:

- Identified what was needed to create inter-sector coordination to get the permits required for the construction, delivery, and operation of EdP;[269]

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[260] Fundacion Callejas is a non-profit organization focused on promoting sustainable social development in El Salvador through investment in education, health, and the environment.

Fundacion Callejas. "What we do," 2023. https://www.fundacioncalleja.org/.

[261] Invenergy. "EDP Environmental and Social Compliance Report Ago2022 – Jan 2023," 2023. Page 232.

[262] Invenergy. "EDP Environmental and Social Compliance Report Ago2022 – Jan 2023," 2023. Page 233.

[263] Ibid.

[264] Invenergy. "06. Labor Overview," 2022. Slide 25.

[265] Ibid.

[266] Communication with EdP. 23 May 2023.

[267] Ibid.

[268] Ibid.

[269] Meeting with PROESA, 16 May 2023.

- Created a clear roadmap for future complex infrastructure projects in the county;[270]
- Simplified the permitting process, and reduced bureaucracy without compromising transparency and control of the project;[271]
- Introduced a process that included a list of responsible entities, the licenses and permits required, and the timelines and steps to permitting and authorization procedures for investment and construction works in El Salvador.[272]

In the future, this can help reduce transaction costs and simplify approval processes for large and complex infrastructure projects.[273]

### 5.4.8 Environmental measures

In response to the ESIAs, EdP has committed to funding approximately US$5.3 million in mitigation, prevention, compensation, and monitoring measures to make up for the unavoidable environmental and social impacts caused by the Project.[274,275] This funding has contributed to:

- Reforestation campaigns;[276]
- Installation of artificial reefs;[277]
- Terrestrial fauna relocation, compensation, and monitoring for the construction and operations stages of the power plant and the transmission line;[278]
- Marine biodiversity evaluation and monitoring for the pre-construction, construction, and operations stages of the power plant;[279]
- Installation of a marine and terrestrial fauna rescue center;
- Compensation measures for fishermen in the Acajutla Port;
- Measures to monitor air quality and emissions;
- Measures to monitor effluents, the infiltration of rainwater, and the plant's use of underground water resources; and
- Measures to prevent collisions of birds and bats with transmission cables.[280]

While many of these projects were executed to abate impacts, they will continue to deliver benefits into the future. Table 2.2 contains a complete list of EdP's environmental and social compensation activities. In addition to the environmental activities described in Table 2.2, EdP

[270] Meeting with the Ministry of Environment and Natural Resources, 16 May 2023.

[271] Meeting with the Ministry of Economy, 16 May 2023.

[272] Ibid.

[273] Meeting with Organismo Promotor de Exportaciones e Inversiones de El Salvador (PROESA), 16 May 2023.

[274] Invenergy. "Environmental plan Transmission Line," 2019.

[275] Invenergy. "Environmental plan Power Plant," 2019.

[276] EdP. "Campana de Reforestación de Escuelas, Proyecto: Energía del Pacifico (EDP)," Page 1.

[277] Invenergy. "Environmental and Social Compliance & Performance Report – Semiannual 2023," 2023. Page 210.

[278] Invenergy. "EDP-ESMS-PL-014 Terrestrial and biodiversity evaluation and monitoring plan updated," 2020. Page 1.

[279] Invenergy. "EDP-ESMS-PLN-022 Marine biodiversity evaluation and monitoring program Rev A clean Rev MM," 2019. Page 1.

[280] Communication with EdP. File named: "Actividades ambientales Castalia Power Plant 2023," 12 June 2023.
Communication with EdP. File named: "Actividades ambientales TL Castalia," 12 June 2023.

developed and implemented environmental and social management plans to address the negative environmental and social impacts of the Project.[281] Table 5.11 describes these plans.

**Table 5.11: EdP's environmental and social plans**

| Plan | Purpose |
|---|---|
| **Air quality management** | ▪ Reduction in emissions<br>▪ Dust management<br>▪ Control the quality of air near power lines |
| **Noise, vibration, and light management** | ▪ Noise management during construction<br>▪ Reduction of noise in marine terminal<br>▪ Lighting the marine terminal and the dock<br>▪ Monitor noise<br>▪ Control noise and vibrations |
| **Erosion, sedimentation, and soil quality management** | ▪ Soil and rainwater management during construction<br>▪ Establish measures for disposal sites of dredged material<br>▪ Control erosion and sedimentation |
| **Biodiversity management** | ▪ Relocate fauna<br>▪ Reforestation campaigns and support to the Fondo de Inversion Ambiental de El Salvador<br>▪ Reduce interaction with fauna<br>▪ Manage turbidity levels and biomonitoring oysters<br>▪ Reduce impact on marine habitat<br>▪ Replant fields across Acajutla<br>▪ Biotic monitoring |
| **Social** | ▪ Compensation measures for fishermen in the Acajutla Port<br>▪ Implement a fortuitous findings plan |
| **Water management** | ▪ Monitor effluents |

*Source: Invenergy*[282]

### 5.4.9 Demonstration effects

EdP's continuing success verifies that El Salvador can develop, manage, and pay for large-scale privately financed infrastructure. The financing, construction and operation of an infrastructure project with the complexity of EdP creates significant demonstration effects not only in El Salvador, but regionally. Demonstration effects are important because they create benefits by demonstrating that a project or intervention works in practice, catalyzing investment for projects that the market previously perceived to be too risky. In the context of infrastructure projects, demonstration effects occur when a project demonstrates that a technology, country, or investment can provide an adequate rate of return to investors when the market previously

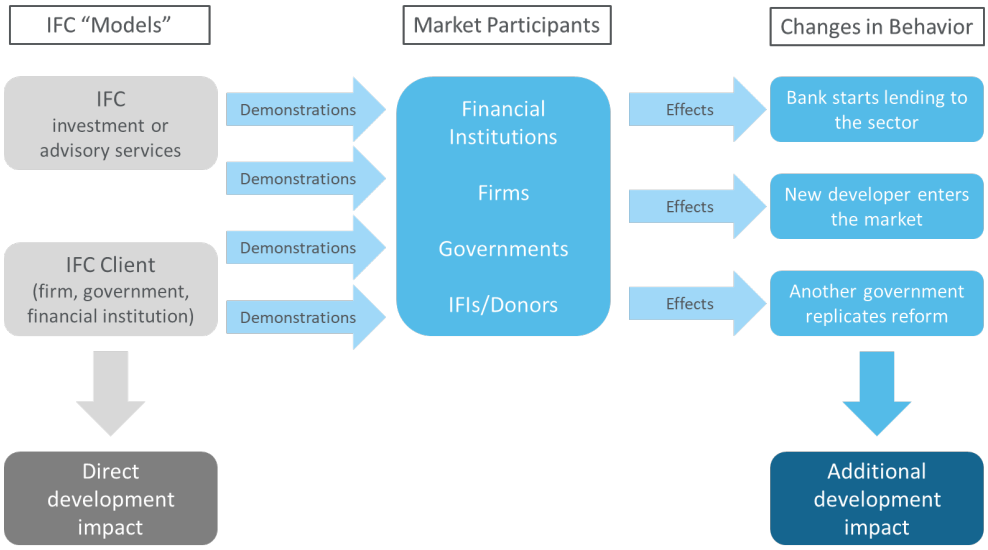
[281] Invenergy. "EDP=ESMS=MAN Environmental and Social Management System Manual," 2020.

[282] Invenergy. "EDP-ESMS-MAN Environmental and Social Management System Manual," 2020. Pages 36-38.

doubted its ability to do so.[283] EdP's demonstration effects have the potential to catalyze additional investment in El Salvador and the region. It is the first LNG terminal on the Pacific coast of Central America,[284] and represents the largest foreign direct investment in El Salvador.[285]

Given EdP's success, it is reasonable to expect that the cost of capital for similar projects will decrease in the future, as will total transaction costs. IFC, in studying its own impact, illustrated demonstration effects with the visual in Figure 5.8. For El Salvador's market for large-scale IPPs, EdP has taken the risk role illustrated for IFC, proving the viability of projects of this scale.

**Figure 5.8: How IFC illustrates demonstration effects**




*Source: Adapted from International Finance Corporation, IFC Demonstration Effects Study.*[286]

[283] Private Infrastructure Development Group. "Results Monitoring Handbook," April 2019. https://dev.pidg.org/wp-content/uploads/2019/04/RM-Handbook-April-2019-final.pdf Page 26.

[284] EdP. "Request for Information: Development Impact Report for EdP," 2022. Page 1.

[285] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 1.

[286] International Finance Corporation. "IFC Demonstration Effects Study," 2013.https://cica.net/wp-content/uploads/2015/06/IFC-Africa-Evaluation-Final-Report.pdf. Page 22.

# Appendix A: Scenario analysis

As discussed, COVID-19 created major challenges for EdP and its partners during its development. Given these challenges, the Project could have declared force majeure and delayed EdP for a prolonged period of time. Instead, Invenergy and its partners bore additional costs to deliver EdP in as timely a manner as possible, completing the project only 4 months behind schedule.[287]

Had the decision to delay the project been made, the economic benefits realized by the project would have been reduced for two reasons:

- Disruptions in supply chains and the war in Ukraine caused real cost increases that would have reduced the size of the cost savings realized by EdP. Evidence of these real cost increases in supplies and labor are described below; and
- Delays in the project would have reduced the economic benefit realized by the project, as El Salvador would have continued bearing the cost of oil generation, rather than from natural gas.

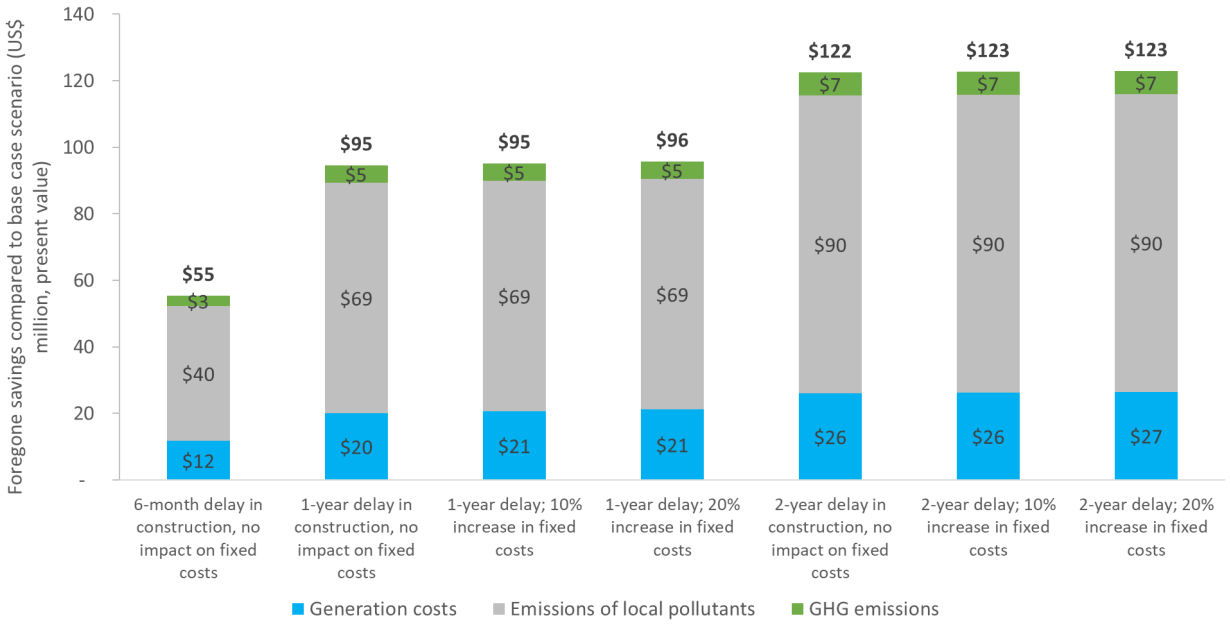
The scenario analysis in this section quantifies the reduction in benefits had these alternative futures materialized by considering seven alternative outcomes related to timing and impact on costs in real terms:

- 6-month delay in construction, no impact on costs;
- 1-year delay in construction, no impact on costs;
- 1-year delay in construction and 10 percent increase in costs;
- 1-year delay in construction and 20 percent increase in costs;
- 2-year delay in construction, no impact on costs;
- 2-year delay in construction and 10 percent increase in costs; and
- 2-year delay in construction and 20 percent increase in costs.

The results of the scenario analysis (see Figure A.1) demonstrate what the foregone savings would have been had the alternatives occurred instead. These foregone savings are calculated by comparing the scenarios with the With Project base case.

[287] Invenergy. "EDP White Paper (WH draft) 2 23 2023(198099093.1)," 2023. Page 3.

**Figure A.1: Results of the scenario analysis**




*Note: All scenarios above reflect an alternative reality in comparison to actual COD and costs (in real terms) associated with construction supplies, equipment, and fixed labor.*

This analysis assumes EdP claimed force majeure and exceeded the 6-month commercial operation date (COD) window provided for in the contract. As shown in the figure, a 1-year delay in COD would have cost El Salvador about US$95 million (in present value terms) in foregone savings, realized as the sum of avoided generation costs and emissions of local pollutants and GHGs. Had construction halted completely with the Project experiencing a 2-year delay, those foregone savings would have increased to about US$120 million. Even just a further 6-month delay, which would have pushed back COD to December 2022, El Salvador would have foregone roughly US$55 million in savings. Based on these results, a 1 to 2-year delay means the additional costs of nearly US$60 million to continue construction through the pandemic yielded a benefit-to-cost ratio of between 1.58 and 2.05, depending on the length of the delay.

These assumptions about cost changes are based on real price quotes from EdP's suppliers and subcontractors (see Table A.1). Conservative estimates suggest that EdP would have faced almost US$100 million in higher costs had construction paused until after the pandemic (defined as Q4 of 2022). The price of raw materials experienced the most significant price increases, ranging from 33 percent to 69 percent between Q1 2020 and Q4 2022/Q1 2023. Other equipment and labor costs also increased roughly 20 percent in the same period.

**Table A.1: Price comparison in raw materials, local labor, and equipment**

| Type | Quantity | Unit | Unit price before project construction (2020) | Unit price of Q4 2022/Q1 2023 | Delta (% difference) | Price difference (US$) |
|---|---|---|---|---|---|---|
| *Raw materials* | | | | | | |
| **Steel – power plant** | 15,987.52 | Tons | 550 | 927.05 | 68.6 | 6,028,093 |
| **Steel – lattice towers/substations** | 1,960.59 | Tons | 550 | 927.05 | 68.6 | 739,240 |
| **Steel – PLET and PLR** | 1,028.92 | Tons | 550 | 927.05 | 68.6 | 387,953 |
| **Steel – Mooring System** | 463.62 | Tons | 550 | 927.05 | 68.6 | 174,806 |
| **Steel – Other** | 8.91 | Tons | 550 | 927.05 | 68.6 | 3,358 |
| **Concrete – Power plant** | 22,640.36 | Cubic meter | 150 | 200,00 | 33.3 | 1,132,018 |
| **Concrete – Transmission line/substation** | 5,344.99 | Cubic meter | 150 | 200.00 | 33.3 | 267,249 |
| **Concrete – Pipeline** | 2,175.75 | Cubic meter | 150 | 200.00 | 33.3 | 108,788 |
| **Aluminum – Power plant** | 35.24 | Tons | 1,919 | 2,636.00 | 37.4 | 25,269 |
| **Aluminum – Transmission line** | 254.24 | Tons | 1,919 | 2,636.00 | 37.4 | 182,291 |
| **Copper – Power plant** | 2,459.36 | Tons | 5,808 | 5,808.00 | 62.5 | 8,922,565 |
| **Copper – Transmission line** | 797.87 | Tons | 5,808 | 5,808.00 | 62.5 | 2,894,661 |
| | | | | | **Sub-total** | **20,866,292** |
| *Labor* | | | | | | |
| **Local labor** | 159,090.91 | 1-week | 1,875 | 2,263.44 | 20.7 | 15,467,469 |
| | | | | | **Sub-total** | 15,467,469 |
| *Equipment* | | | | | | |
| **Engines – Power plant** | 19 | N/A | 38,795,072 | N/A | 20.0 | 7,759,014 |
| **Other – Power plant** | N/A | N/A | 100,000,000 | N/A | 20.0 | 20,000,000 |

| Type | Quantity | Unit | Unit price before project construction (2020) | Unit price of Q4 2022/Q1 2023 | Delta (% difference) | Price difference (US$) |
|---|---|---|---|---|---|---|
| **Other – Transmission line/substation** | N/A | N/A | 20,000,000 | N/A | 20.0 | 4,000,000 |
| **Marine works** | N/A | N/A | 50,000,000 | N/A | 20.0 | 10,000,000 |
| **FSRU conversion** | N/A | N/A | 90,000,000 | N/A | 20.0 | 18,000,000 |
| | | | | | **Sub-total** | 59,759,014 |
| **Total price difference** | | | | | | **96,092,775** |

**Note: Labor costs are calculated based on 1-week cumulative man-hours, assuming 44-hour weeks.*
*Source: Data provided by Invenergy, June 2023. Data on raw materials is based on current and historical data from the London Metal Exchange.[288] Data on labor costs are based on actual and historical figures from local sources and subcontractors hired by EdP and other EPC contractors. Price differences in equipment come from actual price quotes provided by Invenergy.*

[288] London Metal Exchange. "Market Data." https://www.lme.com/en/.

# Appendix B: Consulted stakeholders

Table B.1 below lists the in-country stakeholders consulted for the assignment.

**Table B.1: Consulted stakeholders**

| Entity | Role | Date of meeting |
|---|---|---|
| **Ministerio de Education** | Ministry of Education | 16 May 2023 |
| **Organismo Promotor de Exportaciones e Inversiones de El Salvador (PROESA)** | Exports and investment promotion agency of El Salvador | 16 May 2023 |
| **Ente Operador Regional (EOR)** | Market operator of the MER, responsible for the dispatch and exchange of energy through SIEPAC | 16 May 2023 |
| **Grupo AES** | Grupo AES owns and operates four distribution companies that are offtakers from EdP: CAESS, CLESA, EEO, and DEUSEM | 16 May 2023 |
| **Ministerio de Medio Ambiente** | Ministry of the Environment | 16 May 2023 |
| **Ministerio de Economía** | Ministry of the Economy | 16 May 2023 |
| **Unidad de Transacciones (UT)** | Market and system operator of the wholesale market in El Salvador | 17 May 2023 |
| **Dirección General de Energía, Hidrocarburos y Minas** | Government agency responsible for regulating and overseeing energy, hydrocarbon, and mining sectors in El Salvador. It is also responsible for overseeing the exploration, production and distribution of hydrocarbons | 17 May 2023 |
| **Autoridad Maritima Portuaria (AMP)** | Government agency responsible for regulating maritime activities, including port operations, safety, security, and environmental protection | 17 May 2023 |
| **Distribuidora de Electricidad (DELSUR)** | Distribution company and an offtaker of EdP | 17 May 2023 |
| **Comisión Ejecutiva Portuaria Autónoma (CEPA)** | Government agency responsible for managing and developing the ports in El Salvador, including the Port of Acajutla. CEPA is responsible for granting and managing port concessions | 17 and 18 May 2023 |
| **Superintendencia General de Electricidad y Telecomunicaciones (SIGET)** | Regulatory body responsible for overseeing the electricity and telecommunications sectors | 17 May 2023 |
| **Alcaldia de Acajutla** | City Hall of Acajutla | 18 May 2023 |

# Appendix C: Thermal generation cost assumptions for LCOE estimates

**Table C.1: Cost assumptions to estimate LCOE**

| Item | Unit | Value | Notes and sources |
|---|---|---|---|
| ***CAPEX*** | | | |
| **Oil** | US$/MW | 1,300,000 | **Note:** The U.S. Energy Information Administration[289] provides a range of unit capital costs of US$785,000 to US$2,018,000 per MW depending on the technical configuration of the plant. This value reflects the average unit capital costs provided for single cycle, combined cycle, and internal combustion engines.<br>**Source:** U.S. Energy Information Administration.[290] |
| **EdP** | US$/MW | 1,652,621 | **Note:** This value includes development costs, power plant costs, marine works costs, interconnection costs, commission/pre-PPA start costs, and first cargo acquisition costs.<br>**Source:** Invenergy.[291] |
| ***Marginal cost (variable O&M)*** | | | |
| **Oil** | US$/MWh | 177.1 | **Note:** This value represents the average variable O&M cost for all oil-running generation units in El Salvador. This value is an average of the variable cost for all oil power plants, and is not weighted by size or dispatch. In 2022, the average variable cost for oil-fired power plants in El Salvador ranged from US$153.5/MWh to US$201.1/MWh.<br>**Source:** Unidad de Transacciones.[292] |
| **EdP** | US$/MWh | 93.6 | **Note:** This value represents the average variable O&M cost for EdP in its first year of operations. EdP's variable cost is made up of fuel price, lube oil, and other non- fuel variable. Variable costs ranged from US$81.6/MWh to US$98.6/MWh between May 2022 and March 2023.[293]<br>**Source:** Unidad de Transacciones.[294] |
| ***Fixed O&M*** | | | |
| **Oil** | US$/MW-year | 23,308 | **Note:** The U.S. Energy Information Administration[295] provides a range of fixed O&M costs ranging from US$7,330/MW-year to US$36,810/MW-year depending on the technical configuration of the plant. The average value for |

[289] US. Energy Information Administration. "Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2022," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf. Page 2, Combustion turbine-aeroderivative.

[290] Ibid.

[291] This value is calculated in: Invenergy. "1. Lakeshore Model Reconciliation_02.23.2023_v18_(sent)."

[292] Unidad de Transacciones. "Descarga Archivos Programacion diaria 2023," https://www.ut.com.sv/programacion-diaria1.

[293] Ibid.

[294] Ibid.

[295] U.S. Energy Information Administration. "Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2022," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf. Page 2.

| Item | Unit | Value | Notes and sources |
|---|---|---|---|
| | | | single cycle plants, combined cycle plants, and internal combustion engines is used.<br>**Source:** U.S. Energy Information Administration.[296] |
| **EdP** | US$/MW-year | 112,898 | **Note:** This value is the average projected fixed O&M costs over the lifetime of the plant, which includes fixed operating costs for running the power plant, the FSRU, tugboats, marine works, the transmission line, and other fixed costs such as water treatment, lease payments, and insurance.<br>**Source:** Invenergy.[297] |
| ***Plant lifetime*** | | | |
| **Oil** | Years | 20 | **Note:** This value is an assumption based on industry standards. |
| **EdP** | Years | 20 | **Note:** This value is equal to the term set in the PPA term.<br>**Source**: Invenergy.[298] |
| ***Discount rate*** | | | |
| **Social discount rate** | % | 9% | **Note:** The Asian Development Bank and other multilateral banks use a discount rate of 9% as the minimum required economic internal rate of return to assess the economic viability of a project and to choose the least-cost option in sectors such as transport, energy, urban development, and agriculture.<br>**Source:** Asian Development Bank, *Guidelines for the Economic Analysis of Projects*.[299] |

[296] U.S. Energy Information Administration, "Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2022," https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf. Page 2.

[297] These values are calculated in: Invenergy. "1. Lakeshore Model Reconciliation_02.23.2023_v18_(sent)."

[298] Invenergy. "EDP Information Memorandum_Feb 2017_final," 2017. Page 15.

[299] Asian Development Bank. "Guidelines for Economic Analysis of Projects," 2017. https://www.adb.org/sites/default/files/institutional-document/32256/economic-analysis-projects.pdf. Page 52.

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