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Report No: PAD00055

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT
ON A
PROPOSED CREDIT

IN THE AMOUNT OF SDR 28.9 MILLION
(US$38.5 MILLION EQUIVALENT)

AND A PROPOSED GRANT

IN THE AMOUNT OF US$0.25 MILLION
FROM THE CANADA CLEAN ENERGY AND FORESTS CLIMATE FACILITY

TO THE COMMONWEALTH OF DOMINICA

FOR THE

DOMINICA GEOTHERMAL RISK MITIGATION II PROJECT

December 20, 2023

Energy and Extractives Global Practice
Latin America and Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective November 30, 2023)

Currency Unit:	
SDR 0.75 =	US$1
US$1.333 =	SDR 1

FISCAL YEAR
July 1 - June 30

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ABBREVIATIONS AND ACRONYMS

CBI	Citizenship by Investment
CCEFCF	Canada Clean Energy and Forest Climate Facility
CDB	Caribbean Development Bank
CO_2	Carbon dioxide
DA	Designated Account
DGDC	Dominica Geothermal Development Company Ltd
DGPP	Domestic geothermal power plant
DGRMP	Dominica Geothermal Risk Mitigation Project (P162149)
DGRMPII	Dominica Geothermal Risk Mitigation II Project (P179845)
DOMLEC	Dominica Electricity Services Limited
EHS	Environmental, health and safety
ESMP	Environmental and social management plan
FCDO	Foreign, Commonwealth and Development Office (UK)
FM	Financial management
GHG	Greenhouse gas
GIIP	Good international industry practice
GRID	Green, resilient, and inclusive development
GWh	Gigawatt hour
HR	Human resources
IDA	International Development Association
ICR	Implementation Completion and Results Report
IFI	International financial institution
IFR	Interim Financial Report
IFRS	International Financial Reporting Standards
IRC	Independent Regulatory Commission
ISR	Implementation Status and Results Report
kV	Kilovolt
kWh	Kilowatt hour
MFD	Maximizing finance for development
MW	Megawatt
MWh	Megawatt hour
NDC	National Determined Contribution
NRDS	National Resilience Development Strategy
OE	Owner's engineer
OECS	Organization of Eastern Caribbean States
OMLA	Operations, Maintenance and Lease Agreement
PCM	Private Capital Mobilized
PDO	Project Development Objective
POM	Project operations manual
PP	Procurement plan
PPSD	Project Procurement Strategy for Development
SET	Stakeholder Executive Team
SIDS	Small island developing state
SORT	Systematic Operations Risk-rating Tool
STEM	Science, technology, engineering and math
STEP	Systematic Tracking of Exchanges in Procurement
T&D	Transmission and distribution
TA	Technical assistance

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DATASHEET

BASIC INFORMATION

Project Beneficiary(ies)	Operation Name		
Dominica	Dominica Geothermal Risk Mitigation II Project		
Operation ID	Financing Instrument	Environmental and Social Risk Classification	
P179845	Investment Project Financing (IPF)	Substantial	

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach (MPA)	[ ] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[ ] Fragile State(s)
[ ] Performance-Based Conditions (PBCs)	[✓] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made Disaster
[ ] Alternative Procurement Arrangements (APA)	[ ] Hands-on Expanded Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
23-Jan-2024	28-Feb-2029
Bank/IFC Collaboration	
No	

Proposed Development Objective(s)

The Project Development Objective is to integrate geothermal electricity capacity and strengthen the resilience of the national grid in Dominica.

Components

Component Name	Cost (US$)
Technical Assistance and Project Implementation Support	1,850,000.00
Transmission Network Expansion and Resilience Development	36,900,000.00

Organizations

Borrower:	Commonwealth of Dominica
Implementing Agency:	Dominica Geothermal Development Company

PROJECT FINANCING DATA (US$, Millions)

Maximizing Finance for Development

Is this an MFD-Enabling Project (MFD-EP)? Yes

Is this project Private Capital Enabling (PCE)? No

SUMMARY

Total Operation Cost	**97.65**
Total Financing	**97.65**
of which IBRD/IDA	**38.50**
Financing Gap	**0.00**

DETAILS

World Bank Group Financing

International Development Association (IDA)	38.50
IDA Credit	38.50

Non-World Bank Group Financing

Commercial Financing	17.00
Unguaranteed Commercial Financing	17.00
Other Sources	40.00
Caribbean Development Bank	30.00

CARICOM Development Fund	10.00
Counterpart Funding	1.90
Borrower/Recipient	1.90
Trust Funds	0.25
Canada Clean Energy and Forest Climate Facility Trust Fund	0.25

IDA Resources (US$, Millions)

	Credit Amount	Grant Amount	SML Amount	Guarantee Amount	Total Amount
National Performance-Based Allocations (PBA)	38.50	0.00	0.00	0.00	38.50
Total	**38.50**	**0.00**	**0.00**	**0.00**	**38.50**

Expected Disbursements (US$, Millions)

WB Fiscal Year	2024	2025	2026	2027	2028	2029
Annual	1.50	5.88	9.68	11.69	6.20	3.80
Cumulative	1.50	7.38	17.06	28.75	34.95	38.75

PRACTICE AREA(S)

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

CLIMATE

Climate Change and Disaster Screening

Yes, it has been screened and the results are discussed in the Operation Document

SYSTEMATIC OPERATIONS RISK- RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	Low
2. Macroeconomic	Substantial
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Substantial
8. Stakeholders	Moderate
9. Other	
10. Overall	Substantial

POLICY COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

ENVIRONMENTAL AND SOCIAL

Environmental and Social Standards Relevance Given its Context at the Time of Appraisal

E & S Standards	Relevance
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	Relevant
ESS 10: Stakeholder Engagement and Information Disclosure	Relevant
ESS 2: Labor and Working Conditions	Relevant

ESS 3: Resource Efficiency and Pollution Prevention and Management	Relevant
ESS 4: Community Health and Safety	Relevant
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
ESS 8: Cultural Heritage	Relevant
ESS 9: Financial Intermediaries	Not Currently Relevant

NOTE: For further information regarding the World Bank's due diligence assessment of the Project's potential environmental and social risks and impacts, please refer to the Project's Appraisal Environmental and Social Review Summary (ESRS).

LEGAL

Legal Covenants

Sections and Description
Financing Agreement; Schedule 2 - Project Execution; Section I. Implementation Arrangements; A. Institutional Arrangements; para. 1: The Recipient shall cause DGDC to operate and maintain, throughout Project implementation, a Project team to be responsible for the overall implementation, management, monitoring and evaluation of the Project with qualified and experienced staff in sufficient numbers, as well as with adequate funds, facilities, services and other resources acceptable to the Association, as further detailed in the Project Operations Manual.
Financing Agreement; Schedule 2 - Project Execution; Section I. Implementation Arrangements; A. Institutional Arrangements; para. 2: The Recipient shall cause DGDC to maintain an owner's engineer with qualifications, experience, and terms of reference satisfactory to the Association to support the DGDC with the supervision of technical, procurement, contract management and capacity building activities of the Project.
Financing Agreement; Schedule 2 - Project Execution; Section I. Implementation Arrangements; A. Institutional Arrangements; para. 3: No later than thirty (30) days after the Effective Date, the Recipient shall cause DGDC, IRC and DOMLEC to establish, operate and maintain throughout Project implementation, a team (the "Stakeholder Executive Team") comprising the heads of DGDC, DOMLEC and IRC, with functions and responsibilities acceptable to the Association and defined in the Project Operations Manual, to ensure their alignment on key aspects of Project implementation, including, inter alia, on Project schedules, capacity building activities, associated infrastructure and understanding of the technical and/or regulatory requirements for construction and future operation of the new transmission network.
Financing Agreement; Schedule 2 - Project Execution; Section I. Implementation Arrangements; A. Institutional Arrangements; para. 6: The Recipient, through the Ministry of Housing and Urban Development, shall, and shall cause DGDC to, update the Cooperation Agreement no later than (1) month after the Effective Date, under terms and conditions acceptable to the Association, to facilitate and coordinate the implementation of the applicable environmental and social instruments detailed in the ESCP, including details on the roles and responsibilities for land

acquisition. Except as the Association shall otherwise agree, the Recipient shall not assign, amend, abrogate or waive the updated Cooperation Agreement or any of its provisions.
Financing Agreement; Schedule 2 - Project Execution; Section I. Implementation Arrangements; A. Institutional Arrangements. 7. Subsidiary Agreement; para. (a): To facilitate the carrying out of the Project, the Recipient shall make part of the proceeds of the Financing allocated from time to time to Category (1) available to DGDC under a subsidiary agreement between the Recipient and DGDC, under terms and conditions approved by the Association ("Subsidiary Agreement") which shall include, inter alia: (i) the roles and responsibilities of DGDC with regard to the implementation of the Project; and (ii) the obligation of DGDC to comply with the technical, fiduciary and environmental and social requirements applicable to the Project in accordance with the provisions of this Agreement and the ESCP.

Conditions

Type	Citation	Description	Financing Source
Effectiveness	Financing Agreement; Article V - Effectiveness; Termination; para. 5.01. (a):	The Recipient and DGDC have adopted the Project Operations Manual in form and substance satisfactory to the Association.	IBRD/IDA
Effectiveness	Financing Agreement; Article V - Effectiveness; Termination; para. 5.01. (b):	The Project Agreement, the Subsidiary Agreement and the CCEFCF GE-SIDS Grant Agreement have been executed and delivered and all conditions precedent to their effectiveness (other than the effectiveness of this Agreement) have been fulfilled in a manner acceptable to the Association.	IBRD/IDA
Effectiveness	Financing Agreement; Article V - Effectiveness; Termination; para, 5.01. (c):	The Geothermal Resources Concession Agreement has been entered into between the Recipient and the Project Company on terms and conditions acceptable to the Association, including the responsibility of the Project Company to comply with the obligations set forth under Section I.C.7 and 8 of Schedule 2 to this Agreement.	IBRD/IDA

Effectiveness	Financing Agreement; Article V - Effectiveness; Termination; para. 5.01. (d):	The Power Purchase Agreement has been entered into between the Project Company and DOMLEC on terms and conditions acceptable to the Association.	IBRD/IDA
Effectiveness	Financing Agreement; Article V - Effectiveness; Termination; para. 5.01. (e):	The Operations, Maintenance and Lease Agreement has been entered into between the Recipient and DOMLEC on terms and conditions acceptable to the Association.	IBRD/IDA
Effectiveness	Financing Agreement; Article V - Effectiveness; Termination; para. 5.01. (f) (i):	Without limitation to Section 10.02 of the General Conditions: The Recipient furnishes to the Association an opinion or certificate satisfactory to the Association of counsel acceptable to the Association confirming that the Geothermal Resources Concession Agreement, the Power Purchase Agreement and the Operations, Maintenance and Lease Agreement have been duly authorized or ratified, and executed and delivered and are legally binding upon the respective parties thereto in accordance with the said agreements' terms.	IBRD/IDA
Effectiveness	Grant Agreement; Article V - Effectiveness; Termination; para. 5.01. (a):	The execution and delivery of this Agreement on behalf of the Recipient has been duly authorized or ratified by all necessary governmental and corporate action.	Trust Funds

Effectiveness	Grant Agreement; Article V - Effectiveness; Termination; para. 5.01. (b):	The Financing Agreement has been executed and delivered and all conditions precedent to its effectiveness (other than the effectiveness of this Agreement) have been fulfilled in a manner acceptable to the Bank.	Trust Funds

I. STRATEGIC CONTEXT

A. Country Context

1. **The Commonwealth of Dominica (Dominica) is a small island developing state (SIDS) in the Eastern Caribbean Region.** It is an upper-middle income country, with, in 2022, a population of 73,000[1] and a GDP of US$608 million giving a per capita GDP of US$8,364[2]. It is a member of the Organization of Eastern Caribbean States (OECS). Tourism accounted for 36.9 percent of GDP in 2019[3]. The share of agriculture in the economy declined from 30 percent in the early 1990s to 15 percent in 2016. Dominica's poverty headcount reached 28.8 percent and its Gini coefficient was 0.44 in 2008[4]; both may have since risen due to subsequent economic shocks caused by hurricanes and the Covid-19 pandemic. Dominica, like other SIDS in the region, has suffered from low growth, high debt, and limited fiscal space.

2. **Dominica's economy is heavily influenced by natural disasters, a rugged topography, and external events.** As a small island state along the eastern Caribbean Sea with mountainous terrain, Dominica is highly vulnerable to flooding and heavy rainfall – particularly during the rainy season (August to December) and hurricane season (June to October). With a mean annual rainfall of 2187.93mm, climate projections using CMIP 6[5] estimate that consecutive wet days could increase to a maximum of 16.59 by 2053[6]. The mountainous inland terrain means that 90 percent of the population and most of the infrastructure is concentrated along a narrow coastal area in the south and west, rendering both the population and the productive sectors of the country's economy vulnerable and particularly susceptible to sea level rise, flooding, landslides, and storm surges. The category 5 hurricane Maria which swept across the Caribbean in September 2017, brought high winds and heavy rainfall, triggering flash floods and subsequent landslides to Dominica. They killed 31 people, damaged 90 percent of its housing stock and caused the electricity system to fail completely[7]. Damage was estimated to have cost US$1.31 billion, equivalent to 226 percent of GDP[8]. The few sandy beaches limit the opportunities for tourism development. Only about 25 percent of the country is cultivable, restricting further growth in agriculture.

1 Source: United Nations Population Division - https://population.un.org/dataportal/data/indicators/53,41,67,52,71,47,46,70,50,54,51,72,49/locations/212/start/1990/end/2023/table/pivotbylocation
2 Source: World Bank Macro Poverty Outlook and Datasheet for Dominica, April 2023 – https://thedocs.worldbank.org/en/doc/e408a7e21ba62d843bdd90dc37e61b57-0500032021/related/mpo-dma.pdf https://thedocs.worldbank.org/en/doc/a42807d60ed756bf79b8bc844db8a6c4-0500032021/related/data-dma.pdf
3 Estimate from the World Travel and Tourism Council data (2019) is considered high as it includes direct, indirect, and marginally related service sector contributions.
4 Estimated at the time of the last Country Poverty Assessment (CPA) conducted in 2009.
5 CMIP6- Sixth Phase of the Couple Model Intercomparison Project, organized by the World Climate Research Program.
6 Source: Climate Change Knowledge Portal - https://climateknowledgeportal.worldbank.org/country/dominica/climate-data-projections
7 Post-Disaster needs Assessment Hurricane Maria September 18, 2017. Government of the Commonwealth of Dominica: https://www.gfdrr.org/en/dominica-hurricane-maria-post-disaster-assessment-and-support-recovery-planning
8 National Resilience Development Strategy 2030. Government of the Commonwealth of Dominica : https://finance.gov.dm/national-development-strategies/strategies/file/31-national-resilience-development-strategy-dominica-2030

Recent withdrawal of international banks from Dominica has coincided with a contraction in the financial services sector. The Citizenship by Investment (CBI) program is an important source of foreign direct investment which is used for public investment in infrastructure. Inflows reached a peak of around 30 percent of GDP in 2020 and 2021 before falling back to a projected 18 percent in 2022 and 17 percent in 2023[9].

3. **Volatility in recent economic performance reflects regional and global shocks and rebounds.** GDP growth over the past twenty years has averaged 2.1 percent per annum, lower than the 2.6 percent seen in other OECS countries[10], itself lower than the growth recorded in Pacific Islands states and other upper middle-income countries[11]. More recent growth has been erratic. The narrow economic base of just two or three main sectors is vulnerable to external shocks such as the global financial crisis of 2008 and Covid-19 in 2020 and 2021, both of which halted tourist arrivals. Reconstruction following hurricane Maria fueled GDP growth which rose to 5.5 percent in 2019. Following a sharp contraction of 16.6 percent during the Covid-19 pandemic, growth recovered to 5.8 percent in 2022 as travel restrictions were relaxed[12]. Transfers to households during Covid-19 caused the primary fiscal deficit to reach 6.2 percent of GDP in 2021 but is predicted to reduce to 0.3 percent in 2023. Although gross general government debt is expected to decline to 93.4 percent of GDP in 2023 from a peak of 112.6 percent in 2020, the country remains at high risk of debt distress. Inflation increased from 1.5 percent to 7.5 percent in 2022, driven by higher fuel and food prices but is forecast to decline to 6.2-6.3 percent in 2023.[13]

4. **The National Resilience Development Strategy (NRDS) aims at a transition to a more diversified and greener economy.** It is based on five strategic growth poles: (i) renewable energy; (ii) productive enterprises; (iii) creative industries; (iv) infrastructure; and (v) human services which are to be supported within a stable macroeconomic framework[14]. The NRDS calls for development of higher added-value businesses, such as agro-processing and improving Dominica's competitiveness in the Caribbean tourism industry. In addition, building resilience across all sectors is crucial if the country is to follow a sustainable and inclusive development path, because vulnerability to natural disasters and climate change are at the center of Dominica's development challenges. Similarly, the Dominica Climate Resilience and Recovery Plan (2020 – 2030) supports critical resilience initiatives including: renewable energy solutions which encourage shifting domestic renewable energy sources to reduce dependence on fuel imports, through the construction of a domestic geothermal power plant to supply electricity[15].

5. **The economic outlook is positive.** Growth is forecast to reach 4.5-5.0 percent in 2023[16] supported by increased tourist arrivals. Underpinned by the NRDS, and supported by CBI inflows, the public and private investment pipeline is strong and includes planned investments in a new airport and geothermal development. The latter will be critical to the transformation of the economy by driving growth, improving resilience to climate-induced natural disasters, and mitigating future global economic shocks.

B. Sectoral and Institutional Context

6. **Dominica's small population and geography shape the electricity sector.** In 2022, 98 percent of the island's population was served with electricity through 37,000 connections. About 47 percent of the 89 gigawatt-hours (GWh)

Source: IMF Article IV Staff Report for Dominica May 2023: https://www.imf.org/en/Publications/CR/Issues/2023/07/05/Dominica-2023-Article-IV-Consultation-Press-Release-and-Staff-Report-for-Dominica-535752
10 Such as Antigua and Barbuda, Grenada, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines (World Bank Annual GDP Growth Data; 1996-2015).
11 Regional Partnership Framework for the Eastern Caribbean States April 19, 2022. Report No. 160349-LAC.
12 Source: IMF Article IV Staff Report for Dominica May 2023
13 Sources: IMF Article IV Staff Report for Dominica May 2023 and World Bank Macro Poverty Outlook and Datasheet for Dominica April 2023
14 National Resilience Development Strategy 2030. Government of the Commonwealth of Dominica : https://finance.gov.dm/national-development-strategies/strategies/file/31-national-resilience-development-strategy-dominica-2030
15 Dominica Climate Resilience and Recovery Plan 2020-2030 – https://odm.gov.dm/wp-content/uploads/2022/02/CRRP-Final-042020.pdf
16 Sources: IMF Article IV Staff Report for Dominica May 2023 and World Bank Macro Poverty Outlook and Datasheet for Dominica April 2023.

generated were sold to households and 43 percent to commercial customers, the remaining 10 percent was used by industry, hotels, and street lighting. Installed nameplate generation capacity was 25.52 megawatts (MW), serving peak demand of 16.35 MW. 74 percent of the generation capacity (18.88 MW) came from two diesel power plants located at Fond Cole in the southwest outside the capital Roseau, and Sugar Loaf in the northwest outside Portsmouth. A cascade of three small run-of-the-river hydro plant in the Roseau Valley provided the remaining 26 per cent or 6.64 MW of installed capacity. There was also an estimated 15MW of diesel self-generation. The transmission and distribution (T&D) system comprises only overhead distribution lines of over 400 km at 11 kilovolt (kV) and 900 km at 230/400 Volt. An 11 kV ring interconnects the hydro plants and diesel power plants with the load, about 75 percent of which is in the South around Roseau areas and 25 percent in the North around Portsmouth.

7. **Although largely under government supervision, electricity sector policy, regulation and operation are conducted independently.** The Electricity Supply Act of 2006 came into force on March 1, 2007. It placed into a legal framework the government's power reform policy which had been under preparation since 2003. The Act established the Independent Regulatory Commission (IRC) as the sector regulator. Members of the Board of IRC are appointed by the Minister responsible for electricity. The Board has powers and duties independent of the government and may make rules and take enforcement action. The IRC has a general duty to protect the interests of consumers and to ensure the security and efficiency of supply of electricity, including by conducting planning that considers geothermal and wind energy. It has the power to issue licenses for the generation, transmission, and distribution and supply of electricity. Other specific duties include the determination of tariffs and setting standards for performance, technical and customer service as well as for the efficient use of electricity.

8. **The interconnected power system is operated by a single, vertically integrated concessionaire, Dominica Electricity Services Limited (DOMLEC).** The IRC oversees DOMLEC and granted it a 25-year non-exclusive license to generate electricity and a 25-year exclusive license to transmit, distribute and supply electricity, both commencing on 1 January 2014. Under its transmission, distribution, and supply license, DOMLEC also acts as the system operator. DOMLEC's tariffs are subject to determination by the IRC based on its revenue requirements which are computed from its operating and financing costs and the cost of meeting any government-imposed obligations. A public limited liability company, DOMLEC is domiciled in Dominica and listed on the Eastern Caribbean stock exchange. It became majority publicly owned in March 2022 following the sale of a controlling stake by a private investor to the government. The government owns 52 percent of the shares and Dominica Social Security owns 20 percent of the shares. The remaining 28 percent of the shares are owned by private actors, mainly Dominicans. With the change of ownership, several board members were replaced. DOMLEC's recent financial performance is mixed. Having broken even in 2020, it made a profit of EC$3.61 million in 2021 on revenues of EC$92.05 million but in 2022 fell into a loss of EC$0.79 million on revenues of EC$112.23 million, attributed to a 54 percent increase in the cost of fuel[17]. Operating performance is good: losses on gross generation were 7.8 percent in 2021 and 8.2 percent in 2022. Specific fuel consumption in 2022 was 223.6 grams of diesel per kilowatt hour (kWh) produced, leading to a carbon dioxide (CO_2) emissions factor of 700g CO_2/kWh. Per employee there are 183 customers and sales of 440 megawatt hours (MWh).

9. **Dominica's electricity system is vulnerable to recurrent and devastating hurricanes, heavy rainfall, and flooding.** The age of the overhead T&D network was a principal factor in the failure of the electricity system following hurricane Maria. Then, more than 75 percent of the network and most of the generation assets were damaged to a greater or lesser extent. The cost of damage totaled US$33 million, or 65 percent of the net book value of assets at the time. Of the total, US$30 million was attributable to T&D network, the balance accruing to generation, mainly to rebuild the Padu hydropower plant. Lost gross revenues, mainly electricity sales and fuel surcharges, were US$26.9 million, 82 percent of total revenues in 2018. The financing required to repair or rebuild the power system following Hurricane Maria was estimated at US$80.68 million[18], nearly 2.5 times DOMLEC's total revenue in 2016. While it is not possible to forecast

17 Source: DOMLEC Annual Report 2021 and 2022 - https://www.domlec.dm/investors/
18 Post Disaster Needs Assessment for Dominica after Hurricane Maria in 2017, GFDRR

future hurricanes' timing or strength, climate change has increased their frequency and severity; Dominica is thus prudent in planning with future devastating events in mind.

10. **Reliance on diesel generation undermines Dominica's competitiveness.** Seven out of the 13 diesel generating units owned by DOMLEC with aggregate installed capacity of over 10 MW have exceeded their maximum operating hours. Continued operation of those units without replacement risks unexpected shutdowns and engine failures, which would lead to major electricity supply blackouts. Increases in the price of imported diesel in 2022 not only worsened the country's balance of trade but also resulted in sharply rising retail tariffs. Fuel imports rose to a historic peak of 8.5 percent of GDP, three points higher than in 2019[19]. Electricity tariffs reached around 33 US cents/kWh. Unsurprisingly, about 66 percent of firms in Dominica cite the cost and irregularity of electricity as a major or very severe constraint[20]. High value service businesses and inward investment, both of which are essential to the achievement of the NRDS, depend on reliable electricity at predictable cost. Hence a transition away from diesel is a development priority. Absent other sources of energy, DOMLEC would have to invest in new diesel gensets to replace the aged fleet, thus locking in further competitive disadvantage and carbon emissions.

11. **Geothermal power combined with sector reforms provide a transformational opportunity.** Dominica has a confirmed geothermal resource capable of supporting up to 100 MW of generation[21], far exceeding current domestic needs and which could in the longer term provide an exportable surplus. Dominica's geothermal electricity cost is expected to be around US$12c/kWh[22], which would significantly lower the level and volatility of tariffs while substantially improving supply reliability and resilience. The reforms introduced under the 2006 Electricity Supply Act encourage outside investment in electricity generation while leaving DOMLEC responsible for system operation. They thus free the financially constrained DOMLEC from the complexities and costs of developing a power plant using a technology that, while well proven elsewhere, would be new to the country.

12. **The on-going Dominica Geothermal Risk Mitigation Project (DGRMP – P162149) is supporting development of Dominica's first geothermal power plant.** The project aims to diversify Dominica's domestic power generation mix and demonstrate the potential of larger development of the geothermal resource. It was approved in March 2019 and was originally intended to finance the development, construction, and commissioning of the 7 MW domestic geothermal power plant (DGPP) in the Roseau Valley. The Dominica Geothermal Development Company Ltd (DGDC) is wholly owned by the government and is the project implementation agency charged with developing DGPP. It was originally planned that DGDC would contract a firm to design, supply and install the DGPP. Insufficient and costly responses from the market led to the cancellation of procurement in early 2020. Further studies, including a market survey and technical work indicated the need to modify the project technical scope, design, and implementation approach. In May 2020, the government proposed to increase the capacity of the DGPP to 10MW and for it to be developed and financed by a private consortium to leverage private sector investment to cover the additional costs. To enable the change, DGRMP was restructured in March 2022 to finance the drilling of a new production and a new reinjection well and studies into the construction of new transmission capacity. The drilling of new wells was required to reduce upstream resource risks, increase bankability of the downstream development of the DGPP, and reduce geothermal energy costs by enabling the increase in capacity. In April 2023, DGDC reported that the drilling of both additional wells had been completed successfully. The knowledge from the drilling will help the government finalize negotiations with its private partner for the DGPP. Following the restructuring and the improved progress, the most recent supervision in May 2023 rated the project moderately satisfactory for achievement of its development objective and for implementation progress.

19 Source: IMF Article IV Staff Report for Dominica May 2023.
20 World Bank, 2010, evaluation of raw data from Enterprise Survey in Dominica.
21 Based various surface studies and well drillings, GoCD confirmed the existence of up to 100 MW in geothermal capacity in the Wotten Waven-Laudat field, Roseau Valley.
22 Estimated based on the planed 10 MW geothermal power plant in Roseau Valley.

13. **The government is driving forward development of the DGPP with private financing.** In 2020, a private consortium of four French companies was selected by the government to negotiate the development of the 10 MW DGPP for domestic supply while also moving toward development of a larger power plant for export to the neighboring French territories of Guadeloupe and Martinique. In May 2022, the government withdrew from negotiations following the exit of the key member of the consortium. The government then decided to focus its priority on development of the geothermal generation for domestic supply and in early 2023 engaged in negotiations of the DGPP with a new independent power producer. Reportedly, significant progress has been made in the negotiations. The government signed the key agreements with the private developer in December 2023 aiming to construct the DGPP within 24 months from the signing date of the agreements.

14. **Complementary investment in transmission capacity is now needed.** Additional transmission capacity is required to evacuate the geothermal electricity to the country's primary load centers. The technical design and preparation of the environmental and social instruments for the transmission investment have been financed under DGRMP and are now being finalized. They have informed the preparation of the proposed project. Table 1 provides information of the on-going and proposed uses and source of funds for the development of the domestic geothermal power plant in Dominica.

Table 1. Enabling Domestic Geothermal Power Plant- Funding Sources

#	Project	Uses of Funds	Amount	Source of Funds
1	DGRMP (P162149)	Drilling of geothermal wells & technical assistance	US$39 million (as approved)	IDA Loan, FCDO grant[23], SIDS DOCK Grant[24], CTF contingent grant[25]
2	Independent Power Producer	Privately owned Domestic Geothermal Power Plant of 10 MW development	US$57 million (estimate)	Estimated private equity at US$17 million and potential concessional funds for debt finance (under negotiations)
3	DGRMPII (P179845)	Transmission infrastructure for interconnection of DGPP to grid & technical assistance	US$40.65 million (proposed)	IDA loan, Canada Clean Energy and Forest Climate Facility (CCEFCF) grant

C. Relevance to Higher Level Objectives

15. **The proposed project will buttress achieving the overarching aim of the Regional Partnership Framework for the Eastern Caribbean States for the period FY22-25[26] to support green, resilient, and inclusive development[27] (GRID) and competitiveness in Dominica.** The project addresses two of the high-level outcomes and associated objectives which underpin the Regional Partnership Framework for the Eastern Caribbean States for FY2022-2025. Under High-Level Outcome 1: "Strengthening resilience to climate change and other shocks," the project will contribute to Objective 1: "Enhance Environmental Protection and Climate Change Response" by decarbonizing electricity supply and making the transmission and distribution system more resilient to future hurricanes. It will also contribute to Objective 2: "Improve Fiscal, Debt, and Public Financial Management" by reducing DOMLEC's need to import diesel. Furthermore, by reducing the country's dependence on diesel imports and monetizing domestic geothermal resources, the Project will support the government's fiscal recovery from past natural disasters and continuing climate change challenges. Under High-level Outcome 3: "More and Better Jobs" it will contribute to Objective 5: "Enhance the Enabling Environment for Businesses" by lowering and stabilizing retail electricity tariffs.

16. **The proposed project is consistent with Dominica's National Determined Contribution (NDC)[28] in its mitigation**

23 A grant provided by Foreign, Commonwealth & Development Office (FCDO)
24 A grant under Small Island Developing States (SIDS) DOCK support program.
25 A grant provided by Clean Technology Fund (CTF)
26 World Bank. 2022. Regional Partnership Framework for the Eastern Caribbean States for the period FY22-25. Report No. 160349-LAC
27 World Bank. 2021. Green, Resilient, and Inclusive Approach. https://openknowledge.worldbank.org/entities/publication
28 The Commonwealth of Dominica, updated Nationally Determined Contribution (NDC), released July 4, 2022

and adaptation pillars and is aligned with the Paris Agreement. Dominica's updated NDC sets out an ambitious greenhouse gas (GHG) emission reduction target of 45 percent below 2014 levels by 2030. The mitigation pillar prioritizes development of geothermal energy to achieve 100 percent renewable energy generation by 2030 and 98.6 percent reduction of GHG emitted by the energy industries. The adaptation pillar of the NDC aims at the integration of climate change considerations into the planning, development, and implementation of all economic sectors. In proposing to finance transmission to evacuate electricity from a geothermal power plant, the project directly contributes to the national mitigation commitments and universally aligned with the Paris Agreement's mitigation goals. Creating redundancy of the transmission network and laying one of the two key transmission lines underground supports national adaptation and resilience goals. National adaptation and resilience are strengthened through long-term planning and modelling of grid modernization, which will include addressing increased severity and frequency of hurricanes and enhancement in emergency preparedness capacity of DOMLEC against extreme climate events, while also supporting the Paris Agreement's adaptation and resilience goals.

17. **The project supports the World Bank Group's Private Capital Mobilization efforts, explicitly pursuing the Maximizing Finance for Development strategy.** The transmission network proposed to be financed under the project is the prerequisite for development of the DGPP, which is to be financed partially with private capital. DGPP is considered an associated facility for the proposed project; neither would be viable without the other. Transmission lines and substations must be in place to allow for testing, commissioning, and connection of the DGPP to the grid and to evacuate the power produced to consumers. The proposed project would leverage the US$57 million needed to develop DGPP including mobilizing about US$17 million in private sector equity with the remaining balance likely coming from other IFI, including Caribbean Development Bank (CDB) which currently is undertaking its due diligence of the DGPP. In addition, through targeted capacity building to improve DOMLEC's ability to sustainably operate and manage the expanded transmission network the project is considered as maximizing finance for development (MFD)-enabling by allowing the safe and sustainable operation of the infrastructure necessary for the proper function of the geothermal power plant.

18. **Substantial support is planned to assist women to work in the energy sector.** Data for the Caribbean indicate that women are significantly underrepresented in science, technology, engineering, and math (STEM) fields of study. For example, in engineering, female students represented 36 percent of enrollments in 2016-2017, a 1.5 percentage point decrease from 2012-2013. In Dominica, as with other countries in the Caribbean, despite a high proportion of females working in public service, there is evidence that they are significantly underrepresented in technical roles in energy related jobs, at multiple levels. The proposed project introduces a sponsorship program to enable women to be employed in technical positions in the energy sector within the first year of completing the respective programs.

II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

19. The Project Development Objective is to integrate geothermal electricity capacity and strengthen the resilience of the national grid in Dominica.

PDO Level Indicators

20. The primary results arising upon completion of the proposed Project are expected to be as shown in Table 2.

Table 2: Key Results and Indicators

Key Results	Indicators
Geothermal electricity capacity integrated into the national grid	- Capacity of geothermal electricity generation connected to the national grid. - Share of renewable electricity in domestic generation production. - GHG emissions avoided under the project
Resilience of the national grid strengthened	- Share of transmission lines in length constructed underground under the project. - Availability of spare parts for emergency use within seven km of the transmission lines and substations constructed under the project

B. Project Components

21. **This proposed Dominica Geothermal Risk Mitigation II Project (DGRMP II) would finance the first of two phases of transmission network development required to support the DGPP.** The first phase entails construction of new 33 kV and 69 kV transmission lines and associated substations for connecting and evacuating electricity generated at the DGPP to Fond Cole substation- the largest load center of the national grid which is in the southwest of the island. The second phase would extend the 69 kV transmission line from Fond Cole substation to Sugar Loaf substation in the north of the island; it would be financed by a follow-up investment project.

22. As with DGRMP, the proposed project will facilitate the on-going negotiations for the DGPP with the private investor, the outcome of which is expected to be 10MW of geothermal generation capacity becoming available to the DOMLEC system. When both projects are completed, the share of renewable electricity used by the domestic power system is expected to increase significantly while the reliability of the electricity supply will be improved because most of the diesel generators which have exceeded their life expectancy will be displaced by the new geothermal capacity. The average cost of electricity generated (and consequently the tariff paid by consumers) is expected to decrease. DGRMP and DGRMP II will, between them, enable significant greenhouse gas (GHG) emission reductions by displacing the diesel generating units that would continue to operate or be retired and replaced under the current 'business as usual' baseline.

23. The proposed project will create a robust network for transmission of electricity from the new geothermal power plant to the Fond Cole Station, including connecting three existing hydroelectric power plants in the Roseau Valley. Parallel routes and significant undergrounding of 33 kV and 69 kV lines will introduce redundancy between key power plants including DGPP with Fond Cole station. The lines and stations will be built to withstand known natural hazards in the area, such as strong winds, floods, landslides associated with Category 5 hurricanes. Other features such as rapid system restoration and optimum levels of spare parts holdings are also factored into the design and procurement. The project will finance goods, works, and consultant services in support of these goals.

24. The proposed project will have two components. Costs and financing are shown in Table 3.

Component 1: Transmission Network Expansion and Resilience Development. This component will finance the construction of new transmission lines and substations for connecting the DGPP with the country's largest electricity system load center in Fond Cole (near Roseau city) and technical assistance to enhance emergency preparedness of DOMLEC, the national electric utility as described below.

1**. Network Expansion**. Network expansion will include: (a) A 69 kilovolt (kV) overhead transmission line of around 7.6 km from the DGPP to the Fond Cole substation; (b) a 33 kV underground transmission line of around 11 km, connecting the DGPP with Fond Cole substation via New Trafalgar and Padu substations (c) construction of new 69/33/11 kV substation at Fond Cole, a new 33/2.2 kV substation at New Trafalgar and new 33/11 kV substation at Padu, (d) an 11 kV underground line of 0.5 km connecting the DGPP to the existing Laudat substation and (e)

other related T&D system strengthening. All new transmission lines and substations will be constructed to standards and with features which harden them against extreme weather events and subsequent effects such as flooding and erosion. Counterpart funds will finance land acquisition.

2. **Resilience Development**. Resilient Development will include: (a) Purchasing emergency spare parts and equipment for efficient and fast emergency and damage repair responses to future extreme weather events; and (b) providing technical assistance to DOMLEC to improve its climate diagnostics, undertake further climate risk assessments such as vulnerability mapping tool, develop an emergency preparedness plan and safety regulations for the upgraded transmission system.

Component 2: Technical Assistance (TA) and Project Implementation Support. This component will finance technical assistance to:

1. improving the capacity of DOMLEC to operate and manage the 33kV and 69kV networks sustainably, a more complex task than managing the present 11kV distribution system, through training, technical assistance and on the job learning by doing;
2. providing educational, training and employment opportunities for women in the energy sector. This sub-component will be financed with a US$0.25 million grant from Canada Clean Energy and Forest Climate Facility (CCEFCF);
3. carrying out capacity building in regulatory framework development and grid modernization through training, technical assistance; and
4. providing support for project implementation by DGDC through the provision of technical, engineering and project management expertise.

25. Sub-component 2.2 will support activities aimed at reducing the gender gap in female employment for technical jobs in the energy sector. It will provide women with educational programs and employment opportunities in electrical, mechanical engineering or other relevant majors, preparing them to obtain technical jobs in the energy sector. DGDC, in collaboration with the Ministry responsible for education and human resource development will undertake a series of activities to increase female employment in technical positions, including:

(a) Conducting outreach & education programs at the secondary school level to inform soon-to-be graduates of the profile and attractiveness to females of technical jobs in the energy and utility fields in Dominica to females. This work will involve identifying and assisting in dismantling the barriers to entry and advancement in these fields for women. It will include assistance to those choosing technology related subjects, to enable their success.

(b) Providing sponsorship programs including, *inter alia*, scholarships and stipends dedicated to women to pursue technical degrees or apprenticeships in the workplace for females at different levels in utilities and engineering companies. This broad program would be open to students and new graduates from Dominica State College, as well as other qualified females who have already left school.

Table 3. Cost Estimates and Financing, in US$ million

Component	Estimated Cost	Funding Source				Project's Associated Facility
		IDA loan	CCEFCF grant	Govt	Total	
Implemented by DGDC						Domestic Geothermal Power Plant with estimated cost of US$ 57 million financed by a private investor.
Component 1: Transmission Network Expansion and Resilience Development	**38.80**	**36.90**		**1.90**	**38.80**	
1.1 Network Expansion	35.30	33.40		1.90	35.30	
1.2 Resilience Development	3.50	3.50			3.50	
Component 2: Technical Assistance and Project Implementation Support	**1.85**	**1.60**	**0.25**	**-**	**1.85**	
Total	**40.65**	**38.50**	**0.25**	**1.90**	**40.65**	

C. Project Beneficiaries

26. **Direct project beneficiaries include grid-connected electricity-consuming business and households.** They will gain from an electricity system able to transport affordable geothermal electricity, enabling it to displace expensive diesel-based electricity. Cost savings will be passed on to them as lower retail prices. Lower electricity prices will improve business competitiveness compared with international rivals, and thus make Dominica a more attractive destination for investment. A more resilient and reliable electricity system will further strengthen Dominica's attractiveness to investors. Households will experience welfare gains arising from lower spending on electricity and more reliable service leading to improved income opportunities, education, and health.

27. **Women seeking technical jobs in the energy sector will benefit**. Labor force participation in Dominica is lower for women (59.5%) than men (70.6%) (2013 data) and the labor market is gender segregated. The 2011 Population and Housing Census indicates most women and men work in the service sector (37% and 30%, respectively). Women's employment is focused on the service sector. Only 3.3% of them are employed in industry compared with 12.8% for men. Associate degrees in electrical or mechanical engineering are critical to obtaining technical level positions in the energy sector. Apprenticeships (or internships) are also important, as there are few entry-level positions available, given that Dominica is a small-island state. Without apprenticeships, it can be difficult for new graduates to obtain their first employment opportunity. The project's target is that a minimum of 60 percent of the project's women beneficiaries of sponsorship program will be successfully employed in technical positions in the energy sector within the first year of completing the respective programs. Such technical positions could be across the energy sector, including within the utility, private sector companies, or the public sector.

28. **A wider group benefits from positive environmental externalities**. All Dominicans will benefit from lower local pollutant emissions as well as the reduced volumes of diesel landed, transported, and stored, with attendant risks of spills.

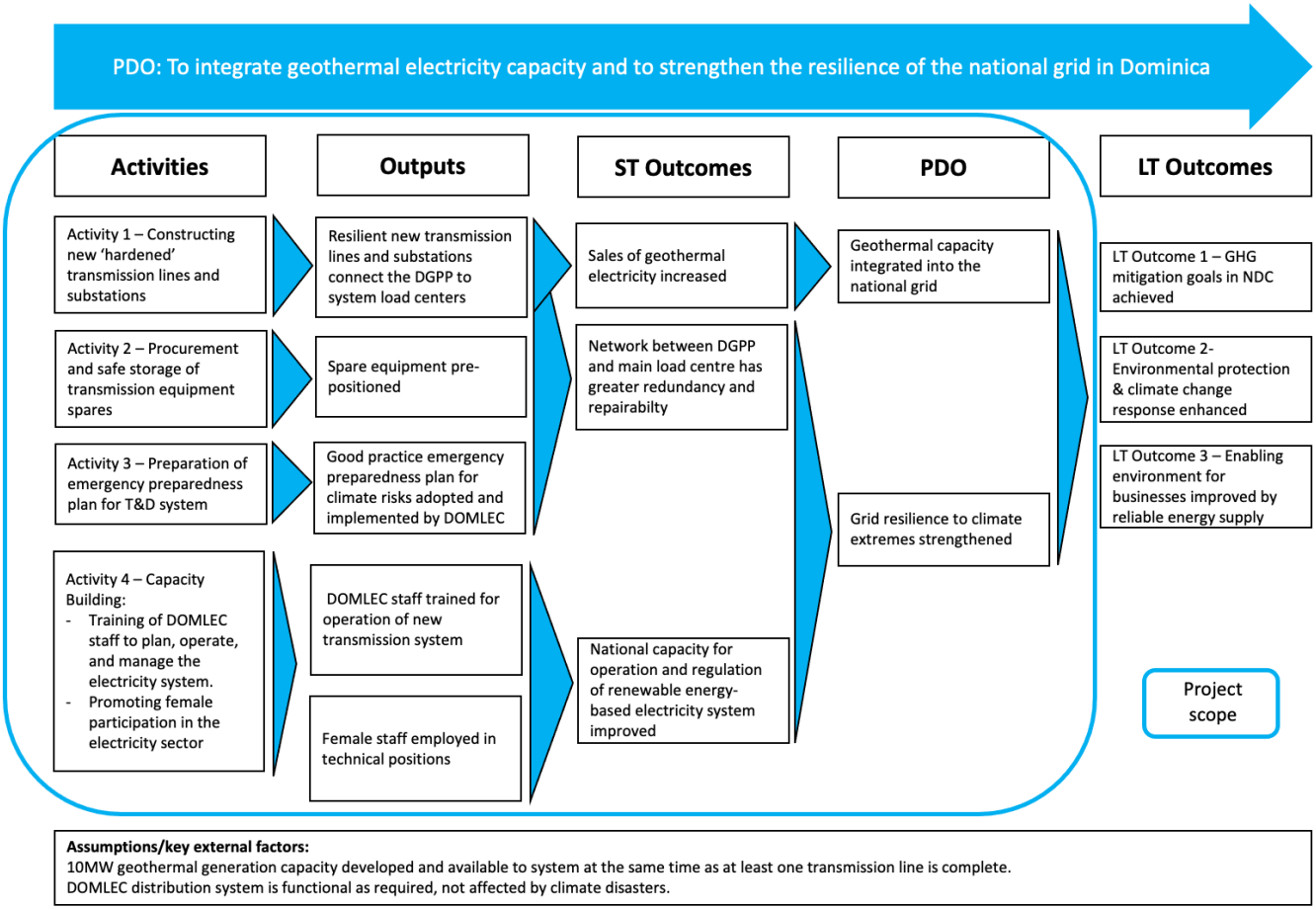
29. **Mitigation and adaptation climate co-benefits.** The transmission system to be built will evacuate indigenous renewable electricity from DGPP in the amount of 74.9 MWh per year to Dominican consumers, sustainably replacing over 60% of imported diesel fueled generation and associated GHG emissions. Adaptation benefits will be delivered through undergrounding the 33kV transmission lines which, along with the new overhead 69 kV transmission line connecting the

DGPP with Fond Cole, will create network redundancy. Through tailored design and advanced technologies resilience of the transmission infrastructure built under the project will be improved, reducing climate risks resulting from hurricanes and heavy rainfall.

D. Results Chain

30. The ***Theory of Change*** is illustrated in Figure 1.

Figure 1. Theory of Change



E. Rationale for Bank Involvement and Role of Partners

31. **The Bank can provide strategic added value in supporting Dominica's geothermal development program, given its global technical experience in the field.** The Bank has significant relevant technical experience gained over many years and contexts. The resource risk is high in any geothermal project and is particularly so in a greenfield development in a country where the technology is unproven. The Bank has supported a number of countries in the successful development of their geothermal resources. Small island electricity transmission and distribution systems encounter challenges as they integrate renewable energy sources and again, the Bank has had experience of supporting several countries in this endeavor. Last, the Bank's experience in assisting countries build back following natural disasters, including in the Caribbean, provides valuable insights.

32. **Access to public, concessional financing for expanding and building climate resilience of the T&D network is paramount to Dominica.** Its historic need to rebuild following hurricane Maria, small size and vulnerability to future hurricanes limit Dominica's attractiveness to private financing. In addition, DOMLEC's majority public ownership and its exclusive license for the T&D renders it unlikely that private financing beyond the DGPP is available in the amounts needed and on terms that maintain its financial viability while keeping tariffs affordable. The Bank has been able to use its convening power in DGRMP to obtain other sources of concessional financing in addition to IDA to support Dominica's geothermal development. A similar approach will be adopted for the proposed project to alleviate financial burden and risks to the government and consumers in Dominica.

33. **The proposed project will continue to serve as a platform for development partners in geothermal development and to enhance the sector resilience to climate extremes.** It will run in parallel with DGRMP initially and afterwards will become the main channel for donors to leverage debt financing and monitor progress and compliance of the DGPP. The proposed project will also serve as a platform for coordinating further support by development partners to assist the second phase of the transmission network expansion to scale up benefits of DGPP and build a more resilient power system in Dominica.

F. Lessons Learned and Reflected in the Project Design

34. **Lessons from Bank experience have been assimilated into project design.** Table 4 identifies the main lessons from experience and how they have been included in the project design.

Table 4: Key Lessons and Project Design

Lesson	Lesson incorporated Into Project Design
Prioritize interventions that focus on integrating renewable sources into power systems; support scale up; and use convening capacity to mobilize financing through partnerships and effective coordination within World Bank Group.	Project builds on DGRMP and is facilitating other sources of financing for both geothermal generation and T&D system build out. Further scale up contemplated by including support for planning future transmission system expansion with potential co-financing from other international donors
Ensure continuing alignment between client priorities and Bank intervention.	Project design fits naturally with DGRMP which has established close liaison between the government, DGDC, DOMLEC, IRC and the Bank. Alignment within government and stakeholders is to be maintained through joint working arrangements.
Focus on grid stability, long term, and integrated approaches.	Technical design aims at improving system resilience to ensure close integration of geothermal into the system.
Access does not end with the arrival of a connection but depends on power supply adequacy, service reliability, affordability and quality. Maintain financial sustainability.	Project aims to improve power quality, make it more resilient while also reducing supply costs. Involvement of government and regulator supports these aims.
Align project with implementation capacity and take measures to address slow implementation by setting modest objectives and working closely with implementing agencies. Consolidate scarce government capacity in a centralized implementation agency.	Project designed for simplicity, to be implemented by DGDC to take advantage of its solid operational and fiduciary capacity. Substantial, targeted, but flexible technical assistance to support DGDC and DOMLEC.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

35. **Project implementation will be led by DGDC with support from internationally experienced consultants.** DGDC is the implementing agency for the on-going DGRMP and has primary responsibility for the DGPP development on behalf of the government. DGDC is a Limited Liability Company which has a fully independent Board of Directors and three

Shareholder Representatives, which exercise Government's shareholder rights in the same manner as the shareholders of any other private company. These Shareholder Representatives are the Cabinet Secretary, Financial Secretary and Permanent Secretary in the Ministry responsible for energy. They elect four directors, including an Executive Chairman. None of them is a member of the Government. The Board has responsibility for approving contract awards and signing contracts with providers. DGDC has eight permanent staff members with responsibility for procurement, technical, financial, safeguards and administrative functions reporting to its Managing Director. The contract of the Owner's Engineer (OE) which has extensive experience in similar projects will be extended to support the project in all aspects including technical, procurement, contract management and capacity building. Other consultants will be recruited to support implementation of the E&S plans and provide additional procurement support during tender processes.

36. **The transmission assets to be built under the project are to be leased to and be operated by DOMLEC.** DOMLEC is structured as a vertically integrated utility in the generation, transmission, and distribution of electricity. DOMLEC has no experience in operating the network at higher voltage levels than 11 kV, nor of geothermal electricity. It must thus build its human resource and skill sets during project implementation so that it is ready to lease and operate the 33 kV and 69 kV transmission lines and substations built by the Project.

37. **DGDC will be partnered with DOMLEC for the project implementation under oversight of Stakeholder Executive Team (SET).** DOMLEC has already engaged closely with DGDC during project preparation and the three new substations will be built on DOMLEC owned land. During project implementation, DOMLEC is committed to scale up its support into a full engagement in engineering design decisions and construction supervision. At least one DOMLEC engineer will be assigned to work full time for the project. In addition, DOMLEC will assign 10 technical, health and safety, and human resource staff, forming project Functional Teams to work part time with DGDC. An on-the-job training program for the DOMLEC team will be included in the scope of work of the OE and the selected engineer, procure and construct (EPC) contractor. The SET comprising the heads of DOMLEC, the IRC and DGDC will be established. The SET will ensure stakeholder alignment on key aspects of the project implementation, including project schedules, capacity building, associated projects and technical/regulatory requirements for construction and future operation of the new network. It will meet monthly and any issues which cannot be resolved within this team will be escalated to the DGDC Shareholder Representatives. A project operation manual (POM) has been drafted and will be finalized before the project becomes effective. The governance arrangements for the project are illustrated in Figure 2.

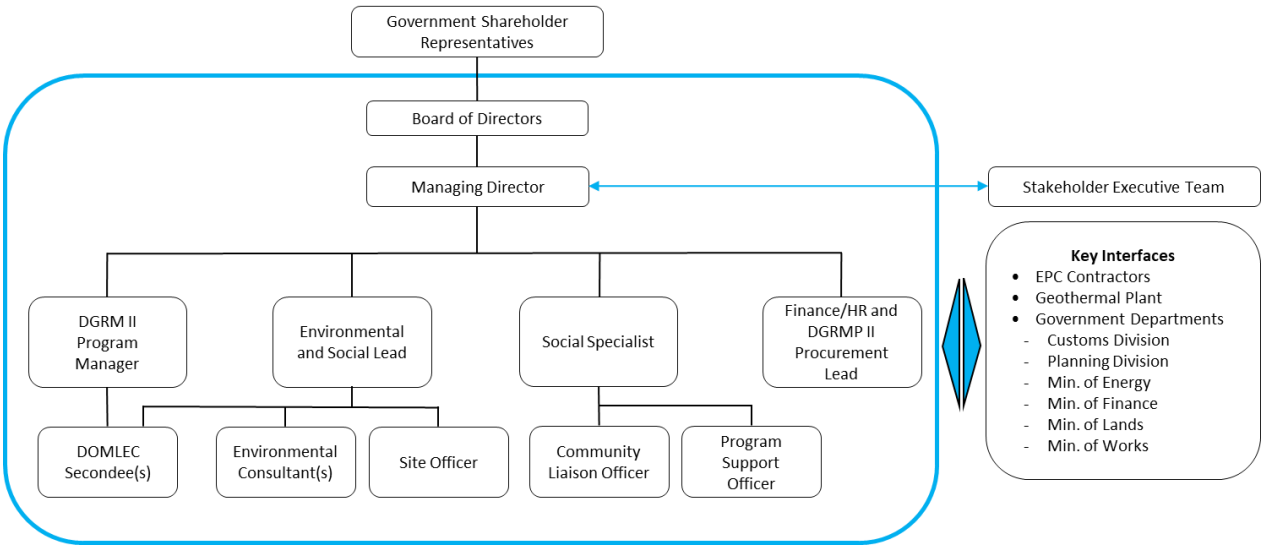
38. **Project agreements will backstop the governance arrangements.** Funding made available to the Project from the World Bank and other development partners will be channelled to DGDC through the Government. Legal agreements for credits and grants between the Government and the World Bank and a project agreement between DGDC and the World Bank will be entered. Therefore, the Government will enter into a Subsidiary Financing Agreement with DGDC to transfer funding on the same conditions to the company. An Operations, Maintenance and Lease Agreement (OMLA) will be signed between the Government and DOMLEC to govern the leasing arrangement and operations of the transmission assets.

39. **Gender.** DGDC will lead the gender program in partnership with the Ministry responsible for education and human resource development. DGDC will enter a Memorandum of Understanding with the Ministry for its supports to the program activities, which also involve other stakeholders such as Dominica State College, DOMLEC etc. DGDC will include in the POM detailed eligibility criteria and procedures for the selection of Eligible Beneficiaries and for the approval, granting and supervision of Scholarships and Stipends under the gender program acceptable to the Bank. DGDC will prepare annual work plans for the program following procedures to be detailed in the POM. External consultants will be recruited to support the planned outreach and communication activities.

40. **Early implementation actions are under way.** The bidding documents for the procurement of the transmission equipment which were prepared and given no objection by the Bank, have been issued. Retroactive financing, permitted under the project, will allow the procurement to proceed while agreements and other tasks are completed. To make best

use of limited capacity, one transmission line will be given priority so that it is ready in time for the testing of the power plant.

Figure 2. Project Implementation and Governance



B. Results Monitoring and Evaluation Arrangements

41. **Monitoring and Evaluation (M&E) will be the responsibility of DGDC with support from its consultants and DOMLEC**. The results framework and its M&E include indicators of progress towards the PDO and intermediate results indicators linked to the completion of outputs. Periodic target values for the indicators have been estimated for the expected five-year project duration. DGDC will be responsible for gathering and consolidating information on project activities and submitting progress reports every six months to the Bank against the intermediate results indicators, supported as necessary by the owner's engineer and DOMLEC functional team. DGDC will also prepare a project completion report which will serve as input for the World Bank's Implementation Completion and Results Report (ICR). The results framework is found in Section VII below.

42. **DGDC will also report on progress of DGPP.** Delay in completion of DGPP can affect the viability of the transmission lines; similarly, delay in completion of the transmission lines can affect the viability of DGPP. DGDC will therefore monitor and report on progress of DGPP as part of the M&E framework for the proposed project, forming the basis for a continued dialogue.

C. Sustainability

43. **Macroeconomic and sector policies support the transition to geothermal power.** Both the Climate Resilience and Recovery Plan and the NRDS, both published in 2020 and planned to run through 2030 underpin the government's high-level commitment to switching from diesel to geothermal electricity generation for both climate and economic reasons. The allocation of CBI revenue to geothermal and fiscal consolidation, to provide headroom for further climate investment underpins the sustainability of the transition. At the sector level, IRC will approve the power purchase agreement between DOMLEC and the private project company subject to the latter obtaining a generation license.

44. **There are strong incentives to maximize geothermal generation.** The regulatory regime which governs the tariffs DOMLEC can charge consumers underpins geothermal electricity because its production cost is lower than diesel, currently the only alternative. Future generation by wind or solar, even if lower cost, is unlikely to displace geothermal altogether because of the need for baseload capacity, especially during low wind periods or at night. The tariff regime allows DOMLEC to earn a return on its regulated assets, which will include all those to be constructed under the proposed project including those which improve system resilience. Because the assets to be constructed will be critical to the sustained operation of the DOMLEC system, they can be expected to be fully utilized.

45. **Timely completion and operation of DGPP is critical to sustainability.** The project will invest in a new transmission network dedicated to evacuating electricity from the DGPP to the grid. Its economics relies on the availability of electricity from DGPP for transmission to Roseau where it can be distributed and sold. The government has made clear its commitment to ensuring completion of DGPP, evidence of which includes the signing of the Geothermal Resources Concession Agreement with the private sector developer and operator of the plant.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic, and Financial Analysis (if applicable)

Technical

46. **The project technical design and load flow analyses have been undertaken for the proposed transmission lines and substations.** The reports have been reviewed by the Bank and found satisfactory. The project will introduce new technologies to Dominica's electrical sector. The national grid currently operates at 11 kV, while the project introduces 33 kV and 69 kV voltage levels. To build its resilience against climate extremes, the overhead transmission lines are designed with steel monopole structures, which is a departure from the wooden poles currently in use. Importantly, the project plans a parallel second transmission line underground, which would protect it against impacts of wind, floods and landslides and creates redundancy for the grid connection with the DGPP in case the overhead line fails. The new substations will also introduce new technology in the form of gas insulated switchgear (GIS). The equipment and technologies to be introduced are commercially proven and have been widely used by utilities in developed and developing countries, including in neighboring countries in the Caribbean and will be implemented in accordance with internationally accepted technical standards. Building capacity in DOMLEC to enable it to successfully operate the new transmission infrastructure is essential to meet the project objectives and thus is included in both components. The on-the-job training and skills transfer to be provided by the OE and the transmission network EPC contractor under Component 1 will backstop any teething troubles. A dedicated capacity building plan for DOMLEC will be prepared and implemented under Component 2.

Economic and Financial Analysis

47. **The economic and financial feasibility of the project is based on the methodology of cost-benefit analysis following the applicable World Bank guidance documents**.[29] Although the proposed project is directed to the development of the transmission network, this investment is essential to the proposed geothermal generation investment (without which that generation cannot reliably be delivered), and therefore the economic analysis assesses the *combined* geothermal and transmission project. A short summary of the results is provided below with the detailed analysis in Annex 3.

[29] *Investment Project Financing Economic Analysis* OPSPQ Guidance Note, 2013. *Power Sector Investment Projects: Guidelines for Economic Analysis*, GEEDR 2016. *Integrating Climate Change and Disaster Resilience into the Economic Analysis of Power Sector Investment Projects* ESMAP*GFDRR, 2022.

48. **Economic Analysis.** The analysis shows that the project net present value (NPV) at a discount rate of 6% is US$ 36.7 million and the economic rate of return (ERR) is at 9.9%. At the low estimate of the social value carbon (SVC), the NPV increases to US$67.9 million with an ERR of 12.7%, and at the high estimate of SVC, the NPV increases to US$99.2 million with an ERR of 15.2%. These returns are all substantially above the 6% hurdle rate. The lifetime reduction in GHG emissions is 1.117 million tons.

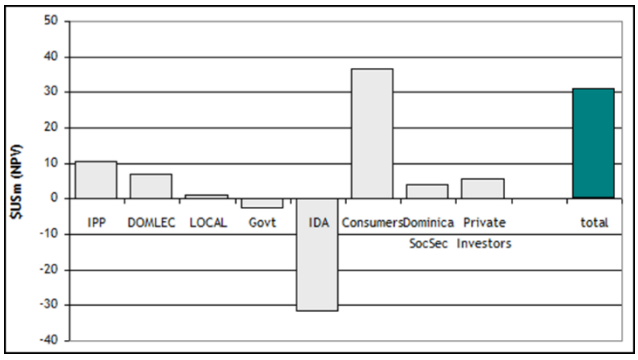
49. Sensitivity analysis indicates that the first and most important uncertainty is delay. The consequences would depend on whether the delay is in the IPP generation project (for which the PPA would provide for liquidated damages payable to buyer), or in the transmission project - in which case the buyer would need to compensate the seller (the generation IPP) under the take-or-pay provisions of the PPA. The switching value (at which the ERR falls to the hurdle rate of 6%) for delay is 3 years; if the delay is more than 3 years at the hurdle rate is not achieved.[30]

50. A second important uncertainty is the crude oil price. The switching value (at which the ERR falls to the hurdle rate of 6%) is around US$48/bbl. – which is highly unlikely as a long- term average. The 2022 IEA World Energy Outlook forecast for its "stated policies scenario" shows a 2030 crude oil price of US$82/bbl, while the Brent futures price on the commodity market (at the time of writing) is US$70/bbl.

51. The economic returns are seen to be robust with respect to the main assumptions.

50. Financial Analysis. The corresponding distributional analysis – that shows the distribution of financial benefits to each stakeholder – is shown in Figure 3. The net impact on Government is roughly neutral. Consumers are likely the main beneficiary of the project.

Figure 3: Distribution of financial benefits (as NPVs, 6% discount rate)



Climate Considerations

52. **Paris Alignment.** The operation is aligned with the mitigation and adaptation goals of the Paris Agreement.

53. **Assessment and reduction of mitigation risks.** The project does not carry a risk of preventing Dominica's transition to a low-carbon development pathway and will have a positive contribution to it by financing interventions that can be considered universally aligned and will support national efforts to GHG emissions reduction. Indeed, the project will build transmission lines and substations needed for testing, commissioning, and integrating the new geothermal power plant to the national grid, enabling an increase of the share of renewable electricity production in Dominica from 21% to 85% and sustainably replacing over 60% of imported diesel fueled generation.

54. **Assessment and reduction of adaptation risks:** The Climate and Disaster Risk Screening Tool was used to identify climate and disaster risks, such as flooding, an extreme rainfall patterns, storm surges and landslides which could potentially negatively impact the infrastructure implemented through the project. Adaptation risks were taken into

[30] This is a conservative assessment of the impacts of delay in the transmission line project being financed by the Bank – even if some of transmission upgrades are delayed, some part of the Geothermal generation project output may still be injected into DOMLEC's grid (albeit at higher losses and lower reliability).

consideration in the project design. Indeed, all new transmission lines and substations will be constructed to standards and with features which harden them against extreme weather events and subsequent effects such as flooding and erosion. For example, the second transmission line would be underground, which would protect it against impacts of wind, floods and landslides from hurricanes and creates redundancy for the grid connection with the DGPP in case the overhead line fails. In addition, the project will provide technical assistance to DOMLEC to improve its climate diagnostics, further climate risk assessments such as vulnerability mapping tool, develop an emergency preparedness plan and safety regulation for the upgraded T&D system which help reduce adaptation risks to an acceptable level.

B. Fiduciary

Financial Management

55. **The proposed financial management (FM) arrangement after mitigation measures is acceptable to the Bank**. FM and disbursement arrangements of the Project will be undertaken by DGDC, which has experience implementing Bank-financed project (DGRMP, P162149). The FM capacity assessment of DGDC was carried out to ensure that the relevant systems satisfy the Bank's minimum fiduciary requirements. The FM capacity assessment identified the following risks: (i) although DGDC has experience in managing Bank-funded project, DGDC's financial unit has only one FM Officer who is also responsible for supporting contract management activities, and (ii) adequate internal control systems may not be in place. Mitigation measures to address the above risks have been agreed to include: (i) training to DGDC on the Bank's fiduciary requirements, (ii) clearly defined roles and responsibilities of DGDC staff in the Operations Manual, (iii) project budget will be reviewed and approved by DGDC Board, and (iv) an Owner's Engineer (OE) with extensive experience in similar projects will be hired to support the project in all aspects including technical, procurement, contract management and capacity building. Details of the project financial management and disbursement arrangement are provided in Annex 2.

Procurement

56. **Procurement Procedures.** DGDC will carry out procurement activities under the project in accordance with the World Bank's "Procurement Regulations for IPF Borrowers dated September 2023 (Procurement Regulations). Moreover, the World Bank's Anticorruption Guidelines dated October 15, 2006 (revised January 2011 and July 1, 2016) shall be observed and applied.

57. The Project will use the Systematic Tracking of Exchanges in Procurement (STEP) system to plan, record, and track procurement transactions, documents, and complaints. DGDC shall upload all procurement and contract information in the STEP system, which will be used to provide the World Bank with a consolidated list of all contracts for works, goods, non-consulting services and consulting services awarded under the project and shall maintain STEP up to date with all the documentations generated in each procurement process till the payment of the last invoice. The World Bank will carry out post review annually with a sample selected from STEP.

58. **Project Procurement Strategy for Development (PPSD) and Procurement Plan (PP)**. Both PPSD and PP documents were prepared by DGDC, reviewed, and found satisfactory by the Bank. Procurement approach and methods for all contracts to be financed by this project will follow the selection methods and market approach options as detailed in the PP approved by the Bank. The PPSD and PP will be available on the World Bank's external website and in STEP or any other system agreed with the World Bank. They will be updated through STEP in agreement with the World Bank as necessary to reflect actual implementation needs to achieve the project development objectives.

59. **Procurement risk**. Overall, the procurement risk is rated *substantial* due mainly to: (i) the available resources within DGDC to manage contracts and procurement activities, (ii) lack of qualified bidders due to the country's remote location combined with the relatively small size of the project, and (iii) limited local technical experience in the new transmission system, geothermal power plant and facilities. As described earlier, DGDC will be staffed with a dedicated

procurement specialist with experience in World Bank's Procurement Regulations. The OE's contract will include support for the project team in procurement and contract management. Further an international procurement consultant with relevant experience in Bank financed projects, especially with procurement using rated criteria will be hired to provide additional support during the tender process. To further mitigate identified risks, DGDC will benefit from close support from the Bank through prior review of main contracts and will only use standard Bank documents and contracts templates for procurement. The World Bank will also carry out procurement support missions semiannually. The risk rating will be adjusted periodically during project implementation based on the implementation agency's performance.

60. **Retroactive financing.** Reimbursement will be available for the financing of eligible expenditures included in the Project description and paid for with counterpart funds not more than 12 months before the signing of the Financing Agreement. The total amount of retroactive financing is 20 percent or less of the Bank loan amount, the payments are for items procured in accordance with World Bank's Procurement Regulations, ESF requirements, and Anti-Corruption Guidelines.

C. Legal Operational Policies

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Area OP 7.60	No

D. Environmental and Social

61. **The environmental, health, and safety risks related to the construction of the transmission lines and upgrade and construction of the substations are Substantial** due to (i) the anticipated occupational health and safety risk during construction including working at heights and in difficult terrain; (ii) traffic management issues related to transporting equipment and materials through residential areas and narrow winding roads; (iii) potential impacts on biodiversity including the possibility of bird collisions; and (iv) the institutional capacity of DGDC to supervise and monitor the DGRMP which is the project's Associated Facility and has a Substantial E&S risk rating, and DGRMP II if both are implemented simultaneously. Although the project requires land acquisition for construction of the new 69 kV overhead line of about 7.6 km by expanding the existing easement of a non-operational 11 kV line owned by DOMLEC and the access road to it, the social risk rating is Moderate linked primarialy to impacts under ESS5 because the resettlement impacts are expected to be small and easy to manage as already documented in an Abreviated Resettlement Action Plan (ARAP). The ARAP will be updated once two realignments are finalized, but at this stage there are around 20 people who will be impacted by pole towers, tower easements, and acess road easements. The specific impacts will be loss of land, restrictions in use of land, and loss of crops and trees. Project Affected Persons (PAPs) and community members have been consulted with on the design of the transmission line, resulting in a design change to the underground cable segment between the Fond Cole to Glasgow, with other changes to reduce impacts currently being investigated. No other significant issues were raised during the public consultations.

62. **Environmental and social Impacts are likely to be short-term and reversible and will be addressed through mitigation measures incorporated into the Environmental and Social Management Plan (ESMP)** in line with good international industry practice (GIIP) delineated in the WB Group General Environmental, Health and Safety (EHS) Guidelines and Guideline for Electric Power Transmission and Distribution. Final drafts of the environmental and social instruments - Environmental and Social Impact Assessment (ESIA), Environmental and Social Management Plan (ESMP)

(with biodiversity management plan), ARAP, Labor Management Procedures, and Stakeholder Engagement Plan (SEP) which were reviewed by the Bank, have been disclosed in November 2023.

63. DGPP is an associated facility for the purposes of environmental and social standards. The environment and social instruments for the plant were updated and cleared by the Bank in 2021, following Performance Standards. The RAP is to be implemented by the Ministry of Housing and Urban Development in coordination with DGDC.

64. **Citizen engagement.** The SEP provides guidance for stakeholder engagement during project implementation; laying the foundation to strengthen and maintain relationships with all stakeholders throughout the project cycle. Two stakeholder consultations and engagements are expected every year on average during the project implementation. The SEP will be periodically revised and updated as necessary during project implementation. The DGDC's Social Specialist and Community Liaison Officer (CLO) will be primarily responsible for SEP implementation, under the oversight of the DGDC's Managing Director. Grievances related to land valuation and compensation will be addressed by the Lands Department of the Government with support from DGDC, while other grievances related to ARAP implementation, such as impact on livelihoods, will be addressed by DGDC. Overall, DGDC will be responsible for all other project-related grievance redress including monitoring and evaluation.

V. GRIEVANCE REDRESS SERVICES

65. **Grievance Redress.** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result of Bank non-compliance with its policies and procedures, and the Dispute Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the Bank's Grievance Redress Service (GRS), visit http://www.worldbank.org/GRS. For information on how to submit complaints to the Bank's Accountability Mechanism, visit https://accountability.worldbank.org.

VI. KEY RISKS

66. **The overall residual risk is assessed as substantial**. Key substantial risks include:

67. **Macroeconomic risks are *Substantial***. The after-effects of the pandemic continue to affect the macroeconomic position. While macroeconomic management by government is largely sound, modest growth and exposure to potential external shocks or weather events threaten willingness to continue with reforms which could have a significant effect on the government budget, which would affect the adequacy and timeliness of counterpart funding, including for land acquisition which is critical for the achievement of the PDO. The fiscal position is improving, notwithstanding Dominica being at high risk of debt distress. Demand for electricity is likely to remain high even with a weakening or unstable macro-economic picture and will further grow as the economy diversifies. Bank and IMF staff are engaged with the authorities, and both mitigate and provide early warning of deterioration of the macro-economic situation.

68. **Institutional capacity for implementation and sustainability risks are rated *Substantial***. The proposed project will be added to the DGDC portfolio which includes the implementation of the on-going DGRMP and the negotiations and the upcoming supervision of the privately financed DGPP development on behalf of the government. There are risks that the additional responsibility will overburden DGDC management and staff. Delays in completion of DGPP could jeopardize

the PDO because there would not be the required geothermal energy for use. The division of responsibilities between DGDC as the implementing agency and DOMLEC which will take over and operate the transmission lines and substations creates a further risk. DGDC may not have the management expertise, technical skills, or incentives to ensure the transmission lines and substations meet DOMLEC's requirements or technical standards while DOMLEC may not be willing or have incentives to take over an asset for the construction of which it was not directly responsible.

69. Mitigation measures already include the technical assistance under DGRMP aimed at building capacity of DGDC and IRC, and coordination with other international donors which have been engaged with the selected private investor in the DGPP development. The OE will support both DGDC and DOMLEC. The SET includes heads of DGDC, DOMLEC and IRC and is geared to manage project risks. DOMLEC has stated its commitment to partner with DGDC and has increasing incentives to ensure the project is delivered on time because its own generation assets are increasingly unreliable and prone to fail. DOMLEC has created a functional team, including one full time staff member to work on the project. Secondment of DOMLEC staff to DGDC and joint participation in the Technical Working Group to supervise construction will reduce uncertainty. A draft OMLA between DGDC and DOMLEC has been prepared, finalization of which will clarify the handover arrangements. Progress in development and construction of DGPP has been included in the M&E plan to allow continuous assessment of this risk as well as the implementation risks of the transmission line.

70. **Fiduciary risks are Substantial due to procurement risk.** Although DGDC has experience in implementation of the DGRMP, there is still uncertainty in the market readiness for the planned procurement of the transmission investment given the low awareness by international suppliers of goods, works and services of investments in the electricity sector in Dominica and across the Caribbean in the last decade while the capacity of local suppliers of civil work is very limited. The structure of DGDC as a private company streamlines approval process but also limits the oversight by the government of its procurement decisions. Project Procurement Strategy Development expanded the market research for the project activities and developed the project strategy to mitigate the risks.

71. **Environmental and social risks are *Substantial***. The environmental, health and safety risks related to the construction of the transmission lines and upgrade and construction of the substations are *Substantial* due to (i) the occupational health and safety risk during construction including working at heights and in difficult terrain; (ii) the traffic volumes needed to transport equipment and materials through residential areas and narrow winding roads; (iii) the potential impacts on biodiversity including the possibility of bird collisions; and (iv) the institutional capacity of DGDC to supervise and monitor the DGRMP which is the project's Associated Facility having a Substantial E&S risk rating and DGRMP II as both are implemented simultaneously. Although the project requires land acquisition for construction of the new 69 kV overhead line of about 7.6 km by expanding the existing easement of a non-operational 11 kV line owned by DOMLEC and the access road to it, the social risk rating is *Moderate* because the resettlement impacts are expected to be small and not involve the resettlement of people. These impacts relate to assets such as crop and tree damage and livelihoods impacts which are expected to occur during the construction phase and for which DGDC has some experience in handling according to World Bank requirements. To date, the required social risk mitigation actions are being well implemented. Early consultations were held with impacted communites with no significant issues being raised. Impacts are likely to be short-term and reversible and would be addressed through mitigation measures incorporated into the Environmental and Social Management Plan (ESMP) in line with good international industry practice (GIIP) delineated in the WB Group General Environmental, Health and Safety (EHS) Guidelines and Guideline for Electric Power Transmission and Distribution. The draft project environmental and social instruments such as Environmental and Social Management Framework, Resettlement Action Plan, Labor Management Plan and Stakeholders Management Plan have been completed and disclosed.

VII. RESULTS FRAMEWORK AND MONITORING

PDO Indicators by PDO Outcomes

Baseline	Closing Period
Geothermal electricity capacity integrated into the national grid	
Capacity of privately developed geothermal electricity generation connected to the national grid (Megawatt)	
Dec/2023	Feb/2029
0	10
Increased share of renewable electricity generation production in the generation mix (Percentage)	
Dec/2022	Feb/2029
21%	85%
GHG emissions avoided under the project (Tones/year)	
Dec/2023	Feb/2029
0	49,479
The resilience of the national grid strengthened	
Share of transmission lines in length constructed underground under the project. (Percentage)	
Dec/2023	Feb/2029
0	61
Availability of spare parts for emergency use within 7 km of the transmission lines and substations constructed under the project (Yes/No)	
Dec/2023	Feb/2029
No	Yes

Intermediate Indicators by Components

Baseline	Closing Period
Technical Assistance and Project Implementation Support	
DOMLEC staff benefited from on-the-job and other trainings (Number)	
Dec/2023	Feb/2029
0	30
Outreach/advocacy workshops/events to promote females in technical jobs (Number)	

Dec/2023	Feb/2029
0	6
Scholarships provided for female students to pursue electrical, civil, or mechanical engineering degrees (Number)	
Dec/2023	Feb/2029
0	10
Apprenticeships/internship support provided for female students in STEM field (Number)	
Dec/2023	Feb/2029
0	10
Female beneficiaries successfully employed in technical positions within the first two years of completing scholarship and apprenticeship programs (Percentage)	
Dec/2023	Feb/2029
0	60
Feedback received and implemented during stakeholder consultations and engagements during project implementation (Percentage)	
Dec/2023	Feb/2029
0	70
Transmission Network Expansion and Resilience Development	
Transmission lines constructed under the project (core sector indicator) (Kilometers)	
Dec/2023	Feb/2029
0	18.7
33kV transmission line connecting DGPP to Fond Cole: construction progress (Percentage)	
Dec/2023	Feb/2029
0	100
33kV line connecting DGPP to Fond Cole: commissioning and acceptance (Yes/No)	
Dec/2023	Feb/2029
No	Yes
69kV line connecting DGPP to Fond Cole: construction progress (Percentage)	
Dec/2023	Feb/2029
0	100
69kV line connecting DGPP to Fond Cole: commissioning and acceptance (Yes/No)	
Dec/2023	Feb/2029
No	Yes
11 kV transmission line connecting DGPP to Laudat Station: construction progress, including commissioning and acceptance (Percentage)	
Dec/2023	Feb/2029
0	100
69/33/11kV substation at Fond Cole: construction progress (Percentage)	

Dec/2023	Feb/2029
0	100
69/33/11kV substation at Fond Cole: commissioning and acceptance (Yes/No)	
Dec/2023	Feb/2029
No	Yes
33 kV Substations at New Trafalgar and at Padu: construction progress (Percentage)	
Dec/2023	Feb/2029
0	100
33 kV Substations at New Trafalgar and at Padu: commissioning and acceptance (Yes/No)	
Dec/2023	Feb/2029
No	Yes
Spares purchase and storage for the transmission lines and substations (Percentage)	
Dec/2023	Feb/2029
0	100
An Emergency Preparedness Plan for the transmission network is adopted by DOMLEC for implementation (Yes/No)	
Dec/2023	Feb/2029
No	Yes

Monitoring & Evaluation Plan: PDO Indicators by PDO Outcomes

Geothermal electricity capacity integrated into the national grid.	
Capacity of privately developed geothermal electricity generation connected to national grid (Megawatt)	
Description	Electricity generating capacity installed connected to the Laudat substation in MW
Frequency	Six monthly from second year of project
Data source	Owner's engineer progress report
Methodology for Data Collection	Field measurement, based on completion of commissioning tests of the geothermal plant and of Laudat substation
Responsibility for Data Collection	Technical Working Group, using owner's engineer reports and reports from DG
Increased share of renewable electricity generation production in the generation mix (Percentage)	
Description	Share of renewable energy generation (hydro, geothermal and solar) in Dominica generation mix
Frequency	Six monthly from second year of project
Data source	DOMLEC
Methodology for Data Collection	Purchases/electricity generation measured on DOMLEC meters at geothermal and hydro generation substations
Responsibility for Data Collection	DGDC in liaison with DOMLEC
GHG emissions avoided under the project (Tones/year)	
Description	GHG emissions avoided by substituting geothermal electricity generation for diesel-based intones CO_{2e}/year
Frequency	Six monthly from second year of project
Data source	DOMLEC
Methodology for Data Collection	Purchases of geothermal generation measured on DOMLEC meters at DGPP substation assumed to substitute entirely for generation at Fond Cole diesel power plant
Responsibility for Data Collection	DGDC in liaison with DOMLEC
The resilience of the national grid strengthened	
Share of transmission lines in length constructed underground under the project (Percentage)	
Description	Percentage of the new transmission network length built underground out of total new transmission lines constructed under the project which are highly resilient to hurricanes impacts such as wind, floods, and landslides.
Frequency	Once at project close
Data source	DOMLEC
Methodology for Data Collection	
Responsibility for Data Collection	DGDC in liaison with DOMLEC
Availability of spare parts for emergency use within 7 km of the transmission lines and substations constructed under the project (Yes/No)	
Description	Availability of critical spare parts for overhead transmission lines, underground lines and substations securely stored within 7 km of each transmission line and substation.
Frequency	Once at project close
Data source	DOMLEC
Methodology for Data Collection	
Responsibility for Data Collection	DGDC in liaison with DOMLEC

Monitoring & Evaluation Plan: Intermediate Results Indicators by Components

Transmisison Network Expansion and Resilience Development	
Transmission lines constructed under the project (core sector indicator) (Kilometers)	
Description	Length of 69 kV and 33 kV transmission lines constructed in km
Frequency	Six monthly from second year of project
Data source	Owner's engineer progress reports.
Methodology for Data Collection	Field measurement correlated with technical design/specification.
Responsibility for Data Collection	Technical Working Group, using owner's engineer reports.
33kV transmission line connecting DGPP to Fond Cole: construction progress (Percentage)	
Description	Percentage of physical work completed.
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	(Work completed ÷Total work required) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC
33kV line connecting DGPP to Fond Cole: commissioning and acceptance (Yes/No)	
Description	Commissioning and acceptance of line
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	
Responsibility for Data Collection	DGDC
69kV line connecting DGPP to Fond Cole: construction progress (Percentage)	
Description	Percentage of physical work completed.
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	(Work completed ÷Total work required) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC
69kV line connecting DGPP to Fond Cole: commissioning and acceptance (Yes/No)	
Description	Commissioning and acceptance of line
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	
Responsibility for Data Collection	DGDC
11 kV transmission line connecting DGPP to Laudat Station: construction progress, including commissioning and acceptance (Percentage)	
Description	Construction, commissioning and acceptance of line
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	(Work completed ÷Total work required) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC
69/33/11kV substation at Fond Cole: construction progress (Percentage)	
Description	Percentage of physical work completed
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	(Work completed ÷Total work required) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC

69/33/11kV substation at Fond Cole: commissioning and acceptance (Yes/No)	
Description	Yes/no – either the substation is commissioned and accepted, or not
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	
Responsibility for Data Collection	DGDC
33 kV Substations at New Trafalgar and at Padu: construction progress (Percentage)	
Description	Percentage of physical work completed
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	(Work completed ÷Total work required) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC
33 kV Substations at New Trafalgar and at Padu: commissioning and acceptance (Yes/No)	
Description	Yes/no – either the substation is commissioned and accepted, or not
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	
Responsibility for Data Collection	DGDC
Spares purchase and storage for the transmission lines and substations (Percentage)	
Description	Measures the progress in delivery of spares to site
Frequency	Six monthly from second year of project
Data source	Parts supplier/Owner's engineer
Methodology for Data Collection	Good supplier will notify the owner's engineer when the spares arrive at destination. Owner's engineer will inspect for completeness and condition and accept spares on behalf of DOMLEC and notify relevant staff in DOMLEC who will inform the Technical Working Group
Responsibility for Data Collection	DGDC
An Emergency Preparedness Plan for the transmission network is adopted by DOMLEC for implementation (Yes/No)	
Description	An Emergency Preparedness Plan for the transmission network, completed by an international consultant, accepted by DOMLEC for implementation
Frequency	Six monthly from second year of project
Data source	Contractor/Owner's Engineer
Methodology for Data Collection	
Responsibility for Data Collection	DGDC in coordination with DOMLEC
Technical Assistance and Project Implementation Support	
DOMLEC staff benefited from on-the-job and other trainings (Number)	
Description	Measures the amount of training delivered/received by DOMLEC staff.
Frequency	Six monthly from second year of project
Data source	Consultant providing training.
Methodology for Data Collection	(Number of DOMLEC staff who have received training in planning, operating and managing the electricity system ÷ Total number of DOMLEC staff programmed to receive training) x 100 to give a value for percentage completion.
Responsibility for Data Collection	DGDC in coordination with DOMLEC
Outreach/advocacy workshops/events to promote females in technical jobs (Number)	
Description	Measures progress in promoting female participation in the electricity sector
Frequency	Six monthly
Data source	DGDC
Methodology for Data Collection	Number of workshops and other outreach activities undertaken ÷ total number of

	workshops and other outreach activities planned) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC
Scholarships provided for female students to pursue electrical, civil, or mechanical engineering degrees (Number)	
Description	Measures progress in promoting female participation in the electricity sector
Frequency	Six monthly
Data source	DOMLEC, training institutions
Methodology for Data Collection	Number of Scholarships provided to female students to pursue electrical, civil, or mechanical engineering degrees.
Responsibility for Data Collection	DGDC
Apprenticeships/internship support provided for female students in STEM field (Number)	
Description	Measures progress in promoting female participation in the electricity sector
Frequency	Six monthly
Data source	DOMLEC, training institutions
Methodology for Data Collection	Number of apprenticeships/internships undertaken ÷ total number of apprenticeships/internships planned) x 100 to give a value for percentage completion
Responsibility for Data Collection	DGDC
Female beneficiaries successfully employed in technical positions within the first two years of completing scholarship and apprenticeship programs (Percentage)	
Description	Measures progress in promoting female participation in the electricity sector
Frequency	Six monthly
Data source	DOMLEC, training institutions
Methodology for Data Collection	
Responsibility for Data Collection	DGDC
Feedback received and implemented during stakeholder consultations and engagements during project implementation (Percentage)	
Description	Measure level of engagement with stakeholders, local communities
Frequency	Six monthly
Data source	DGDC
Methodology for Data Collection	On completion of each consultation, Community officer prepare a report to DGDC management on the content of discussions; the numbers of people attended; number of suggestions received, responded to and implemented; and outcomes.
Responsibility for Data Collection	DGDC

ANNEX 1: Implementation Arrangements and Support Plan

COUNTRY: Commonwealth of Dominica
Dominica Geothermal Risk Mitigation II Project

1. **The strategy for project implementation support by the World Bank reflects the nature of the project and its risk profile.** The strategy aims at making IS to the implementing agency more efficient while remaining focused on the implementation of the risk mitigation measures identified in the Systematic Operations Risk-Rating Tool (SORT). The strategy is also an indicative and flexible instrument that will be revisited during project implementation, as part of the Bank's periodic supervision through ISRs and will be adjusted based on unforeseen challenges and field conditions.

2. **World Bank team members will ensure timely, efficient, and effective implementation support to DGDC and will carry out formal implementation support missions and field visits at least one a year.** The Bank's supervision will review the progress of implementation of each Component and its contribution to the PDO and will support the following critical areas: (i) technical implementation support to ensure that the project is being carried out in an efficient, effective and integrated manner; (ii) fiduciary capacity support to ensure that the funds are used in accordance with value-for-money and that there is adequate capacity, internal control systems, and overall governance; and (iii) oversight of the management of environmental and social factors in the area of influence of the project. Particular attention will be paid to the procurement and execution of the contract for the transmission expansion, which accounts for about 90% of the project funds. Apart from technical support from a power engineer specialized in T&D, a specialist on geothermal energy generation will also be provided to monitor the DGPP integration to the network. A gender specialist will also be added to the team to support implementation of the gender program. The World Bank team will coordinate closely with the government, IRC, DOMLEC and other stakeholders to monitor project progress.

3. **The World Bank will provide support to the DGDC and training of the fiduciary staffs.** Regular supervision missions will ascertain whether the procurement and FM provisions of the project legal agreements and POM are being followed. The FM Specialist will review (i) the project's accounting and internal control systems, (ii) budgeting and financial planning arrangements, (iii) IFRs, (iv) audit reports, including financial statements and remedial actions recommended in the auditor's Management Letter, and (v) disbursement management and financial flows. Supervision of procurement activities will be carried out primarily through prior review supplemented by supervision missions at least twice a year. Procurement supervision will be more focused in the first 12 months of project implementation, when the higher risk contracts are expected to be awarded. The supervision missions will also review progress in the implementation of the Procurement Plan.

4. **World Bank specialists in environmental and social risk mitigation will be responsible for supervising the GoSL's compliance with World Bank Group safeguards policies and performance standards** and with the implementation of the ESMP and other E&S instruments prepared for the project. They will conduct supervision missions and site visits to the field twice a year during the duration of the project, review the deliverables prepared, provide technical assistance, and conduct training to support capacity building (including on gender-related issues) in the DGDC and other relevant agencies as needed.

Implementation Support Plan and Resource Requirements

5. The overall implementation support plan for the project and resource requirements are described in Table A.1 below.

Table A.1: World Bank Personnel Resources Required by Time Frame

Time	Focus	Skills needed	Resource estimate (Staff weeks)
First 12 months	Project management	TTL, Energy Specialist	20
	Power Engineering technical support	Transmission & Distribution engineering	8
	Geothermal generation technical support	Geothermal energy generation expert	4
	Procurement implementation support	Procurement Specialist	8
	Financial management implementation support	Financial Management Specialist	4
	Environmental implementation support	Environmental Specialist	5
	Social implementation support	Social Specialist	6
	Gender implementation support	Gender Specialist	4
12 months to Project end date	Project management	TTL, Energy Specialist	20
	Power Engineering technical support	Transmission & Distribution engineering	6
	Geothermal generation technical support	Geothermal energy generation expert	2
	Procurement implementation support	Procurement Specialist	4
	Financial management implementation support	Financial Management Specialist	3
	Environmental implementation support	Environmental Specialist	4
	Social implementation support	Social Specialist	4
	Gender implementation support	Gender Specialist	2

ANNEX 2: Financial Management and Disbursement Arrangements

COUNTRY: Commonwealth of Dominica
Dominica Geothermal Risk Mitigation II Project

1. **Budgeting, Accounting and Reporting.** DGDC will prepare an annual work plan and budget which will identify the detailed project activities. The annual work plan and budget will be submitted to the DGDC Board for approval, and thereafter to the Bank, for no objection. The annual work plan and budget will be consistent with the agreed format of the project IFRs. DGDC is required to conduct regular budget vs. actual variance analysis, report them on the semi-annual IFRs, provide reasons why differences occur between the planned (budget) and actual expenses if any, and take necessary actions to ensure the project is implemented as planned. The budget cycle should include planning and implementation of all project activities, which are to be reflected in the company's annual budget.

2. Administration, accounting, and reporting of the project will be set up in accordance with the Bank requirements, which obligate Borrowers to prepare financial statements in accordance with acceptable accounting standards. DGDC uses International Financial Reporting Standards (IFRS) Accrual Basis accounting principles, however, for the purpose of the project, Cash Basis of accounting will be followed. DGDC uses an appropriate Accounting Software System (QuickBooks) to record accounting transactions, which provides for separate, self-balancing sets of accounts in accordance with generally accepted accounting principles and procedures. All project budgeting and accounting transactions will run through the company's accounting system. This should function as the DGDC's budgetary and accounting tool, used to record the Project's expenditures and to make relevant payments in accordance with the annual budget. It will be the basis for the preparation of IFRs and any other required project financial statements, as well as for monitoring physical progress and contract management. All payments will follow the commitment, verification and payment routine. All project costs are to be recorded according to the established Chart of Accounts.

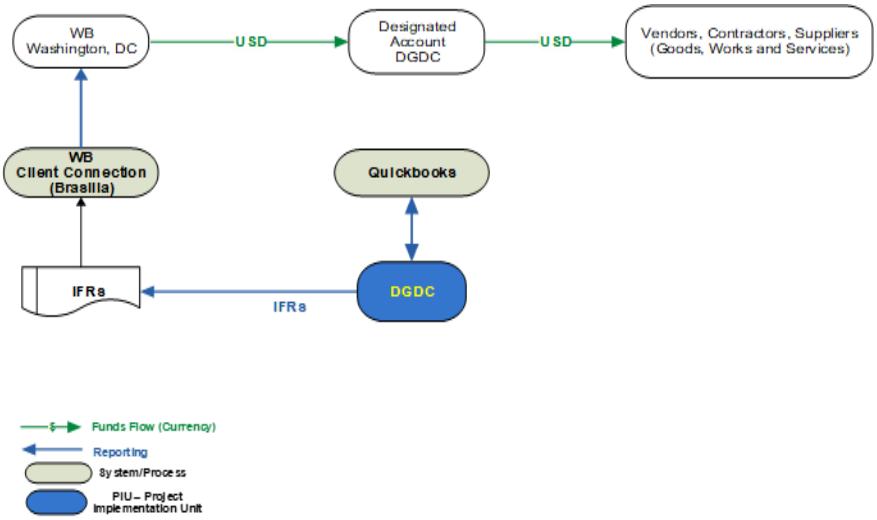
3. The Unaudited IFRs are due within 45 days following each calendar semester. The format of the IFRs is the same as the annual project financial statements except without the notes to the financial statements. Financial reporting will include project progress, Statement of Sources and Uses of Funds, Use of Funds by Components and Activities, Use of Funds by Disbursement Category, and Statement of Designated Account Reconciliation.

4. **Internal Controls**. To mitigate the project's potential risks around internal controls, regular oversight by MoF, periodic supervision from the Bank, and annual external audits will serve as the mechanism to ensure that controls are functioning appropriately. In addition, proper authorization for payment requests, segregation of duties, and other relevant internal control mechanisms will be clearly defined in the Operations Manual. Internal controls will provide management with reasonable assurance as to the safeguarding of assets against losses from unauthorized use or disposition, and the reliability of financial records for preparing financial statements. The internal control structure includes a series of checks and balances required for the appropriate recording and authorization of transactions and ensures that access to assets is limited to authorized personnel. Each transaction should be divided into component tasks completed by different staff members to increase the likelihood of detecting unintentional errors and prevent misappropriation. DGDC's integrated financial management system, used for recording transactions under the Project, should have inbuilt controls in place that help to ensure that transactions are properly authorized and that payments are made only for due circumstances (i.e. where goods or service are confirmed as delivered), as described in the POM.

5. **Funds Flow and Disbursement Arrangements.** The Bank loan proceeds will flow from the Bank into a project Designated Account (DA), denominated in USDD, at the Bank of Dominica. All bank withdrawal applications will need to be signed off by the authorized representatives via the Bank's Client Connection. The ceiling of the DA will be variable based on the cash forecast. The following disbursement methods may be used to withdraw funds from the Bank: (a) reimbursement, (b) advance, (c) direct payment and (d) special commitments. Funds deposited into the DA as advances

would follow World Bank disbursement policies and procedures, as stipulated in the Financing Agreement, and in the Disbursement and Financial Information Letter (DFIL). Advances made to the DA would be documented using IFRs and supporting documents defined in the DFIL. Documentation of eligible expenditures paid out of the DA are expected to be on a bi-annual basis, following the instructions included in the DFIL.

6. The following chart describes the flow of funds mechanisms to be used for the Project.



7. **External Auditing.** Annual project financial statements will be audited by an external auditor in accordance with acceptable auditing standards. The external audit will be conducted under Terms of Reference acceptable to the Bank. Auditors will be required to issue an opinion on consolidated project's financial statements, covering all sources of funding. Auditors will also be required to issue a Management Letter, where relevant internal control weaknesses will be identified, which will contribute to the strengthening of the control environment. The audit report and the Management Letter will be submitted to the Bank no later than within six months after DGDC's fiscal year end.

8. **Supervision Plan.** The scope of project supervision will entail assessment of the implementation of FM arrangements and FM performance; identification of corrective actions, if necessary; and monitoring of the FM risk. It will be determined based on the project risk and will include: (a) review of IFRs; (b) review of the audit report and follow-up on any issues raised by auditors in the management letter, as appropriate; (c) participation in project supervision; and (d) updating of the financial management rating in the Implementation Status and Results Report (ISR).

ANNEX 3: Economic and Financial Analysis

COUNTRY: Commonwealth of Dominica
Dominica Geothermal Risk Mitigation II Project

1. The economic and financial feasibility of the project is based on the methodology of cost-benefit analysis following the applicable World Bank guidance documents.[31] Although the proposed project is directed to the development of the transmission network, this investment is essential to the proposed geothermal generation investment (without which that generation cannot reliably be delivered), and therefore the economic analysis assesses the *combined* geothermal and transmission project.

2. Table A.2 shows the complete expenditure associated with the Dominica geothermal project. Costs incurred in 2023 or before are sunk and are excluded from the economic analysis.[32] Only the incremental costs incurred in 2024 and beyond are relevant to the investment decision now required (for the DGRMP-II project)

Table A.2: Total expenditure for geothermal development

Entity bearing the expenditure	Purpose	total	2020	2021	2022	2023	2024	2025	2026	2027
Geothermal Project [Generation]										
IPP	Power Plant	53.0					15.9	37.1		
IPP	Substation at the power plant	4.0					1.2	2.8		
DGRMP (WB loan+Grant)	Reinjection & Production wells	25.8		2.0	13.4	10.4	0.0			
DGRMP (Govt contribution)	Land, management	3.8	0.3	1.3	1.6	0.3	0.3			
Total Geothermal generation project		**86.6**	**0.3**	**3.3**	**15.0**	**10.7**	**17.4**	**39.9**	**0.0**	**0.0**
Transmission project										
DGRMP	TA for Transmission line	1.8				0.9	0.9			
DGRMPII (IBRD loan)	Transmission lines	38.5					7.7	11.6	15.4	3.9
DGRMPII by government	Land Acquisition, management	3.4					2.2	0.4	0.4	0.4
Total T&D		**43.7**	**0.0**	**0.0**	**0.0**	**0.9**	**10.8**	**12.0**	**15.8**	**4.3**

Economic Analysis

3. The key assumptions for the economic analysis are as follows (with all taxes and duties stripped out of the estimated financial costs):

- **Discount rate**: 6%. The numeraire is US$ at constant 2023 prices.
- **Transmission CAPEX**: As shown in Table 1 (but excluding sunk costs)
- **Make-up wells** are added every 8 years at US$10 million per well.
- **Geothermal O&M**: US$4.72million/year
- **Transmission OPEX**: 1.5% of CAPEX
- **Time horizon**: 25 years (as for the proposed PPA)
- **Geothermal production**: 83.2 GWh based on 95% availability (as assessed by the developer).
- **Social Value of Carbon**: low and high values as defined in the relevant World Bank Guidance document,[33] updated to 2003 prices.

[31] *Investment Project Financing Economic Analysis* OPSPQ Guidance Note, 2013. *Power Sector Investment Projects: Guidelines for Economic Analysis*, GEEDR 2016. *Integrating Climate Change and Disaster Resilience into the Economic Analysis of Power Sector Investment Projects* ESMAP*GFDRR, 2022.

[32] The World Bank's seminal guidance on economic analysis (L. Squire & H. van der Tak, *Economic Analysis of Projects*, World Bank,1984) notes that while sunk costs must be always excluded when evaluating an incremental investment, it is still useful to examine whether, in hindsight, the project decision (in this case to replace diesel with clean geothermal) including sunk costs, was well founded. The ERR at constant 2020 prices is indeed still above the hurdle rate at 6.5% (NPVUS$5.8million), or 11% at the low social value of carbon (NPV US$47.8million) and 13.2% (NPV US$74.1 million) at the high value of SVC.

[33] *Guidance* Note *for the Shadow Price of Carbon in Economic Analysis*, Nov 2017.

- **GHG emissions**: diesel 0.699 Kg/kWh; geothermal 0.162 Kg/kWh[34]
- **Diesel capacity credit**: with 13 diesel units currently in operation, some of which are long overdue for replacement, absent a detailed assessment of which units would be replaced and when, rigorous calculation of the capacity credit is difficult. The capacity credit is therefore based on the simplified (but conservative) assumption that DOMLEC would need to provide the same 10 MW of reliable power provided by the geothermal project into new reliable diesels. At US$700/kW for a 1-2 MW machine,[35] this implies a capacity credit of US$7 million.
- **Diesel fuel avoidance**: this is the principal benefit of the project, whose magnitude is set by the cost of imported diesel fuel. In 2022, when the average price of West Texas Intermediate (WTI)[36] was around US$95/bbl., the cost to DOMLEC for diesel was US$1.06/litre.[37] For the baseline estimate of economic returns we assume a 2030 crude oil price of US$80/bbl.[38]

4. Table A.3 shows the table of economic flows for the baseline estimate of economic returns. The ERR 9.9% (NPV US$36.7 million). At the low estimate of the social value carbon (SVC), the ERR increases to 12.7% (NPV US$67.9 million), and at the high estimate of SVC, the returns increase to 15.2% (NPV US$99.2 million). These returns are all substantially above the 6% hurdle rate. The lifetime reduction in GHG emissions is 1.117 million tons.

[34] Jacobs, *Dominica Geothermal Development, Environmental and Social Impact Assessment*, July 2018; Volume 2, section 5.3.1. This is somewhat higher than the World Bank default value of 0.122 Kg/kWh (https://documents1.worldbank.org/curated/en/875761592973336676/pdf/ Greenhouse-Gas-Emissions-from-Geothermal-Power-Production.pdf)
[35] DOMLEC's diesels range in size from 750kW to 2.4MW, the oldest dates to 1986, the most recent to 2009. Some are high speed diesels, some are medium speed. Estimates for new diesels ex-manufacturer in the US Gulf region are in the range of 250US$/kW to $330/kW, but delivered and installed costs estimates vary widely.
[36] The World Bank forecast for crude oil is the average of WTI, Brent and Dubai. WTI is typically US$1.5/bbl lower than the World Bank average.
[37] The ratio of the cost of US Gulf low sulfur diesel to WTI is taken at 1.1.
[38] The World Bank Commodity Market Outlook (CMO) that pre-pandemic forecasted 10-15 years ahead, is now limited to just two years ahead.

Table A.3: Table of economic flows

				NPV	2024	2025	2026	2027	2028	2029	2030
[1]	***Costs***										
[2]	***IPP***										
[3]	Geothermal Power Plant	53.00	[$USm]	**-45.1**	-15.90	-32.10	-5.00		-		
[4]	Substation		[$USm]	**-3.6**	-1.20	-2.80					
[5]	make-up wells[IPP]		[$USm]	**-8.1**	-	-	-	-	-	-	-
[6]	OPEX	4.72	[$USm]	**-47.8**	-	-	-	-4.72	-4.72	-4.72	-4.72
[7]	***Transmission line***										
[8]	DGRMP transmission line TA		[$USm]	**-0.8**	-0.89						
[9]	DGRMP-II IBRD loan	38.50	[$USm]	**-31.6**	-7.70	-11.55	-15.40	-3.85			
[10]	DGRMP-II Govt contribution		[$USm]	**-3.1**	-2.20	-0.40	-0.40	-0.40			
[11]	Transmission OPEX	0.015	[$USm]	**-5.8**	-	-	-	-0.58	-0.58	-0.58	-0.58
[12]	Total costs		[$USm]	**-145.6**	-27.89	-46.85	-20.80	-9.55	-5.30	-5.30	-5.30
[13]	***Benefits***										
[14]	avoided diesel generation		[GWh]					83.22	83.22	83.22	83.22
[15]	cost of diesel		[$/kWh]		0.21	0.21	0.21	0.21	0.20	0.20	0.20
[16]	avoided cost of diesel fuel		[$USm]	**176.7**	-	-	-	17.07	16.87	16.67	16.48
[17]	avoided diesel CAPEX	700	[$USm]	**5.5**	-	-	7.00				
[18]	Total benefits		[$USm]	**182.2**	-	-	7.00	17.07	16.87	16.7	16.5
[19]	**Net economic flows**		**[$USm]**	**36.7**	**-27.9**	**-46.9**	**-13.8**	**7.5**	**11.6**	**11.4**	**11.2**
[20]	ERR			9.9%							
[21]	***GHG emission impacts***										
[22]	Total emission reduction		[1000t]	-1117.2				-44.7	-44.7	-44.7	-44.7
[23]	Low SVC										
[24]	Social value of Carbon [low]		[$/ton]		54	55	56	57	59	60	61
[25]	GHG emission reduction benefit		[$USm]		0.0	0.0	0.0	2.6	2.6	2.7	2.7
[26]	**Economic flows incl. low SVC**		**[$USm]**	**67.9**	**-27.9**	**-46.9**	**-13.8**	**10.1**	**14.2**	**14.0**	**13.9**
[27]	ERR (incl low SVC)			12.7%							
[28]	High SVC										
[29]	Social value of Carbon [High]		[$/ton]		106	109	111	115	117	120	122
[30]	GHG emission reduction benefit		[$USm]		0.0	0.0	0.0	5.1	5.2	5.4	5.5
[31]	**Economic flows incl. low SVC**		**[$USm]**	**99.2**	**-27.9**	**-46.9**	**-13.8**	**12.7**	**16.8**	**16.7**	**16.6**
[32]	ERR		[ ]	15.2%							

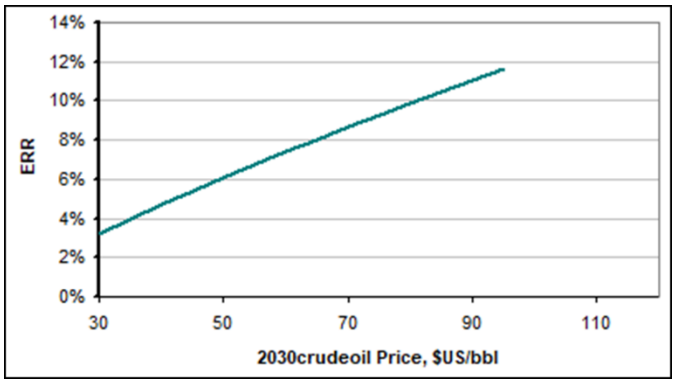
Note: snapshot only: model calculations extend to 25-year life

5. The first and most important uncertainty is delay. The consequences would depend on whether the delay is in the IPP generation project (for which the PPA would provide for liquidated damages payable to buyer), or in the transmission project - in which case the consequences the buyer would need to compensate the seller (the generation IPP) under the take-or-pay provisions of the PPA. The switching value (at which the ERR falls to the hurdle rate of 6%) for delay is 3 years; if the delay is more than 3 years at the hurdle rate is not achieved.[39]

6. A second important uncertainty is the crude oil price. The switching value (at which the ERR falls to the hurdle rate of 6%) is around US$48/bbl. – which is highly unlikely as a long-term average. The 2022 IEA World Energy Outlook forecast for its "stated policies scenario" shows a 2030 crude oil price of US$82/bbl., while the Brent futures price on the commodity market (at the time of writing) is US$70/bbl.

[39] This is a conservative assessment of the impacts of delay in the transmission line project being financed by the Bank – even if some of transmission upgrades are delayed, some part of the Geothermal generation project output may still be injected into DOMLEC's grid (albeit at higher losses and lower reliability).

Figure A.1: Sensitivity of economic returns to the oil price



7. The switching values for all the important assumptions are shown in Table A.4. The economic returns are seen to be robust with respect to the main assumptions.

Table A.4: Switching Values

		Baseline Value	Switching value	
Crude oil price	[US$/bbl.]		48	US$48/bbl. is highly unlikely, even for a single year, and extremely unlikely as a long-term average.
Diesel CAPEX	[US$/kW]	700	undefined	Even at zero capacity credit, the ERR only decreases to 9.1%
CAPEX (T&D project)	[US$USm]	US$40m	US$71.1 million (205% increase)	A205% CAPEX increase for a T&D is most unlikely. Past experience shows civil works increases of this order of magnitude, but not for the *total* cost.
Geothermal output	[GWh]	82.3	67 GWh (20% decrease)	A 20% generation reduction (as a long-term average value over the project lifetime) would imply a major project failure. DOMLEC would be protected by liquidated damage provisions of the PPA for failure to deliver the contracted quantity if this is the fault of the IPP and not covered under force majeure provisions.
Construction delays	[years]	0	3	See text

Financial Analysis

8. The incremental cash flow assessment is shown in Table A.5. These financial flows are based on the following additional assumptions:

- ***IPP revenue target***: 10.4% return on equity.
- ***IPP income taxes*** (levied at 25% of net profits) and benefit-sharing; as per IPP financial model.
- ***DOMLEC profits*****:** determined largely by the difference in power purchase costs from the geothermal IPP, and diesel fuel savings, with positive cash flows of ~US$6million per year.
- ***Tariff reductions***: 50% of net cash flow passed to consumers.
- ***DOMLEC retained earnings***: 25% of net cash profits.
- ***DOMLEC Dividends*** paid in proportion to equity shares (52% Government, 20% to Dominica Social Security Fund, 28% to other private investors)

Table A.5: Incremental financial flows

				NPVs	2024	2025	2026	2027	2028	2029	2030
[1]	***IPP transactions [from IPP financials]***										
[2]	PPA payments to IPP	[$USm]		123.8	-	-	-	11.28	11.37	11.47	11.57
[3]	Local community	[$USm]		-1.2	-	-	-	-0.11	-0.11	-0.11	-0.12
[4]	Income taxes	[$USm]		-3.1	-	-	-	-0.02	-0.30	-0.31	-0.32
[5]	IPPcashflows	[$USm]	10.4%	10.5	-	-8.48	-9.42	1.26	1.01	1.02	1.04
[6]	***DOMLEC incremental cashflows***										
[7]	energy purchased from IPF	[$USm]		-123.8	-	-	-	-11.28	-11.37	-11.47	-11.57
[8]	Transmission line CAPEX	[$USm]		-31.6	-7.70	-11.55	-15.40	-3.85	-	-	-
[9]	IDA financing	[$USm]		31.6	7.70	11.55	15.40	3.85			
[10]	Transmission line OPEX	[$USm]		-7.0	-	-	-	-0.58	-0.59	-0.60	-0.61
[11]	avoided diesel CAPEX	[$USm]		5.5	-	-	7.00				
[12]	avoided diesel costs	[$USm]		198.6	-	-	-	19.63	19.42	19.22	19.02
[13]	net cash flow before tariff re	[$USm]		73.4	-	-	7.00	7.77	7.46	7.14	6.84
[14]	tariff reductions	[$USm]	50%	-36.7	-	-	-3.50	-3.89	-3.73	-3.57	-3.42
[15]	net profit	[$USm]		36.7	-	-	3.50	3.89	3.73	3.57	3.42
[16]	Income tax	[$USm]	25%	-9.2	-	-	-0.88	-0.97	-0.93	-0.89	-0.85
[17]	net cash flow	[$USm]		27.5	-	-	2.63	2.92	2.80	2.68	2.56
[18]	retaimed earnings	[$USm]	25%	-6.9	-	-	-0.66	-0.73	-0.70	-0.67	-0.64
[19]	available for dividends	[$USm]		20.6	-	-	1.97	2.19	2.10	2.01	1.92
[20]	***Dividend distributions***										
[21]	Govt	[$USm]	52%	-10.7	-	-	*-1.02*	*-1.14*	*-1.09*	*-1.04*	*-1.00*
[22]	Dominica Social Security	[$USm]	20%	-4.1	-	-	*-0.39*	*-0.44*	*-0.42*	*-0.40*	*-0.38*
[23]	private investiors	[$USm]	28%	-5.8	-	-	*-0.55*	*-0.61*	*-0.59*	*-0.56*	*-0.54*
[24]	**Net cash flows**	**[$USm]**		6.9	-	-	**0.66**	**0.73**	**0.70**	**0.67**	**0.64**
[25]	**FIRR**	**[ ]**		**undefined, all cashflows positive**							

9. The corresponding distributional analysis – that shows the distribution of financial benefits to each stakeholder – is shown in Figure A.2. Obviously, IDA, which provides US$40million grant, appears as a significant loser (this being the point of concessionary assistance). Government is a small loser, because the incremental income tax revenue from the geothermal IPP and DOMLEC, and its dividend distributions from DOMLEC profits, do not make up for the loss of excise and customs revenue from diesel. However, given its 52% ownership of DOMLEC, the net impact on Government is roughly neutral. Consumers are likely the main beneficiary of the project.

Figure A.2: Distribution of financial benefits (as NPVs, 6% discount rate)