

Electricity-sector Transitions for Green Industrialization: A Case Study of Ethiopia

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Introduction

Climate change mitigation requires a transformative change in the way economies of different countries are structured, in the ways goods produced and consumed, and in the types of energy used to further economic growth.¹ In 2015, the Paris Agreement adopted a bottom-up approach, allowing for Nationally Determined Contributions by both developed and developing countries to address climate change.² In response, policy-makers in developing economies are increasingly adopting policies to pursue green industrialization pathways.³ Green industrialization entails the decoupling of industrialization from its harmful environmental impacts by greening the inputs, production, and outputs of industries.⁴ Sustainably industrializing is chal-

1. Samuel Fankhaeser, Friedel Sehleier, and Nicholas Stern, "Climate change, innovation and jobs," *Climate Policy* 8, no. 4 (2008): 421–429, doi:10.3763/cpol.2008.0513.

2. Robert Falkner, "The Paris Agreement and the new logic of international climate politics," *International Affairs* 92, no. 5 (2016): 1107–1125, doi:10.1111/1468-2346.12708; and Jennifer Jacquet and Dale Jamieson, "Soft but significant power in the Paris Agreement," *Nature Climate Change* 6, no. 7 (2016): 643–646, doi:10.1038/nclimate3006.

3. Padmasai Lakshmi Bhamidipati, James Haselip, and Ulrich Elmer Hansen, "How do energy policies accelerate sustainable transitions? Unpacking the policy transfer process in the case of GETFiT Uganda," *Energy Policy* 132 (2019): 1320–1332, doi:10.1016/j.enpol.2019.05.053; Chukwumerije Okereke et al., "Governing green industrialisation in Africa: Assessing key parameters for a sustainable socio-technical transition in the context of Ethiopia," *World Development* 115 (2019): 279–290, doi:10.1016/j.worlddev.2018.11.019; Judit Rodríguez-Manotas et al., "Getting on the ground: Exploring the determinants of utility-scale solar PV in Rwanda," *Energy Research & Social Science* 42 (2018): 70–79, doi:10.1016/j.erss.2018.03.007; Dani Rodrik, "Green industrial policy," *Oxford Review of Economic Policy* 30, no. 3 (2014): 469–491, doi:10.1093/oxrep/gru025; and Jeremy Wakeford et al., "Innovation for green industrialisation: An empirical assessment of innovation in Ethiopia's cement, leather and textile sectors," *Journal of Cleaner Production* 166 (2017): 503–511, doi:10.1016/j.jclepro.2017.08.067.

4. Ralph Luken and Edward Clarence-Smith, *Green Industrialization in Sub-Saharan Africa* (Dar es Salaam, Tanzania: Institute for African Leadership for Sustainable Development, February 2019), https://media.africaportal.org/documents/Green-Industrialisation-Report_Web_compressed.pdf; and UN Industrial Development Organization (UNIDO), *UNIDO Green Industry: Policies for supporting Green Industry* (Vienna: May 2011), https://www.unido.org/sites/default/files/2011-05/web_policies_green_industry_0.pdf.

lenging, however, for countries that are only beginning to industrialize, as they face a variety of challenges such as a lack of private capital and government financial resources to adopt efficient technologies, a lack of knowhow to deploy advanced technologies, weak institutions to design and implement environmental regulations, and weak political commitment.⁵ As developing countries attempt to industrialize in a climate-constrained world, it is crucial to look at countries that have seen relative success in their efforts.

Many developing countries such as Rwanda, Uganda, and Ethiopia have proposed plans to pursue green growth so that their economies can avoid locking in a messy transition in the future.⁶ Uganda was the first in Africa to introduce feed-in-tariffs and competitive auctions policies to deploy renewable energy.⁷ Rwanda has implemented market-driven policies for deploying grid-scale renewable energy.⁸ Ethiopia has gone one step further to become the first developing country to implement an economy-wide carbon-neutral growth strategy.⁹ With a population of 109 million and a median age of only 18 years, Ethiopia is faced with the critical need to industrialize and provide employment opportunities for its young demographic.¹⁰ Besides, with 70 percent of Ethiopia's population without an electricity connection, access to affordable electricity is a critical socioeconomic objective for the country.¹¹ Ethiopia has embraced the principles of a green economy and adjusted its industrial policy by adopting the concept of green industrialization.¹² Ethiopia's Growth and Transformation Plan (GTP), along with its Climate Resilient Green Economy (CRGE) strategy, aims to achieve middle-income status by 2025, all while ensuring the country's economic growth is carbon neutral.¹³ Some recent studies have looked at how Ethiopia's green industrialization strategy emerged and the level of green innovation in its leather and textile sector.¹⁴ This paper looks at how Ethiopia is transforming its electricity sector to be suitable for green industrialization and what further needs to be done for Ethiopia to integrate more non-hydro renewable energy to power its green industrialization aspirations.

The remainder of the paper will present a research framework and methodology, an overview and assessment of Ethiopia's electricity-sector policies, and a discussion on how Ethiopia could further its green industrialization efforts in the electricity sector.

5. UNIDO, UNIDO Green Industry.

6. Bhamidipati, Haselip, and Hansen, "How do energy policies accelerate sustainable transitions?"; Okereke et al., "Governing green industrialisation in Africa"; Rodríguez-Manotas et al., "Getting on the ground"; and Wakeford et al., "Innovation for green industrialization."

7. Bhamidipati, Haselip, and Hansen, "How do energy policies accelerate sustainable transitions?"

8. Rodríguez-Manotas et al., "Getting on the ground."

9. Federal Democratic Republic of Ethiopia, Ethiopia's Climate-Resilient Green Economy: Green economy strategy (Addis Ababa: 2011), <https://www.undp.org/content/dam/ethiopia/docs/Ethiopia%20CRGE.pdf>; and National Planning Commission, Growth and Transformation Plan II (GTP II) (2015/16–2019/20) (Addis Ababa: 2016), <https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database/ETHIOPIA%29%20Growth%20and%20Transformation%20Plan%20II%2C%20Vol%20I.%20%20%282015%2C16-2019%2C20%29.pdf>.

10. "Ethiopia Country Profile," World Bank, 2018, https://databank.worldbank.org/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=ETH.

11. "Ethiopia's Transformational Approach to Universal Electrification," World Bank, March 2018, <https://www.worldbank.org/en/news/feature/2018/03/08/ethiopias-transformational-approach-to-universal-electrification>.

12. Carlos Lopes, "Three Sectoral Policies in Ethiopia's Structural Transformation," in *The Oxford Handbook of the Ethiopian Economy*, Fantu Cheru, Christopher Cramer, and Arkebe Oqubay, eds. (Oxford: Oxford University Press, 2019): 872–884, doi:10.1093/oxford-hb/9780198814986.013.46.

13. Federal Democratic Republic of Ethiopia, Ethiopia's Climate-Resilient Green Economy; and National Planning Commission, Growth and Transformation Plan II.

14. Okereke et al., "Governing green industrialisation in Africa"; and Wakeford et al., "Innovation for green industrialization."

Research Framework and Methodology

A primary challenge for governments seeking a sustainable transition lies in identifying a combination of policies that are suitable for their national objectives, implementation processes, institutional capacities, and sectors or technologies targeted.¹⁵ The literature on policy mixes for sustainability transitions offers several conceptual frameworks to assess the characteristics and performance of a combination of policies.¹⁶ It provides a framework for considering specific trade-offs and potential conflicts within and between sets of objectives (policies), and for understanding how these different policies may interact to influence the attainment of goals and intended outcomes.¹⁷ The literature defines *policy strategy* as the combination of policy objectives and principal plans for achieving them.¹⁸ *Policy instruments* constitute the concrete tools to achieve the overarching objectives of the policy strategy. *Policy implementation* is “the arrangements by authorities and other actors for putting policy instruments into action.”¹⁹

This paper assesses Ethiopia’s green industrialization policy mix in the electricity sector for its overall *coherence of policy implementation* and the *consistency of the policy instruments* toward the country’s overall green industrialization strategy. The *coherence* of the policy implementation captures how synergistic and systematic the implementation process is.²⁰ *Coherence* can be assessed based on the level of policy integration and implementation coordination.²¹ Implementation coordination can be assessed based on the government’s strategic capacity specific to the issue area—the presence of issue-based coordinating committees, mechanisms for stakeholder engagement with the state, and clarity in terms of institutional mandates for monitoring and enforcement.²² The *consistency* of policy instruments captures how well aligned the instruments are with the overall policy strategy and with each other, thereby contributing to the achievement of policy objectives. The existence of synergies between policy instruments to pursue policy objectives would mean high consistency, while the existence of contradictions would mean low consistency.²³

15. UNIDO, UNIDO Green Industry.

16. Neil Gunningham et al., *Smart regulation: Designing environmental policy* (Oxford: Oxford University Press, 2004).

17. Matthew Burke and Jennie Stephens, “Energy democracy: Goals and policy instruments for sociotechnical transitions,” *Energy Research & Social Science* 33 (2017): 35–48, doi:10.1016/j.erss.2017.09.024.

18. Michael Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors* (New York: Simon and Schuster, 2008); and Karoline Rogge and Kristin Reichardt, “Policy mixes for sustainability transitions: An extended concept and framework for analysis,” *Research Policy* 45, no. 8 (2016): 1620–1635, doi:10.1016/j.respol.2016.04.004.

19. Rogge and Reichardt, “Policy mixes for sustainability transitions.”

20. Ibid.; and Tom Jones, “Policy Coherence, Global Environmental Governance, and Poverty Reduction,” *International Environmental Agreements* 2, no. 4 (2002): 389–401, doi:10.1023/A:1021319804455.

21. Edurne Magro et al., “Coordination-Mix: The Hidden Face of STI Policy,” *Review of Policy Research* 31, no. 5 (2014): 367–389, doi:10.1111/ropr.12090.

22. Stefan Četković, “Policy Capacity for Promoting Green Sectors Reconsidered: Lessons from the Renewable Electricity and Organic Farming Sectors in Serbia,” *Journal of Environmental Policy & Planning* 17, no. 1 (2015): 65–83, doi:10.1080/1523908X.2014.886505; and Michael Porter, “Clusters and Economic Policy: Aligning Public Policy with the New Economics of Competition,” Harvard Business School, November 2007, https://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf.

23. Rogge and Reichardt, “Policy mixes for sustainability transitions”; and Michael Howlett and Jeremy Rayner, “Patching vs Packaging in Policy Formulation: Assessing Policy Portfolio Design,” *Politics and Governance* 1, no. 2 (2013): 170–182, doi:10.17645/pag.v1i2.95.

METHODOLOGY

This article uses a case study approach to assess the characteristics of Ethiopia’s green industrialization strategy and implementation.²⁴ The study collected primary data through 29 in-depth semi-structured interviews, lasting for about 45 to 60 minutes, with sector experts and key decision makers involved in the policy process. The interviews included conversations with experts from government agencies and ministries, international organizations, bilateral development institutions, industry, and academia during two visits to Ethiopia in June and November 2019 (see Table 1). The interviews aimed to understand the primary drivers for green industrialization, assess the different characteristics of Ethiopia’s policy strategy and implementation process, and the overall opportunities and challenges to policy implementation in the electricity sector. The study asked interviewees questions about the policies, programs, and institutional arrangements that Ethiopia has put in place to pursue its green industrialization efforts.

Table 1: Details of Semi-structured Interviews in Ethiopia

Interview Category	No. of Interviews
Government - Ministry	7
Government - Agency/Bank	8
International/bilateral Donors	7
Private Sector	4
Think Tanks and Research Institutions	3

Case Study: Ethiopia

GREEN INDUSTRIALIZATION IN ETHIOPIA

Since Copenhagen, Ethiopia has made climate change a national priority.²⁵ Ethiopia’s commitment to green growth indicates that the government believes green and climate-resilient growth is compatible with a rapid exit from poverty.²⁶ In the GTP’s first period (GTP I), covering 2010 to 2015, the government of Ethiopia for the first time set a goal to achieve net-zero emissions by 2025.²⁷ In 2011, Ethiopia laid out Africa’s first national green economy plan—the CRGE strategy.²⁸ The strategy aims to achieve “middle-income status by 2025 in a climate-resilient green economy by stimulating economic development and growth, ensure abatement and avoidance of future emissions, and promote resilience to climate change.”²⁹ The CRGE strategy aims to achieve its green industrialization objectives through the greening of industrial inputs using renewable energy electrification, greening production, and reducing waste through energy efficiency and eco-industrialization.

24. Robert Yin, *Case Study Research and Applications: Design and Methods* (New York: SAGE Publications, 2017).

25. Christopher John Paul and Erika Weinthal, “The development of Ethiopia’s Climate Resilient Green Economy 2011–2014: Implications for rural adaptation,” *Climate and Development* 11, no. 3 (2019): 193–202, doi:10.1080/17565529.2018.1442802.

26. Haileselassie Medhin and Alemu Mekonnen, “Green and Climate-Resilient Transformation in Ethiopia,” in *The Oxford Handbook of the Ethiopian Economy*, 287–307.

27. Ministry of Finance and Economic Development, *Growth and Transformation Plan 2010/11–2014/15*, (Addis Ababa: Federal Democratic Republic of Ethiopia, November 2010), <https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-data-base/ETHIOPIA%29%20Growth%20and%20Transformation%20Plan%20I%2C%20Vol%20I.%20%282010%2C11-2014%2C15%29.pdf>.

28. Steve Bass et al., *Making Growth Green and Inclusive: The Case of Ethiopia*, Green Growth Papers Vol. 2013/07 (Paris: OECD, June 2013), doi:10.1787/5k46dbzhrkhl-en.

29. Federal Democratic Republic of Ethiopia, *Ethiopia’s Climate-Resilient Green Economy*.

The GTP II, the second five-year period, from 2015 to 2020, and the CRGE are the two main policy strategy documents that govern the overall green industrialization efforts in Ethiopia. The main goal of the GTP II is to transform the economic structure away from agriculture toward industry and exports (see Table 2).³⁰ GTP II documents also include climate change as a significant objective alongside structural change, employment creation, and economic expansion.³¹ The government of Ethiopia has shown a meaningful commitment to climate change objectives by mainstreaming the CRGE's green economy objectives into GTP II's renewable energy electrification targets (see Figure 1 and Table 2).³²

30. Michael Mbate, "Structural change and industrial policy: A case study of Ethiopia's leather sector," *Journal of African Trade* 3, no. 1 (2016): 85–100, doi:10.1016/j.joat.2017.01.001.

31. Susannah Fisher et al., *Bringing together the low-carbon and resilience agendas: Bangladesh, Ethiopia, Rwanda* (London: International Institute for Environment and Development, 2014), <https://pubs.iied.org/10099IIED/>.

32. National Planning Commission, *Growth and Transformation Plan II*.

Table 2: Description of Green Industrialization Policy Strategies and Instruments

Category	Name	Timeline	Details
National development plans Prepared by: National planning commission; Ministry of Finance and Economic Cooperation (MOFEC)	Plan for Accelerated and Sustainable Development to End Poverty (PASDEP)	2005 - 2010	1) Balance economic development and population growth; 2) unleash the potentials of Ethiopia's women; 3) strengthen infrastructure; and 4) improve skills and employment opportunities.
	Growth and Transformation Plan (GTP) - I	2010 - 2015	1) Increase generation capacity from 2,000 MW to 8,000 MW by 2015. 2) Promote energy mix by developing wind and geothermal resources. 3) Increase electricity coverage from 41 percent to 75 percent.
	Growth and Transformation Plan (GTP) - II	2015 - 2020	1) Increase generation capacity from 4,180 MW to 17,208 MW by 2020. 2) Target capacities of 1,224 MW in wind, 300 MW in solar, and 577 MW in geothermal. 3) Increase electricity coverage by 60 to 90 percent.
Climate change strategy Prepared by: Prime Minister's Office; Former Environment, Forests, and Climate Change Commission (EF-CCC)	Climate Resilient Green Economy Strategy (CRGE)	2011	Achieve carbon-neutral middle-income status before 2025. Green economy pillars: 1) Expand electricity generation from renewable sources of energy for domestic and regional markets. 2) Leapfrog to modern and energy-efficient technologies in transport, buildings, and the industrial sectors.
Electricity-sector strategy Prepared by: Ministry of Water, Irrigation, and Electricity (MOWIE)	Universal Electricity Access Program (UEAP)	2005 - 2016	1) Mandate: Electrify rural towns and villages through extension of the grid. 2) Target: Electrify approximately 50 percent of rural towns within five years.
	National Electrification Plan (NEP)	2018 - 2023	Achieve universal access by connecting 65 percent of the households to the grid and 35 percent of households through off-grid connections by 2025 (i.e., 8.2 million additional households connected to the grid, 3.3 million households served by grid-compatible mini-grids, and 6 million households connected through off-grid solar)
Electricity-sector policy instruments	Direct public investment policy	Until 2013	Access to low-cost land; customs duty exemption on capital goods and construction materials for Engineering Procurement, and Construction (EPC) contractors; right to refund on customs duties paid on capital goods purchased from local manufacturers.
	Negotiated PPP policy	2013 – current	Access to low-cost land; income tax exemption for electricity generation for five years; customs duty exemption on import of machinery and components.
	Competitive auctions policy	2018 – current	\$200 million World Bank guarantee to unleash another \$750 million in private financing (equity and commercial debt) through partnership with Ethiopian banks. Backstop payment guarantee for independent power producers along with loan guarantees.

Source: Federal Democratic Republic of Ethiopia, Ethiopia's Climate-Resilient Green Economy; National Planning Commission, Growth and Transformation Plan II; Ministry of Finance and Economic Development, Growth and Transformation Plan 2010/11–2014/15; Seleshi Bekele, National Electrification Program 2.0 (Addis Ababa: Ethiopian Government, March 2019), <https://www.africa-energy-forum.com/article/ethiopia-national-electrification-program-20-report>; World Bank Group, Renewable Energy Guarantees Program: Ethiopia (Washington, DC: 2019), <http://documents.worldbank.org/curated/en/235841556075535380/pdf/Ethiopia-Renewable-Energy-Guarantees-Program-Project.pdf>; and Ethiopian Energy Authority (EEA), Energy Efficiency and Conservation Action Plan (EEA, 2019), <http://eea.gov.et/media/attachments/DRAFT%20STRATEGY%20AND%20PROGRAM/Energy%20efficiency%20and%20conservation/Energy%20Efficiency%20Program.pdf>.

ELECTRICITY SECTOR: POLICY STRATEGY AND INSTRUMENTS

Ethiopia's electricity demand is likely to surge in the upcoming decades.³³ Currently, only 44 percent of Ethiopia's population has access to electricity, with 33 percent of the population connected to on-grid electricity and 11 percent to off-grid services.³⁴ In 2018, the government introduced the national electrification plan (NEP), an electricity-sector-specific plan to achieve universal electricity access by 2025.³⁵ Under the NEP, the government aims to provide 65 percent of the total population with grid access and 35 percent of the population with off-grid solar and mini-grids.³⁶ Besides the NEP, the government has prioritized the development of industrial parks and export-processing zones and has enacted policies to encourage foreign direct investment (FDI) and private investment in light manufacturing.³⁷ Ethiopia also plans to sell power to neighboring countries as part of its green industrialization strategy. The government estimates that Ethiopia may be able to export 1 GW of power to neighboring countries by 2025, thereby generating more than \$0.5 billion in export revenue.³⁸ These measures will drive the demand for electricity generation.

The GTP II has set an ambitious power generation target of 17,000 MW by 2020 to meet the country's surge in power demand from electrification and industrialization, a 15,000 MW increase from Ethiopia's installed capacity of 2,000 MW in 2015.³⁹ Power generation in Ethiopia is almost entirely dependent on hydropower (89 percent of the 4,207 MW of installed capacity). Ethiopia, however, has significant unharnessed non-hydro renewable energy potential, including solar power (5.5 kW/m²/day), 10,000 MW of geothermal power, and 5,000 MW of wind power.⁴⁰ Given its large share of baseload hydropower, Ethiopia's power sector is also well positioned in the short term to absorb significant amounts of renewable energy into the grid network, as the threshold for integrating variable renewables is higher for systems with large shares of hydropower.⁴¹ In a bid to increase energy security and do so sustainably, the government set a target to achieve a 15 percent share of renewables by 2025 while keeping hydro as the main base-load power source.⁴² Interviewees said that GTP energy targets were the main driver for renewable investments in Ethiopia.⁴³ Renewable energy deployment, however, was not significant until 2018 (see Table 3) as there was no legal framework for private-sector participation in the electricity sector. The government was also slow to reform the electricity sector or give up public ownership.

33. Md Alam Hossain Mondal et al., "Ethiopian energy status and demand scenarios: Prospects to improve energy efficiency and mitigate GHG emissions," *Energy* 149 (2018): 161–172, doi:10.1016/j.energy.2018.02.067.

34. World Bank Group, *Renewable Energy Guarantees Program: Ethiopia* (Washington, DC: 2019), <http://documents.worldbank.org/curated/en/235841556075535380/pdf/Ethiopia-Renewable-Energy-Guarantees-Program-Project.pdf>.

35. Seleshi Bekele, *National Electrification Program 2.0* (Addis Ababa: Ethiopian Government, March 2019), <https://www.africa-energy-forum.com/article/ethiopia-national-electrification-program-20-report>.

36. Ibid.

37. Arkebe Oqubay, "Industrial Policy and Late Industrialization in Ethiopia," in *The Oxford Handbook of the Ethiopian Economy*, 604–629.

38. World Bank Group, *Renewable Energy Guarantees Program*.

39. National Planning Commission, *Growth and Transformation Plan II*.

40. Dawit Gebremeskel et al., "Assessment of Resource Adequacy in Power Sector Reforms of Ethiopia," *IEEE*, 2019, 81–86, doi:10.1109/PowerAfrica.2019.8928820.

41. World Bank Group, *Renewable Energy Guarantees Program*.

42. National Planning Commission, *Growth and Transformation Plan II*.

43. Interviews 6, 8, 12, 16, and 26. For a list of interviewees, see Appendix II.

DIRECT PUBLIC INVESTMENT REGIME

Three policy regimes have governed Ethiopia's electricity sector in the last two decades: direct public investment, public-private partnership (PPP) with direct negotiations, and PPP with competitive auctions (see Table 2 and Figure 1). In 2008, the Ethiopian Electric Power Corporation (EEPCo) commissioned the 120 MW Ashegoda wind power plant. EEPCo gave the build, operate, and transfer (BOT) turnkey contract to French company Vergnet (see Table 3). Similarly, in 2009 and 2012, EEPCo gave BOT contracts to HydroChina to develop a 51 MW wind farm called Adama Phase I and a 153 MW Adama Phase II.⁴⁴ The Export-Import Bank of China provided financing for the project through a preferential export buyer's credit. Similar to public investments in wind, the Ethiopian government attempted to invest in geothermal exploration. Geothermal development, however, was slow due to high upfront costs, uncertainties associated with exploration, and limited local technological capacity.⁴⁵

The Ethiopian government provided several incentives, including a customs duty exemption on capital goods and construction materials for Equipment, Purchase, and Construction (EPC) contractors and the right to refund customs duties paid on capital goods purchased from local manufacturers.⁴⁶ Access to low-cost land, labor, and other inputs also motivated foreign investors to build wind power projects for EEPCo.⁴⁷ Despite incentives and attractive financing options from China and other development partners, EEPCo's strategy to generate wind and geothermal power by itself was not scalable, given that it owned all of the investment debt. To reduce its debt burden, EEPCo attempted to introduce a renewable feed-in-tariff (FIT) policy at \$0.1 per kWh for wind and geothermal so that private producers could enter the power generation market. Private companies, however, were not confident of EEPCo's revenue generation capabilities, which were constrained by low electricity prices. The average tariff for residential and industrial customers was less than \$0.03 per kWh until 2018.⁴⁸

Power-sector Reforms and the Public-private Partnership Regime

In November 2013, the government enacted Energy Proclamation 810/2013, which defined a new regulatory framework for “economic and technical regulation” of the energy sector.⁴⁹ The government split the national utility monopoly EEPCo into two public enterprises, Ethiopian Electric Power (EEP) and the Ethiopian Electric Utility (EEU). Both are still public enterprises but are semi-unbundled. The EEP is responsible for the generation, transmission, purchase, and sale of electricity. The EEU is engaged in power distribution, customer service, and cost recovery. The government also established a new regulatory authority, the Ethiopian Energy Authority (EEA), to set tariffs and efficiency standards and oversee compliance.⁵⁰

44. Yanning Chen, “Comparing North-South technology transfer and South-South technology transfer: The technology transfer impact of Ethiopian Wind Farms,” *Energy Policy* 116 (2018): 1–9, doi:10.1016/j.enpol.2017.12.051.

45. Solomon Kebede, “Opportunities and Challenges in Geothermal Exploration and Development in Ethiopia,” *GRC Transactions* 38 (2014): 4, <http://pubs.geothermal-library.org/lib/grc/1033593.pdf>; and Paula Rolffs et al., “Innovative risk finance solutions—Insights for geothermal power development in Kenya and Ethiopia,” *Climate and Development Knowledge Network*, February 8, 2017, <https://cdkn.org/resource/working-paper-innovative-risk-finance-solutions-insights-geothermal-power-development-kenya-ethiopia/>.

46. Frangton Chiyemura, “The Winds of change in Africa-China relations? Contextualising African agency in Ethiopia-China Engagement in Wind energy Infrastructure Financing and Development,” (Phd thesis, The Open University, 2019), <http://oro.open.ac.uk/68225/>.

47. Ibid.

48. Gebremeskel et al., “Assessment of Resource Adequacy”; Mulugeta Biadgo Asress et al., “Wind energy resource development in Ethiopia as an alternative energy future beyond the dominant hydropower,” *Renewable and Sustainable Energy Reviews* 23 (2013): 366–378, doi:10.1016/j.rser.2013.02.047.

49. “Energy Proclamation,” Federal Democratic Republic of Ethiopia, January 27, 2014, <http://extwprlegs1.fao.org/docs/pdf/eth170216.pdf>.

50. Gebremeskel et al., “Assessment of Resource Adequacy.”

The newly created EEP moved away from the public investment model to a PPP model where it negotiated directly with independent power producers (IPPs) and signed power purchase agreements (PPAs) to accelerate renewable energy deployment. The EEP negotiated its first geothermal PPP with the Iceland-based American exploration company, Reykjavik Geothermal, to develop the 500 MW potential at both the Corbetti and Tulu-Moye geothermal reservoirs. The USAID Power Africa program helped the EEP negotiate and sign a PPA in December 2017.⁵¹ The government, however, could not implement the PPA, as there were issues with bankability. A USAID expert said, “[t]he developmental state modeled banking sector did not understand PPPs.”⁵² Simple things such as the ability of the IPP to have an offshore account were not possible.⁵³ While the power-sector reform helped the EEP reduce its debt by encouraging IPP participation, renewable energy deployment continued to be limited due to institutional barriers and low electricity prices.

Public-private Partnership with Competitive Auctions

In 2018, the government passed PPP Proclamation 1076/2018 to allow for private participation in infrastructure, power, and other sectors that were traditionally the domain of the public sector in Ethiopia.⁵⁴ The PPP Proclamation created a legal framework to remove institutional barriers that discouraged international IPPs from participating in Ethiopia’s electricity sector.⁵⁵ Additionally, in December 2018, the EEA announced a revised tariff framework to bring electricity tariffs to a cost-recoverable level of \$0.07 per kWh by 2021, with further annual revisions.⁵⁶ These reforms have led to a proliferation of PPPs, particularly in solar PV deployment. The government has asked the World Bank to help conduct competitive auctions to develop solar IPPs in Ethiopia. The World Bank, under its Renewable Energy Guarantees Program (REGREP) and International Financial Corporation (IFC) scaling solar program, provides institutional support such as advisory assistance for legal and regulatory reform in the power sector, capacity development for conducting auctions and power procurement, and training on PPPs for the EEP and other power-sector agencies.⁵⁷ Under REGREP, the World Bank also provides payment guarantees to cover the EEP’s power purchase obligations and loan guarantees for commercial lenders to support the IPP developers bidding for projects.

In phase 1 of the REGREP program, the World Bank supported the development of a 100 MW Metehara solar project (see Table 3). Enel Green Power (EGP), a renewable energy subsidiary of the Italian power generation company Enel, won the competitive auction, which attracted 60 bids. Enel is investing \$120 million in the construction of the plant. The EEP will off-take the output under a 20-year PPA.⁵⁸ The EEP has agreed to build, own, and operate a 2.5 km transmission line to connect the plant and has also agreed to provide payments in local currency indexed to the U.S. dollar and escalated every year by 2 percent.⁵⁹ In phase 2, two solar IPPs amounting to 250 MW at Dicheto and Gad are being developed under the IFC scaling solar program. Phase 3 will support an estimated 450 MW of solar and 100 MW of wind IPPs (see Table 3). Seeing the interest from IPPs for solar PV auctions, the government is now planning to move

51. United States Agency for International Development (USAID), *Power Africa: 2018 Annual Report* (Washington, DC: 2018), https://www.usaid.gov/sites/default/files/documents/1860/2018-Annual_Report1015_508.pdf.

52. Interview 12.

53. Interviews 12 and 25.

54. “Public Private Partnership Proclamation,” Federal Democratic Republic of Ethiopia, February 22, 2018, <http://extwprlegs1.fao.org/docs/pdf/eth182196.pdf>.

55. World Bank Group, *Renewable Energy Guarantees Program*.

56. Gebremeskel et al., “Assessment of Resource Adequacy.”

57. World Bank Group, *Renewable Energy Guarantees Program*.

58. James Herbert, “Ethiopia’s REGREP on reality,” *IJGlobal*, May 1, 2019, <https://ijglobal.com/articles/139663/ethiopias-regrep-on-reality>.

59. World Bank Group, *Renewable Energy Guarantees Program*.

from direct negotiations to competitive auctions for wind deployment as well.⁶⁰ A senior EEP expert noted, “[the] government has requested IFC to do a detailed study for scaling wind IPP development.”⁶¹ A Danish wind energy expert said, “Denmark is helping train EEP’s IPP unit [to] understand wind IPP development and choose greenfield sites with high wind potential for auctions in 2020” (see Table 3).⁶²

Table 3: Renewable Energy Deployment in Ethiopia

Power plant	Technology	Capacity (MW)	Cost (USD)	Year started	Year completed	Financier	Policy Instrument	EPC / IPP
Ashegoda	Wind	120	290 million	2008	2013	French	Public investment	Vergnet
Adama I	Wind	51	117 million	2009	2012	China Ex-Im Bank (85%); EEP (15%)	Public investment	HydroChina
Adama II	Wind	153	345 million	2012	2015	China Ex-Im Bank (85%); EEP (15%)	Public investment	HydroChina
Aysha	Wind	120	257 million	2017	2020	China Ex-Im Bank (85%); EEP (15%)	Public investment	Dongfang Electric
Aluto Langano	Geothermal	5	17 million	2020	2021	JICA grant	Public investment	Toshiba, Toyota Tsusho, Egesim Energy
Corbetti	Geothermal	150	800 million	2019	2023 for first 50MW	InfraCo Africa, Berkeley Energy, Reykjavik Geothermal, and Iceland Drilling	IPP – Direct negotiations	Corbetti Geothermal
Tulu Moya	Geothermal	150	800 million	2019	2022 for first 50MW	Meridiam (51%); Reykjavik geothermal (49%)	IPP – Direct negotiations	Tulu Moya Geothermal and KenGen

60. “Ethiopia: Consultant procurement this month for REIPP programme,” Africa Energy, June 4, 2019, <https://www.africa-energy.com/live-data/article/ethiopia-consultant-procurement-month-reipp-programme>.

61. Interview 26.

62. Interview 22.

Metahara	Solar PV	100	120 million (Price per kWh not disclosed)	2019	2020	Guarantor - World Bank	IPP – competitive auctions	ENEL Green Power
Gad – I Ditcheto - I	Solar PV	250	300 million (Bid price - 0.025/kWh)	2019 (RFP)	Not finalized	IFC scaling solar 1; Guarantor - World Bank	IPP – competitive auctions	Saudi Arabia's ACWA
Weranso, Welencheti, Humera, Mekelle	Solar PV	500	570 million	2020 (RFQ)	Not finalized	IFC scaling solar 2/ MOFEC Guarantor - World Bank	IPP – competitive auctions	TBD
Metema, Hurso	Solar PV	250	---	Planned	Planned	IFC scaling solar 2/ MOFEC Guarantor - World Bank	IPP – competitive auctions	TBD
Assela	Wind	100	---	Planned	Planned	IFC scaling wind / MOFEC Guarantor - World Bank	IPP – competitive auctions	TBD

ELECTRICITY SECTOR: POLICY IMPLEMENTATION

The institutional arrangements governing the electricity sector in Ethiopia have undergone significant changes in the last decade. The government has implemented several institutional reforms to unbundle its electricity monopoly and allow for private-sector participation in power generation. The Ministry of Water, Irrigation, and Electricity (MOWIE) is the primary nodal ministry that plans, leads, coordinates, and monitors overall energy development in Ethiopia.⁶³ MOWIE is also responsible for capacity building, research, development, and dissemination of renewable energy technologies. MOWIE drafts the energy-sector strategy for the five-year GTPs. Before the energy proclamation in 2013, EEPCo, a national electricity monopoly under MOWIE, built and operated all the generation, transmission, and distribution assets across the country. Since then, the EEP, EEU, and EEA, along with the nodal ministry MOWIE, have governed all of the electricity-sector activities, including signing contracts with private-sector developers to deploy wind and geothermal projects. With the passage of PPP Proclamation 1076/2018 in 2018, however, the governance of the electricity-sector investments have also come under the purview of the Ministry of Finance and Economic Cooperation (MOFEC). PPP Proclamation 1076/2018 established a centralized PPP director-

63. "MOWIE Mandate and Responsibility," Ministry of Water Irrigation and Electricity (MOWIE), 2020, <http://mowie.gov.et/mandate-and-responsibility>.

ate within MOFEC to oversee and approve PPP transactions for projects across all sectors. The directorate is responsible for signing PPPs through a transparent and competitive process based on auction-based bidding procedures.⁶⁴ The government has also centralized the oversight of PPPs in MOFEC's PPP directorate. A dedicated PPP board with representation from MOFEC, the Ministry of Public Enterprises, the National Bank of Ethiopia, and the National Planning Commission oversees PPP procurement.⁶⁵

The EEP coordinates with the MOFEC PPP directorate to conduct competitive auctions for power procurement from IPPs. The EEP has established an in-house IPP unit to coordinate with the MOFEC PPP directorate to oversee the development of IPPs. The government has attempted to reduce any conflict of interest by limiting the role of the EEP, the off-taker, to defining the technical aspects of procurement and negotiating PPA terms with the winning bidder. A USAID Power Africa expert said, "MOFEC has the highest relative capacity of all ministries to conduct a confidence-building exercise for the private sector and hence creating the PPP unit at MOFEC made the most sense."⁶⁶

Assessment of Ethiopia's Efforts to Reform the Electricity Sector

Ethiopia's overall policy strategies, the GTPs and the CRGE, have instilled a high degree of *consistency* and *coherence*, and its policy reforms in the electricity sector are in alignment with its green industrialization objectives.⁶⁷ While energy security and climate change are stated as the two main objectives for integrating more renewable energy, interviewees mentioned that Ethiopia's renewable energy policies were implemented mainly based on energy security objectives to supplement erratic hydropower so that industries can get a steady supply of electricity.⁶⁸

Many studies have shown that the alignment of interests other than environmental protection can be central to green transformation.⁶⁹ Under the direct public investment regime, policies were *inconsistent* with the renewable energy targets set in the GTPs. EEPCo could not scale its renewable energy deployment due to its unwillingness to give up public ownership of generation assets. EEPCo's market monopoly and growing public debt also undermined the credibility of its efforts. Policies were less comprehensive, as they did not address institutional barriers for accelerating renewable energy deployment. Policies evolved to become *more consistent* over time with environmental objectives, however. Mounting public debt in the electricity sector motivated the government to open up electricity generation for private-sector participation and reform the electricity sector to be more suitable for IPP-led renewable energy integration.

Interviewees said that Ethiopia's electricity-sector reforms, tariff revision, and the new PPP law have instilled confidence among IPPs and international institutions.⁷⁰ IPPs have been receptive to Ethiopia's tech-

64. "PPP Directorate," Ministry of Finance and Economic Cooperation (MOFEC), 2020, <http://www.mofed.gov.et/>.

65. World Bank Group, Renewable Energy Guarantees Program.

66. Interview 12.

67. Lopes, "Three Sectoral Policies in Ethiopia's Structural Transformation."

68. National Planning Commission, Growth and Transformation Plan II; and interviews 20 and 29.

69. Yixin Dai and Lan Xue, "China's policy initiatives for the development of wind energy technology," *Climate Policy* 15, no. 1 (2015): 30–57, doi:10.1080/14693062.2014.863549; Mike Morris and Lucy Martin, *Political Economy of Climate-relevant Policies: The Case of Renewable Energy in South Africa* (Brighton, UK: Institute of Development Studies/University of Capetown, April 2015), <https://www.ids.ac.uk/publications/political-economy-of-climate-relevant-policies-the-case-of-renewable-energy-in-south-africa/>; Anna Pegels et al., "Politics of Green Energy Policy," *Journal of Environment & Development* 27, no. 1 (2018): 26–45, doi:10.1177/1070496517747660; and Hubert Schmitz, "Who drives climate-relevant policies in the rising powers?," *New Political Economy* 22, no. 5 (2017): 521–540, doi:10.1080/13563467.2017.1257597.

70. Interviews 12, 19, and 22.

nology-centric approach to PPP procurement through direct negotiations for geothermal and competitive auctions for solar and wind. In addition to these policy changes, the government has asked the World Bank to help build institutional capacity to conduct PPP procurement and competitive auctions in the electricity sector.⁷¹ The World Bank's REGREP program is supporting the MOFEC PPP directorate to establish a legal and regulatory framework for IPPs, understand PPP transactions, prepare IPP procurement documents, and conduct competitive auctions. The World Bank is also training the EEP's IPP unit to prepare PPA documents and negotiate PPAs with IPPs.⁷² Such efforts have reduced market barriers and investment risks for renewable energy IPPs.

The institutional arrangements governing the electricity sector in Ethiopia have undergone significant changes in the last decade. Interviewees mentioned that before electricity-sector reforms and the PPP law, the policy process for green industrialization was much *less coherent*. There was no interministerial or interagency coordination when it came to large-scale power generation projects.⁷³ Institutional coordination was also difficult due to the lack of coordinating structures.⁷⁴ The unbundling of EEPCo into the EEP and EEU and the establishment of a regulatory authority, the EEA, brought in much needed institutional reforms to a sector that was struggling to power the country's industrialization process. Furthermore, the establishment of PPP directorates within MOFEC and the EEP has increased the official channels for coordinating renewable energy PPP procurement. These newly established agencies and coordinating units within key ministries have increased the level of *coherence* in Ethiopia's renewable energy electrification policy process.

Barriers and Policy Recommendations

Ethiopia has undertaken three significant reforms to enable its electricity sector to become more economically and environmentally sustainable. First, the Ethiopian government broke the national electricity monopoly. In 2013, the government split national utility EEPCo into two public enterprises, the EEP and the EEU. Second, the government implemented electricity tariff reforms to ensure that it is cost recoverable and hence attractive for private renewable energy developers to be interested in investing. Third, the government passed new legislation to allow private participation in infrastructure projects through an open and competitive bidding process. While renewable energy producers are relatively more satisfied with the level of investment risk they have to bear in this new policy regime, several new reforms are needed to improve private-sector participation and integrate more non-hydro renewable energy into Ethiopia's electricity mix.

First, the government needs to improve the private sector's level of trust among bureaucrats in different ministries. At the core of a successful PPP is building trust through engagement, collaboration, and responsible governance practices.⁷⁵ A senior expert at MOFEC's PPP unit said, "Bureaucrats in the government think that we are allowing the private sector to take away money and control from them. Building trust for renewable energy PPPs among government stakeholders is a big issue."⁷⁶ Trust can be improved by 1) establishing formal channels for stakeholder engagement between government agencies and the private

71. Interview 19.

72. Ibid.

73. Interview 13.

74. Interview 1.

75. Igor Abramov, "Building Peace in Fragile States – Building Trust is Essential for Effective Public-Private Partnerships," *Journal of Business Ethics* 89, no. 4 (2009): 481–494, doi:10.1007/s10551-010-0402-8.

76. Interview 18.

sector; 2) conducting formal training programs to familiarize government bureaucrats about the competitive auctions process and the nature of private-sector engagement in the electricity sector.

Second, the government needs to increase the credibility of the PPP policy by strengthening the legal language in the PPP law to ensure that the EEP, the off-taker of power from IPPs, cannot renegotiate already signed PPAs. For instance, a senior technical expert at the EEP said, “[t]he issue we have with Metehara solar project is that its tariff reflects the rate they bid two or three years ago. Current prices are very low, less than 4 Birr/kWh. We are waiting to renegotiate with the IPP and request them to agree to a lower tariff.”⁷⁷ The EEP’s temptations to renegotiate previously signed PPAs based on future auction prices continue to hinder this sector’s ability to achieve its GTP/CRGE renewable energy targets. A USAID Power Africa expert said, “the government wishes to renegotiate tariffs undermining its stated commitment to renewable energy and private sector participation.”⁷⁸

Third, the government needs to continue its electricity-sector unbundling process and further split the EEP into two agencies—one for electricity generation and another for transmission. Renewable energy experts expressed concern that the off-taker is also able to control the transmission of power. Besides, an international energy expert highlighted that “[the] EEP’s agreement with China, to build and own up to 80% of transmission infrastructure for industrial corridors, has increased competitiveness concerns for renewable energy IPPs from other countries.” By unbundling generation and transmission, the government can assure IPPs that the switch operator, which does not have a stake in power generation, will conduct off-take in a fair and transparent manner.

Fourth, while institutional reforms in the electricity sector have formalized interministerial coordination, it is crucial to ensure that coordination happens in reality. A Danish energy expert said, “[l]ine ministries seldom talk to each other, leave alone agencies within MOWIE and MOFEC. For instance, even within an agency like EEP, the system integration team does not talk to the corporate energy planning team. Data sharing is ad hoc and does not happen through an institutionalized process.”⁷⁹ The government can alleviate these problems by requiring data sharing between and within agencies and mandating issue-based committee meetings to ensure knowledge and information exchange within the government.

Fifth, Ethiopia must strengthen its implementation and technical capacity with the help of resources and training from bilateral and international development agencies. The extent of a state’s bureaucratic capacity determines whether it can act on environmental policies identified and promoted by the leadership.⁸⁰ Interviewees identified bureaucratic capacity as a significant barrier that undermines the credibility of policies to achieve environmental objectives. Institutional memory is low due to employee turnover, and the bureaucracy does not have institutionalized data-gathering mechanisms critical for cross-sectoral efforts such as green industrialization.⁸¹ Besides, the lack of technological equipment is a significant impediment both for enforcement and revenue generation. A senior expert at the electric utility EEU said, “[w]e do not have technology and knowledge to manage electricity customers. We do not have labs to test the equipment we import. We do not have the technology to gather data from generators digitally. We still call the

77. Interview 10.

78. Interview 12.

79. Interview 22.

80. Stacy VanDeveer and Geoffery Dabelko, “It’s Capacity, Stupid: International Assistance and National Implementation,” *Global Environmental Politics* 1, no. 2 (2001): 18–29, doi:10.1162/152638001750336569.

81. Interviews 1, 3, 4, 6, 7, 13, 17, 20, 22, and 24.

generators to get live data on daily power generation and balance loads accordingly.”⁸² These technologies can be updated in partnership with the renewable IPPs, as they have a stake in ensuring that power generated in their plants is duly evacuated. Additionally, the government could leverage its bilateral development partners’ capabilities to create a technological upgrading program for the electricity sector.

Finally, the government must use the renewable energy transition to generate long-term employment and build local capabilities to manufacture renewable energy and allied components. The upcoming green manufacturing strategy should include provisions to promote renewable energy component manufacturing. Similar to other developing countries, renewable energy deployment has created a significant amount of short-term employment in Ethiopia.⁸³ Empirical evidence points to significant employment gains. A senior member of Hello Solar, an Ethiopian solar developer, said, “Hello Solar has created 16,000 jobs by creating a deployment supply chain for off-grid solar systems.”⁸⁴ Small and medium enterprises are significantly underserved, however, receiving less than 10 percent of lending by the domestic financial sector.⁸⁵ Interviewees said that the government sees its fledgling domestic industry as “rent-seeking” and is unwilling to provide incentives to participate in the renewable energy supply chain.⁸⁶ Besides, the government offers few avenues for spillover and learning through backward linkages from foreign IPPs deploying renewable energy. The government can improve opportunities for the domestic private sector by requiring IPPs to procure a certain percentage of renewable energy components locally, starting with the lower part of the value chain. Domestic private-sector enterprises could be asked to co-locate in industrial parks with foreign component manufacturers to promote learning and spillovers.

Conclusion

Since the introduction of the CRGE strategy in 2011, Ethiopia has had to perform a delicate dance trying to balance its ambitious economic objective of becoming a middle-income country by 2025 and the environmental objective of doing so sustainably. The Ethiopian state has taken great strides to show political commitment to pursuing a green industrialization agenda. The government has undertaken significant reforms to make its electricity sector economically and environmentally sustainable. The government must continue these reforms to ensure that it can integrate a significant amount of non-hydro renewable energy into its climate-vulnerable hydropower base-load. Doing so will not only help Ethiopia meet its ambitious carbon-neutral growth commitment but also ensure energy security for the rapidly industrializing nation. ■

82. Interview 26.

83. Michael Pahle et al., “Can the Green Economy deliver it all? Experiences of renewable energy policies with socio-economic objectives,” *Applied Energy* 179 (2016): 1331–1341, doi:10.1016/j.apenergy.2016.06.073.

84. Interview 27.

85. Associated Press, “Ethiopia’s Industrial Parks are Making Jobs a Reality,” *World Bank Group News*, November 18, 2019, <https://www.worldbank.org/en/news/feature/2019/11/18/ethiopias-industrial-parks-are-making-jobs-a-reality>.

86. Christopher Clapham, “The Ethiopian developmental state,” *Third World Quarterly* 39, no. 6 (2018): 1151–1165, doi:10.1080/01436597.2017.1328982.

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Appendix I: Acronyms and Abbreviations

SDG	Sustainable Development Goals
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
CRGE	Climate Resilient Green Economy
UEAP	Universal Electricity Access Plan
NEP	National Electrification Plan
IDS	Industrial Development Strategy
PPP	Public Private Partnership
PPA	Power Purchase Agreement
IPP	Independent Power Producer
FDI	Foreign Direct Investment
MOWIE	Ministry of Water Irrigation and Electricity
MOFEC	Ministry of Finance and Economic Cooperation
EFCCC	Environment Forest and Climate Change Commission
EEPCo	Ethiopian Electric Power Corporation
EEP	Ethiopian Electric Power
EEU	Ethiopian Electric Utility
EEA	Ethiopian Energy Authority
GGGI	Global Green Growth Institute
USAID	United States Agency for International Development
REGREP	Renewable Energy Guarantees Program
IFC	International Financial Corporation
DBE	Development Bank of Ethiopia
CECCC	China Civil Engineering and Construction Corporation
CCCC	China communications and construction company
RFQ	Request for qualification
RFP	Request for proposal;
EPC	Engineering, procurement, and construction
EDRI	Ethiopian Development Research Institute

Appendix II: Interviews

- Int #1 – EFCCC CRGE directorate official
- Int #2 – MOTI CRGE directorate official
- Int #3 – USAID consultant to MOTIF
- Int #4 – EFCCC MRV directorate official
- Int #5 – EEFRI director
- Int #6 – MOWIE CRGE directorate official
- Int #7 – Ethiopian Investment Commission official
- Int #8 – MOWIE state minister
- Int #9 – Afro Amc Solar Inc.
- Int #10 – EEP official
- Int #11 – GGGI director
- Int #12 – USAID Power Africa specialist
- Int #13 – USAID Environmental specialist
- Int #14 – EEA energy efficiency director
- Int #15 – Industrial Parks Development Corporation official
- Int #16 – MOFEC international institutions director
- Int #17 – EEU official
- Int #18 – MOFEC PPP directorate official
- Int #19 – World Bank official
- Int #20 – Ethiopian Development Research Institute policy expert
- Int #21 – Norwegian Embassy CRGE officer
- Int #22 – Danish Embassy energy specialist
- Int #23 – GiZ energy specialist
- Int #24 – EEA research director
- Int #25 – Private legal consultant
- Int #26 – EEP official
- Int #27 – Hello Solar
- Int #28 – Development Bank of Ethiopia – Energy coordination manager
- Int #29 – Delphos International senior consultant