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India's Use of Public/Private Partnerships to Promote Rapid Expansion of Solar Electricity Facilities

Kara Consalo
FAMU College of Law, kara.consalo@famu.edu

INDIA'S USE OF PUBLIC-PRIVATE PARTNERSHIPS TO PROMOTE RAPID EXPANSION OF SOLAR ELECTRICITY FACILITIES

*Karen "Kara" Consalo**

* Karen "Kara" Consalo is an Assistant Professor at the Florida Agricultural and Mechanical University College of Law. She is certified as an expert in City, County, & Local Government Law by the Florida Bar. She received her J.D. with Honors from the University of Florida Levin College of Law along with a Certificate in Land Use and Environmental Law. She received her LL.M. in International Business Law with a concentration in Environmental and Energy Law with Honors from Boston University School of Law.

I. INTRODUCTION

Governments around the world are tasked with protecting the health, safety, and welfare of their citizens.[1] That pursuit necessarily includes provision of electricity to households and businesses. As demonstrated by the United Nations Human Development Index, there is a clear correlation between low and moderate access to and use of electricity (at least at levels sufficient for lighting and cooking), and individual and societal improvements such as enhanced nutrition, increased life expectancy, better infant survival, higher education and literacy rates.[2]

Unfortunately, despite the vital importance of electricity to human health and quality of life, one billion people around the world lack any access to electricity and billions more lack consistent and sufficient electricity for basic lighting and cooking.[3] Providing adequate electricity services to all of their citizens and businesses is a significant challenge facing world leaders. That challenge is exacerbated by Kyoto Protocol and Paris Agreement commitments to reduce use of fossil fuels as energy supplies due to the adverse effects of carbon emissions on air and water pollution caused by reliance on such fuel sources.[4] To balance the need for wider access to reliable electricity with the need to limit carbon emissions and pollutants, new investments in energy infrastructure must be based on renewable energy sources and technologies, such as solar, hydro, and wind power.[5] Such investments will require technical

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1. *See generally* Anne-Marie Slaughter, *3 Responsibilities Every Government Has Towards its Citizens*, WORLD ECON. F. (Feb. 13, 2017), https://www.weforum.org/agenda/2017/02/government-responsibility-to-citizens-anne-marie-slaughter/ [https://perma.cc/GR9G-4WJE].

2. The need for electricity to enhance human welfare is so great that the United Nations has set affordable and clean energy as one of its worldwide Sustainable Development Goals. *The Sustainable Development Goals Report 2019*, U.N. (July 2019), https://doi.org/10.18356/55eb9109-en [https://perma.cc/GT9K-KGYF]; Slaughter, *supra* note 1; *see also* Video Interview with Michael Dworkin, Professor, Vt. L. Sch. (undated); *Human Development Data*, U.N. DEV. PROGRAMME, http://hdr.undp.org/en/data [https://perma.cc/L6KZ-5R46]; *Human Development Index*, ENERGY EDUC., https://energyeducation.ca/encyclopedia/Human_development_index [https://perma.cc/F787-EBPK].

3. *The 2018 Report of the Global Commission on the Economy and Climate: Energy*, NEW CLIMATE ECON. (2018), https://newclimateeconomy.report/2018/energy/ [https://perma.cc/7ANJ-EWXV].

4. *See generally What Is the Kyoto Protocol?*, U.N. CLIMATE CHANGE, https://unfccc.int/kyoto_protocol [https://perma.cc/B9C9-Q4AU]; *The Paris Agreement*, U.N. CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement [https://perma.cc/8WR5-GHP4].

5. *See The Sustainable Infrastructure Imperative: Executive Summary*, NEW CLIMATE

expertise and experience in design and construction of infrastructure projects of all sizes, from micro to mega. In seeking such expertise, many governments have turned to the private sector through public/private development partnerships.

The worldwide energy infrastructure market is expected to expand to $25 trillion USD over the next fifteen years.[6] As such, world leaders must also find ways to finance the development of facilities to expand sufficient and reliable electricity to underserved areas, such as rural communities. This massive obligation can stretch a nation's financial resources, manpower and expertise, particularly in developing nations.[7] Governmental financial constraints often necessitate reliance upon the private sector to provide financial assistance, manpower, and technical expertise to develop their electrical infrastructure through a tool known as public-private partnerships (commonly referred to as "PPPs" or "P3s").

This Article will explore the use of PPPs to encourage the flow of private capital and expertise toward development of low-carbon, low-pollution, sustainable energy generation in India to achieve the country's ambitious goal of creating 175 gigawatts of renewably sourced electricity by 2022.[8] The lessons in India's extensive use of PPPs to achieve such ambitious electricity goals should serve as a model for other governments to engage the private sector to successfully develop solar and other renewable energy projects with limited risk but with significant benefits for their citizens.

II. PROVISION OF SUSTAINABLE ELECTRICITY

There is a worldwide need to both reduce reliance on fossil fuels as energy sources and to ensure reliable electricity service. Burning fossil fuels has been linked to a variety of societal ills, including air and water pollution; harm to human health and ecological resources; increased carbon emissions, which accelerate climate change and extreme weather occurrences; political dependence on oil-rich foreign nations; and fuel scarcity.[9] Converting to sustainable and reliable energy infrastructure,

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ECON. (2016) [hereinafter *Sustainable Infrastructure Imperative*], https://newclimateeconomy.report/2016/ [https://perma.cc/E8RV-EPPC].

6. *See id.*

7. *See* Slaughter, *supra* note 1.

8. *Ministry of New and Renewable Energy Annual Report 2018-19*, GOV'T INDIA MINISTRY NEW & RENEWABLE ENERGY 2 (2019) [hereinafter *Indian Ministry of New & Renewable Energy Report*], https://mnre.gov.in/img/documents/uploads/file_f-1608040317211.pdf [https://perma.cc/2EFD-L94R].

9. *See* Monyl Nefer Toga Makang & Zuzana Dobrotkova, *The Role of the Public Sector in Mobilizing Commercial Finance for Grid-Connected Solar Projects: Lessons Learned and Case Studies*, WORLD BANK (2019), https://documents1.worldbank.org/curated/en/162241562797496542/pdf/The-Role-of-the-Public-Sector-in-Mobilizing-Commercial-Finance-for-Grid-

such as solar, wind, hydro, or biomass, can alleviate these harms by reducing pollution and carbon emissions, enhancing resiliency, and providing reliable sources of electricity generation.[10]

Financing the development of sustainable energy generation and infrastructure is a worldwide goal, memorialized in 2015 at the Addis Conference on Financing for Development, which advocated a "global framework for financing development."[11] As a result, a number of financial initiatives were launched to facilitate sustainable infrastructure development, including the Asian Infrastructure Investment Bank, the Global Infrastructure Hub, the New Development Bank, the Asia Pacific Project Preparation Facility, and the World Bank Group's Global Infrastructure Facility.[12] The Addis Conference also called upon member nations to develop policies and regulatory structures to incentivize private sector investment in sustainable development projects and equalize access to financial services, including frameworks for PPPs.[13]

III. PUBLIC-PRIVATE PARTNERSHIPS

Public-private partnerships are an excellent tool for governments to secure financing and/or development of necessary facilities and services to citizens by harnessing the financial capital and technical expertise of the private sector.[14] Defined in numerous ways, PPPs are characterized by features that distinguish them from full privatization of public services.[15] Generally, PPPs are contractual arrangements between one or more public/governmental entities and one or more private interests through which the public and private entities allocate rights and responsibilities for development, financing, ownership, operation and/or profit sharing of an identified public facility or service.[16] In some cases,

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Connected-Solar-Projects-Lessons-Learned-and-Case-Studies.pdf [https://perma.cc/4KGH-6BTP]; Varun Sivaram et al., *Reach for the Sun: How India's Audacious Solar Ambitions Could Make or Break its Climate Commitments*, STAN. CTR. ENERGY POL'Y & FIN. (2015), https://law.stanford.edu/wp-content/uploads/2015/12/Reach-for-the-Sun-High-Resolution-Version.pdf [https://perma.cc/LHD2-PH6X]; Dworkin, *supra* note 2.

10. *See* Michael Mullan et al., *Climate-Resilient Infrastructure*, OECD ENVIRONMENT POLICY PAPER NO. 14 (2018); *see also* Rafael LealArcas, *Sustainability, Common Concern, and Public Goods*, 49 GEO. WASH. INT'L L. REV. 801, 867 (2017).

11. *See* U.N. Third International Conference on Financing for Development, Addis Ababa, Ethiopia, July 13-16, 2015, *Outcome Document*, A/CONF.227/L.1 (July 15, 2015).

12. *See id.* at 6.

13. *See id.* at 12.

14. *See* Symposium, *Public-Private Partnerships: A Vehicle for Economic Development and Promotion of the Rule of Law*, 4 UNIV. BALT. J. LAND & DEV. 103 (2015) [hereinafter *A Vehicle for Economic Development*], https://scholarworks.law.ubalt.edu/ubjld/vol4/iss2/2/ [https://perma.cc/S5LS-9YPN].

15. *Id.*

16. The Brookings Institute defines PPPs as "a contractual agreement between a public agency and a private sector entity resulting in greater private sector participation in the

a single project will have multiple PPPs between different entities. A common example is the initial establishment of a PPP between the government and a lending institution for financing of a project and a subsequent establishment of a PPP between the government and a development company for construction of the project.

There is no single way to develop a PPP but critical decisions in the design and structure of a PPP can determine the success or failure of the project. This Article will discuss these critical elements of a PPP and explore how various PPPs in India have employed such elements to secure successful financing of solar infrastructure.

A. *Risks of a Public-Private Partnership*

There are a number of political, financial, and legal risks posed to the public entity, the private investors and developers, and the citizen stakeholders. Events beyond the control of the partners, such as weather disruptions, fires, labor shortages, wage increases, material shortages, inflation, interest rate increases, supply difficulties, political turmoil, and even war, can have a dramatic negative affect on all partners and risk the very completion of a PPP project.

Governments also risk citizen ire and loss of support if a project is delayed, overbudget, of substandard quality or service level, or worse, not completed at all.[17] Similarly, if a project goes over-budget through financial miscalculations or unanticipated increases to the scope of work, and those costs are passed onto citizens or businesses through increased taxes or fees, there will likely be political repercussions.[18] Thus, politicians engaged in PPPs risk harm to their reputation, loss of influence, and removal from office.[19] Such political risks are increased in communities where there is already an unfavorable view of PPPs, like

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delivery and/or financing of infrastructure projects." Emilia Istrate & Robert Puentes, *Moving Forward on Public Private Partnerships: U.S. and International Experience with PPP Units*, BROOKINGS-ROCKEFELLER 2 (2011), https://www.brookings.edu/wp-content/uploads/2016/06/1208_trans portation_istrate_puentes.pdf [https://perma.cc/JXL9-6QZR]. The World Bank has promulgated various definitions of a PPP. *See, e.g.*, Tania Ghossein & Fernanda Ruiz Nunez, *Procuring Infrastructure Public-Private Partnerships Report 2018*, WORLD BANK 16 (2018), https:// documents1.worldbank.org/curated/en/891171523343989736/pdf/Procuring-Infrastructure-Public-Private-Partnerships-Report-2018.pdf [https://perma.cc/V6YL-5RY2] ("any contractual arrangement between a public entity or authority and a private entity, for providing a public asset or service, in which the private party bears significant risk and has management responsibility"); Mark Dutz et al., *Public-Private Partnerships Units: What Are They and What Do They Do?*, WORLD BANK 1 (2006), https://openknowledge.worldbank.org/server/api/core/bitstreams/09352f5a-0e61-5af9-9a44-c66c4d6bf04e/content [https://perma.cc/5Z78-99NX] ("often long-term arrangements in which the government purchases services under a contract, either directly or by subsidizing supply to consumers").

17. *See A Vehicle for Economic Development*, *supra* note 14.

18. *See id.*

19. *See id.*

that of governments using PPPs to shirk their responsibilities.[20] On the other hand, commercial interests may criticize PPPs as a form of government subsidy which erodes market forces and creates inefficiencies.[21]

Private partners in a PPP also bear a variety of risks. Fluctuating political agendas and leadership can lead to a delay in results or even cancellation of a project such that economic remuneration cannot be realized. Private entities may also face uneven liability risks when partnering with a public body that benefits from sovereign immunity, which shields the government from lawsuits, placing the burden of legal liability solely on the private partner.[22] Risks to private entities also include unanticipated increases in the scope of work, shortage of materials or labor, increases in costs of land, loss of a customer base, interest rate or exchange rate fluctuations, natural disasters, and other *force majeure* events. When engaging with government entities, private entities also risk disclosure or appropriation of their intellectual property such as patents and copyrights, particularly when conducting business across international borders with varied intellectual property protections.[23]

Stakeholder citizens also face risks both during project development and after the project is completed. During planning and development of an infrastructure project, citizens risk loss of their interests and disregard of their concerns. For example, large areas of land are often required to develop solar energy farms and this land may be taken from citizens through strong arm tactics of the government or its private partner.[24] Proximate citizens then also have to live with the infrastructure project and service provision for years, often decades, after completion. A poorly designed or constructed facility, budget overruns resulting in higher fees and taxes, or subpar service provisions which can detrimentally effect a community on an ongoing basis.[25]

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20. PPPs are distrusted by those who view such partnerships as the government shirking its responsibilities through privatization. Nestor M. Davidson, *Values and Value Creation in Public-Private Transactions*, 94 IOWA L. REV. 937, 955 (2009).

21. *Id.*

22. Diane Howard, *Achieving a Level Playing Field in Space-Related Public-Private Partnerships: Can Sovereign Immunity Upset the Balance*, 73 J. AIR L. & COM. 723, 723–24 (2008).

23. Steven Hilde et al., *Intellectual property policies in early-phase research in public-private partnerships*, 34 NATURE BIOTECHNOLOGY 504, 505–06 (2016).

24. In India, central and state governments have prioritized needs for hydropower over the basic needs of local communities to keep and maintain land for homes, farms, and intact community fabric. Surabhi Karambelkar, *Hydropower Development in India: The Legal-Economic Design to Fuel Growth?*, 57 NAT. RES. J. 361, 371 (2017).

25. *See id.*

International PPPs face additional risks and challenges due to differences in the culture, laws, and political understandings (or lack thereof) of contracting parties.[26] In addition to misunderstandings based on cultural, legal and political differences, international partners also face technical confusion due to international differences in data measurement and collection methods, technology, and business practices.[27]

B. *Risk Mitigation in Public-Private Partnerships*

Risk can rarely be eliminated, but risk can be identified, anticipated, allocated and mitigated to limit the exposure to each party in a PPP.[28] Contracts are the primary tool for risk mitigation as they are adept vehicles for assigning responsibilities, requirements, obligations, penalties, and recourse between the parties. Contracts can be drafted to anticipate eventualities which may delay project completion or increase project cost and designate which party will bear the financial consequences. Governments can also encourage PPPs by enacting laws and regulations to provide consistency and certainty in establishing PPPs. In addition, parties can seek insurance policies to shift the financial risk to a third party outside of the PPP.

1. Contractual Language to Limit Risk

The drafting of a contract to comprehensively anticipate and address risk is the most important element to mitigating risk to the parties. A well-drafted contract will clearly allocate responsibilities and rights between the parties. As explained by Sebastian Dern, there are six common types of contractual structures for PPP arrangements: the Service Contract, the Leasing Contract, the Concession Contract, the Design-Build-Operate (DBO) Contract, the Build-Operate-Transfer (BOT) Contract, and the Build-Own-Operate (BOO) Contract.[29] While the examination of each type of PPP contract is beyond the scope of this Article, it is important to note that identification of the responsibilities or services expected of the public and the private parties is of vital importance to the formation of the PPP.

For example, if the government establishes a PPP to engage the services and expertise of a private entity to design and build a new facility, the ensuing contract should identify the responsibilities of each

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26. David Lick & Roger Hamlin, *Public-Private Partnerships for Promotion of Cross-Border Trade and Transportation*, 37 CAN.-U.S. L.J. 171, 197–98 (2012).

27. *See id.*

28. As noted by O'Stein, one of the main benefits of a public-private partnership is risk-allocation to the partner best able to mitigate or bear the risk. *See A Vehicle for Economic Development*, *supra* note 14.

29. *See* Sebastian Derm, *Public-Private Partnerships in Microgrid Development*, 45 REAL EST. REV. J. (2016); *see also A Vehicle for Economic Development*, *supra* note 14.

party vis-a-vis construction specifications, quality, and deadlines. Similarly, negotiated risk allocation may involve the level to which the government entity has oversight on development plans and to what extent the government has remedies in the event of subpar construction, construction delays or noncompletion.

To further limit risk of delays, cost-overruns, or noncompletion, the public partner should regularly monitor the project's progress. Such monitoring should include assessment of compliance with milestone deadlines, quality evaluation of construction efforts, service quality, and evaluation of customer complaints. Monitoring should be conducted by a trained and unbiased professional or board composed of professionals and perhaps stakeholder citizens. As noted by Miller and Hobbs, monitoring is critical to keep the project on track, maintain stakeholder faith in the process and the project, and allow the public partner to learn valuable lessons for future projects.[30]

Many design/build PPPs will also allocate the right and responsibility to operate and collect revenues from the new facility.[31] Often, revenue generation is the incentive for the private sector to invest the funds and time to design and construct the facility. The period of operation and revenue collection may be time limited or indefinite. Risk should be allocated to ensure the private entity can recoup its expenses even if revenues are not as high as anticipated.[32] Conversely, governments may limit the risk to their citizens by establishing performance standards for the level of service to be provided or by capping the amount of fees, or increases in fees, paid for the service.

In some cases, often known as concession contracts, the government will own and construct the facility but engage a private entity through a PPP to operate and earn revenue from the facility for some period of time.[33] In these cases, the government may mitigate risk to the citizen-customers by limiting the fees to be charged, limiting the term of the contract (with possible renewals), and maintaining performance standards.

In a leasing PPP, the government owns land which it leases to the private entity to achieve a mutual goal, such as solar power generation.[34]

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30. *See* Roger Miller & Brian Hobbs, *Governance Regimes for Large Complex Projects*, 36 PROJECT MGMT. J. 42, 43 (2005).

31. Shouqing Wang et al., *Balancing Public and Private Interests through Optimization of Concession Agreement Design for User-Pay PPP Projects*, 24 J. CIV. ENG'G & MGMT. 116, 116 (2018).

32. *See* Liang Shan et al., *Collar options to manage revenue risks in real toll public-private partnership transportation projects*, 28 CONSTR. MGMT. & ECON. 1057, 1061 (2010).

33. *See generally, id.* (discussing methods to manage revenue risk through concession agreements).

34. *See* Kouton et al., *Risk allocation in energy infrastructure PPPs projects in selected African countries: does institutional quality, PPPs experience and income level make a*

The government leaves financing, development, and operational decisions to the private partner. Even in such open-ended PPPs, the parties can identify and allocate potential risks to each party and to affected citizens through contract negation. Such contracts should identify when, or under what circumstances, the new facility will be turned over from the private entity to the government entity or under what circumstances and in what manner the private entity will close the facility.

As noted above, some PPPs are established solely for the purpose of financing a new project. As explained by Martin Jacobson, in a financing PPP, it is important to identify the best financing methodology for the scope and type of PPP as well as the anticipated revenue stream.[35] As noted by Mr. DecorlaSouza, one tactic to limit risk of nonperformance is to require a level of equity investment from each partner, such as direct capital, provision of land, subsidy commitments, etc.[36] Such up-front equitable investments have the added benefit of lowering the required debt service.[37]

In dealing with electricity infrastructure, most financing methodologies are based on revenue generated by the project which can be a stream based on usage (akin to a toll road) or availability (akin to a medical facility).[38] Solar energy facilities can be of varied size and scope, so PPP contracts for development of larger facilities are likely to be longer term and require more complex financing than for smaller distributed or off-grid solar generators. Risk to private entities in a large-scale solar project can also be contractually limited by identifying how and when the financier will be repaid if the facility completion is delayed or if the facility does not generate revenues as anticipated. The government, for example, may commit to use its taxing power to replace the lost revenues.

In addition to the project specific types of risk-mitigation identified above, there are a variety of risk mitigation tactics which can be incorporated into most PPP contracts. The contract should identify remedial actions in the event that private partners are not complying with the terms of the contract; for example, not meeting deadlines, quality standards, or service requirements. Where penalties for noncompliance are included in a contract, the private party should include excuses for

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difference?, 56 ECON. CHANGE & RESTRUCTURING 537, 543–44 (2022).

35. *A Vehicle for Economic Development*, *supra* note 14.

36. *See id.*

37. Since debt servicers often face the greatest financial risk, it is appropriate to allocate these partners the highest priority and best interest rates in repayment from project revenues. *See id.*

38. *See id.*

noncompliance when it is due to forces beyond the party's control.[39] To incentivize prompt and cost-conscious completion by the private partner, a government can include milestone incentives, such as tax breaks, if the project progresses as anticipated.[40]

It is also important for the parties to anticipate common occurrences in infrastructure projects, like change orders and modifications to the scope of work.[41] By anticipating such eventualities, the parties can predetermine conditions for approval of such changes as well as establish prices (or at least establish floors and ceilings for prices) when such changes are necessitated. *Force majeure* conditions beyond either party's control should also be contemplated so that the risk of any cost increases, completion delays, or revenue loss is allocated and mitigated between the parties.[42]

Any contract should include termination provisions for cause (such as failure of the private partner to complete a project on time) and for convenience (such as a public entity's change in project direction).[43] Termination for cause may include a liquidated damages clause to compensate the harmed party for non-performance, substandard performance, or economic losses.[44] In the event termination of a PPP is due to a failure of the project, the exposure to liability of such failure can be minimized by contractual provisions which dictate how any completed assets will be allocated and how outstanding debts, such as material and labor costs, will be paid.

As noted by Jacobson, in complex PPPs there may be multiple contracts and thus it is important to consider the interplay between contracts since problems under one contract can have direct effects on the fulfillment of other contracts.[45] For example, if financing based upon Contract A fails to provide needed capital at critical times, then associated development contemplated by Contracts B & C cannot be completed because they will lack money to pay for labor and materials. Conversely, if development of a project contemplated under Contract B fails to result in a functional service, the financial parties to Contract A will be left unpaid because the failed service will not provide any cash flow.

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39. *See id.*

40. *See id.*

41. *See id.*

42. *See Resilient Infrastructure Public Private Partnerships (PPPs): Contract and Procurement The Case of India*, WORLD BANK GROUP GLOBAL INFRASTRUCTURE FACILITY (Jan. 2018) [hereinafter *Resilient Infrastructure*], http://pubdocs.worldbank.org/en/230011532671561538/India-PPP-Country-Brief-drmhubtokyo.pdf [https://perma.cc/79FE-XGWY].

43. *See Termination Provisions*, WORLD BANK PUBLIC-PRIVATE PARTNERSHIP LEGAL RESOURCE CENTER, https://ppp.worldbank.org/public-private-partnership/termination-provisions [https://perma.cc/XTK3-BQUE].

44. *See A Vehicle for Economic Development*, *supra* note 14.

45. *See id.*

2. Additional Risk-Mitigation Tools

A well-drafted contract which anticipates, mitigates, and allocates risk is a vital first step to limiting risk. However, partners in a PPP can take other steps to mitigate risk as well. Governments have many legislative and policy tools which can limit the private sectors' real or perceived risks. For example, within the United States, forty states have legislative frameworks which specifically support establishment and successful completion of PPPs.[46] In enacting such laws, these states not only memorialize their support for PPPs but also enable private firms to see clearly established "rules of the game" which creates a level of certainty and confidence for private partners.[47] Governments which encourage flexibility in design and implementation of a PPP, rather than adherence to a "one size fits all" rigidity in development of PPPs, will encourage more successful PPPs and more interest from the private sector.[48] For example, a PPP framework which enables the private partner to adjust prices to reflect changed circumstances and revenue needs, limits risk of nonpayment on debt benefiting both the developer and the financier.[49]

Similarly, a well-structured and transparent procurement process can draw private development partners to a PPP by creating certainty regarding the rules which will determine successful private bidders.[50] Proper procurement processes also ensure the public entity is able to find the most qualified and lowest priced private partners. Finally, a procurement process with a fair and unbiased reputation will encourage greater interest from the private secure and therefore result in more private partnership opportunities.

Proper procurement processes should set achievable technical and financial standards that are also exacting enough to exclude unqualified private enterprises. Exacting but reasonable procurement standards that enable governments to find highly qualified partners at the lowest cost best serve the public good by increasing the odds of a successful long-term outcome. A bid process which results in experienced, qualified, and capable private partners limits the government's risk of cost overruns, delays, or poor service provision.

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46. *See id.*

47. Virginia is an example of a government which has multiple laws to encourage different types of PPPs, including: the traditional public method of soliciting private partners, a Request for Proposal (RFP), used for a design and build project; a team-based process for finance, design, and build projects; and a flexible PPP process by which developers and financiers can propose infrastructure projects which either the public or the private sector suggest are needed within the state. Virginia's variety of laws and associated levels of flexibility help to encourage the private sector to participate and innovate through use of PPPs. *See id.*

48. *See id.*

49. Lick & Hamlin, *supra* note 26, at 201-02.

50. *See* Miller & Hobbs, *supra* note 30, at 47.

Governments can further encourage private financial and development partnerships through full or partial guarantees on debt service.[51] Through use of such guarantees, the government partner (which hopefully has a high credit rating) ensures the payment of part or all of the project debt service in the event that the private developer cannot repay the debt through proceeds from the project. Through such guarantees, the government encourages private financiers to lend money to the project by reducing the risk of doing so. Government guarantees can also encourage private development partnerships when projects are expected to have thin profit margins by limiting the development partner's risk in debt service.[52]

Governments can also limit financial risk to the private development partner by extending their power to obtain low interest government bonds to the private partner. For example, private activity bonds have been used in the U.S. to extend tax exemptions associated with government bonds to private partners and thereby lower private financing expenses.[53]

Low interest government loans are another way for the public partners to encourage private investment by lowering financial risk to the development partner. In the U.S., for example, the Fixing America's Surface Transportation Act provides extremely low interest loans with flexible repayment schedules to the private partners developing regional or national transportation infrastructure.[54]

The regulatory structure of a government also plays a significant role in attracting private investors to a PPP project.[55] Nations with coherent, consistent, and tested legal and regulatory mechanisms are attractive to potential lenders because they provide certainty and consistency.[56] Countries lacking these attributes can suffer from lack of private investor

51. *See A Vehicle for Economic Development*, *supra* note 14. International lenders have expressed concern that Indian utilities have a history of failing to pay debts and of failing to make electricity purchases in accordance with the terms of power purchase agreements. The Indian government needs to take steps to address these concerns, whether through stricter treatment of its utilities with regard to their international commitments or through guarantees of full or partial payment in the event of a utility default.

52. *See id.*

53. *See id.*

54. Transportation Infrastructure Finance and Innovation Act, 23 U.S.C. §§ 601–09 (2015).

55. There are subtle differences in treatment of PPP regulation in civil countries (which are subject to more codified regulations) versus common law countries (which rely heavily on judicial rulings). Ghossein & Nunez, *supra* note 16, at 27. Distinctions can also be found between countries which have enacted independent PPP regulations versus countries which have embedded PPP regulations within broader procurement or contracting codes. *See id.* at 28. Distinctions can also be found between countries which have enacted independent PPP regulations versus countries which have embedded PPP regulations within broader procurement or contracting codes. *See id.* at 27–28; Makang & Dobrotkova, *supra* note 9, at 8.

56. *See* Makang & Dobrotkova, *supra* note 9, at 8.

confidence.[57] Even nations with a history of consistent legal and regulatory frameworks can lose investor confidence if those frameworks are perceived to have been significantly changed.[58]

Both public and private partners can further insulate themselves from risk by requiring third-party insurance policies such as general liability, automobile liability, and workers compensation insurance at adequate, cost appropriate levels to protect against potential liability.[59] Depending on the type of project and the country where the project is located, more specific types of insurance may be necessary to limit risk, such as climate-change related insurance for flooding, wildfires, or earthquakes which can disrupt construction or operation of PPP projects.[60]

In addition to insurance, the public partner may also require surety from the private partner, such as performance bonds, letters of credit, or guarantees.[61] A contractually agreed upon liquidated damages provision in the event of noncompletion would accomplish a similar objective.[62] However, the public partners should take care that such requirements are not so onerous as to limit a private entity's anticipation of return on their investment.

Citizen stakeholders often have a more difficult time limiting their risk, due to their exclusion from the decision making and contract drafting process, and they sometimes lack even notice of the project itself. Thus, protection of the citizen stakeholders falls to the government entity serving as a proxy for their citizens' interests, which often includes the need for high-quality service provision at reasonable rates and without increases of fees or taxes.[63] Even better, the public entity can actively encourage stakeholder participation through transparent decision making, frequent information dissemination, and creation of stakeholder advisory boards through which citizens can share and receive information about the project and address community concerns.[64]

C. *Best Practices for Public-Private Partnerships*

In addition to risk mitigation, there are a number of best practices which should be incorporated at the start of a PPP. One critical element is to clearly articulate performance goals or "deliverables," meaning the

57. *See id.*

58. *See id.* at 9–10 (describing the adverse effects of a government decision in the Philippines to cancel feed-in tariffs which had been used to incentivize solar investment).

59. *See A Vehicle for Economic Development*, *supra* note 14.

60. The governments of India typically require insurance as a precondition for a PPP contract. *See Resilient Infrastructure*, *supra* note 42.

61. *See id.*

62. *See id.*

63. *See* Davidson, *supra* note 20, at 960–61.

64. VIRGINIA A. GREIMAN, MEGAPROJECT MANAGEMENT: LESSONS ON RISK AND PROJECT MANAGEMENT FROM THE BIG DIG 78–109 (2013).

infrastructure or service to be provided by the PPP. Such deliverables should specify with particularity what is to be provided; the amount and quality of such services or facilities; the timeframe for completion, delivery, or operation; and the cost at which the service or facility is to be provided. It is also important to consider the fiscal implications and wisdom of undertaking the project, based upon sound financial estimates of its anticipated costs and benefits.[65]

The second vital element is designation and description of the respective roles of the private and the public entities. Which parties shall be responsible for what aspects of the project? Examination of respective roles should go beyond an evaluation of which party will construct, operate, or provide the facility or service, although that is certainly an important consideration. The parties must also allocate "behind the scenes" responsibilities such as project planning, human resource management, legal advising, public relations management, and risk allocation.

The role of affected citizens and public interest groups who are interested in the project, often referred to as "stakeholders" must also be determined.[66] There are many definitions for stakeholders, ranging from groups or individuals who have "an interest" in the project, to those who may be "affected by" the project, to those who can "affect the achievement" of the project.[67] Regardless of which definition is used, a successful project should identify what groups or persons will be considered stakeholders and what their role will be at various stages of the project's development.[68] Different stakeholders may be assigned different levels of importance and involvement and such expectations should be managed at the onset of the project.[69]

The third important element in establishing a PPP is project oversight and governance. As noted by Virginia Greiman, "[w]eak governance has been the root cause of many project failures," and thus a strong governance framework is critical to a successful PPP.[70] The institutional organization, hierarchy of authority, and allocation of responsibilities amongst the parties are all aspects of project governance. Governance structures can be established through government regulation, contracts, and general practices and procedures. Transparent organizational charts can aid in clarifying and ensuring compliance with the roles and

65. Ghossein & Nunez, *supra* note 16, at 35.

66. GREIMAN, *supra* note 64, at 79.

67. *Id.* at 80.

68. *Id.*

69. *See generally* Karen Z. Consalo, *Bombs and Babies: The Unfortunate Results of Conversion of a Military Defense Site to a Residential Neighborhood*, 5 BARRY ENV'T & EARTH L.J. 23 (2015).

70. GREIMAN, *supra* note 64, at 111.

responsibilities assigned to each party. Various aspects of a PPP, particularly in complex projects, may have different governance structures for various stages and aspects of the project.[71]

Finally, independent oversight of the project, including review of progress toward completion, budgetary compliance, and the parties' compliance with their assigned roles and responsibilities, should be scheduled throughout the duration of the project. Such oversight can be effectuated through supervisory boards or independent audits. If boards are to be used, it is important that the membership be composed of non-affiliated experts rather than political appointees or agents of involved parties.[72] Whatever entity is used to provide oversight, it should be endowed with some level of supervisory authority and power to effectuate change, such as the power to require modifications to the project's budget, construction specifications, scheduling commitments, or governance structures. With these crucial considerations in mind, a PPP can be designed and refined for the exact nature of the infrastructure project at hand.

D. *Contract Management in a Public-Private Partnership*

As noted above, a well-drafted contract is key to risk mitigation. It is also the prime tool by which to memorialize all the rights, responsibilities, obligations, tasks, and performance standards of all parties. Legal documents for each stage of a project should be well-vetted and drafted to ensure compliance by all parties with their designated roles and responsibilities, as well as to establish preemptive procedures in the event of delays, disputes, and other eventualities. Conditions and procedures for early termination of any contract should be well-documented. This serves to limit bad-faith behavior by any party and to limit litigation expenses in the event of a dispute.

Just like other stages of the PPP process, contract management should be conducted in a transparent manner. Making contracts available to the public increases overall transparency and public understanding of the project terms and expectations. It also increases the accountability of the contracting parties.[73] Unfortunately, studies indicate that PPP contract management is rarely part of the public disclosure process.[74]

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71. *See generally* Miller & Hobbs, *supra* note 30.

72. *See* Cletus Agyenim-Boaten, *The role of structure in manipulating PPP accountability*, 30 ACCT., AUDITING, & ACCOUNTABILITY J. 119, 137 (2017).

73. *See* Miller & Hobbs, *supra* note 30, at 15.

74. *See id.*

E. *Types of Financing for Public-Private Partnerships*

Financial PPPs are often necessary, or at least preferred by governments, in large scale infrastructure projects. Traditional commercial financing may be offered by domestic or international lenders, such as banks and other financial institutions. While such lending may be offered on market terms, debt can also be offered on more beneficial terms when the public or private partners seek to stimulate a certain industry. Beneficial terms may include below-market interest rates, extended repayment periods, or an initial term of interest-only repayments.[75]

Such beneficial terms may be offered to achieve equitable investment goals which seek to secure financing for under-serviced communities, ensuring they receive a fair share of basic services.[76] Thus, in the context of electricity, projects in a currently underserved community may be offered financing at lower interest rates or with longer repayment periods than market financing in order to develop a basic electricity grid and generation sources. Conversely, equitable investment can seek to assess service costs to the citizens who benefit most from them. For example, electric infrastructure, which is centered in, and primarily benefits, urban areas should be financed by those urban dwellers, not far away rural residents.

Many international lenders provide loans targeted toward development of sustainable, reliable, and equitable electricity services, including the World Bank which offers loans through the International Finance Corporation (IFC),[77] grants through the Global Environment Facility Trust Fund (GEF),[78] and financial and technical support to large-scale projects through the Green Climate Fund (GCF).[79] Similarly, charitable institutions may provide low-interest loans or grants to targeted projects.[80] Charitable institutions often require result-based commitments

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75. *See id.* at 8.

76. *See* Manuel Pastor, Jr. & Deborah Reed, *Understanding Equitable Infrastructure Investment for California*, PUB. POL'Y INST. CAL. (June 2, 2005), https://www.ppic.org/wp-content/uploads/content/pubs/op/OP_605MPOP.pdf [https://perma.cc/F52Q-QVVF].

77. *Public-Private Partnerships*, INT'L FIN. CORP., https://www.ifc.org/en/what-we-do/sector-expertise/public-private-partnerships [https://perma.cc/HEM3-XYV3].

78. *Global Environment Facility Trust Fund (GEF)*, WORLD BANK, https://fiftrustee.worldbank.org/en/about/unit/dfi/fiftrustee/fund-detail/gef [https://perma.cc/AC6X-RSEE].

79. *Resource mobilisation*, GREEN CLIMATE FUND, https://www.greenclimate.fund/about/resource-mobilisation [https://perma.cc/REN7-9PLT]; *see also Green Climate Fund (GCF)*, WORLD BANK, https://fiftrustee.worldbank.org/en/about/unit/dfi/fiftrustee/fund-detail/gcftf [https://perma.cc/7SRQ-LV5J].

80. *See* Stuart C. Mendel & Jeffrey L. Brudney, *Putting the NP in PPP: The Role of Nonprofit Organizations in Public-Private Partnerships*, 35 PUB. PERFORMANCE & MGMT. REV. 617, 623 (2012).

and self-reporting toward achievement of their sustainable electricity commitments from the financial recipients.

Governments have a significant role in providing financial incentives directed toward infrastructure or facility projects. While governments can and do offer loans and grants, at least one study by the World Bank indicates that such direct financial assistance is of least interest to renewable energy investors.[81] Rather, governments are critical partners for less direct financial assistance they can provide. Governments can greatly reduce the cost of a project by providing tax breaks, fee-waivers, expedited permitting, low-cost land leases, and technical expertise to the project developer.[82] Government subsidies, which can be used to offset the upfront costs of new infrastructure, are also popular incentive tools for infrastructure developers, especially feed-in tariffs (FIT).[83] Under a FIT program, the government grants long-term contracts to the project developer thus guaranteeing a customer base and schedule of payments for the developer's facility or service.[84]

A government's high credit rating, and willingness to guarantee loans or indemnify debt, are also significant incentives to financial investors.[85] Conversely, in a study conducted by the World Bank, approximately ninety percent of the commercial lenders interviewed indicated poor credit reputations as a "critical" impediment to private investment in renewable power developments.[86] The research of Miller and Hobbs also indicates the vital importance of a government's legitimacy and reputation for completing its financial commitments as assurance to the private sector that risk will be mitigated.[87] A government's efforts to assure foreign investors of the safety and security of their investment in the country is critical to infrastructure financing.

IV. RENEWABLE ELECTRICITY INFRASTRUCTURE

Reliable electricity service requires widespread and interconnected electric grids which link power generation sources to substations, transmission lines, and finally to distribution lines.[88] Electricity

81. WORLD BANK GROUP ET AL., THE ROLE OF THE PUBLIC SECTOR IN MOBILIZING COMMERCIAL FINANCE FOR GRID-CONNECTED SOLAR PROJECTS: LESSONS LEARNED AND CASE STUDIES 22 (2019).

82. *See* Makang & Dobrotkova, *supra* note 9, at 3; Elizabeth Trujillo, *Balancing Sustainability, the Right to Regulate, and the Need for Investor Protection: Lessons from the Trade Regime*, 59 B.C. L. REV. 2735, 2751 (2018).

83. Trujillo, *supra* note 66, at 2751.

84. *Id.*

85. Makang & Dobrotkova, *supra* note 9, at 9–11.

86. *Id.* at 11.

87. Miller & Hobbs, *supra* note 30.

88. *See* Makang & Dobrotkova, *supra* note 9, at 6; *U.S. Electricity Grid & Markets*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/green-power-markets/us-electricity-grid-markets

generation can come from many sources. Traditional electricity is generated by burning fossil fuels, such as coal or natural gas, to create thermal energy which is combined with water to create steam which rotates a turbine, thereby converting thermal energy into rotating kinetic or mechanical energy.[89] That energy is transmitted to a generator which converts it into alternating current (AC) electricity for export to the grid.[90]

Renewable fuel sources use similar processes to convert energy into electricity. The two types of solar generation, Concentrated Solar Thermal Power (CSP) and Photovoltaic (PV) systems, harness the power of the sun in two distinct ways. CSP generation facilities capture energy from the sun's rays then convert it into thermal energy to heat water and produce steam which then follows the process described above to create electricity for the grid.[91] Solar energy can also be harnessed when sunlight hits photovoltaic panels, exciting electrons within them to create a direct electric current (DC). This current is converted to AC by inverters and then exported to the grid.[92]

A. *Electrical Grid Issues*

Once electricity is generated, it must be transmitted through various lines to reach the end-user. High-voltage transmission lines are necessary to transmit electricity over long distances while medium-voltage distribution lines transmit electricity over shorter distances, such as within urban centers.[93] Finally, low-voltage distribution lines are used to deliver electricity to the end-users.[94] Transformers, typically located at substations, are used to safely convert voltage between the different transmission lines.[95]

Many countries in Asia have subpar electrical grids which can only transmit a few gigawatts of electricity (the equivalent of a large American city) for the entire country.[96] These small grids often lack geographically

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[https://perma.cc/8WMR-FJBS] (Apr. 18, 2023).

89. *See Electricity Explained: How electricity is generated*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/electricity/how-electricity-is-generated.php [https://perma.cc/N2YH-Q85G].

90. *See id.*

91. Dino Green, *Solar Energy Facts – Concentrated Solar Power (SCP) Vs Photovoltaic Panels (PV)*, RENEWABLE GREEN ENERGY POWER (Jan. 13, 2012).

92. *World's Largest Solar Power Plant Construction*, NAT'L GEOGRAPHIC CHANNEL (Feb. 25, 2017) [hereinafter *Largest Solar Power Plant*], https://youtu.be/gM-0lrIxCnE [https://perma.cc/P4CV-HB3P]; Green, *supra* note 91.

93. *See Electricity Explained: How electricity is delivered to consumers*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/electricity/delivery-to-consumers.php [https://perma.cc/XQX3-TBBG].

94. *See id.*

95. *See id.*

96. *See* Makang & Dobrotkova, *supra* note 9, at 6.

distributed transmission lines or interconnections to larger grids, reducing both the general accessibility and reliability of electricity provision.[97] In addition, such small systems often lack the capacity to maintain electricity reserves, further reducing reliability.[98] Grids are sensitive infrastructure which can be shut down by a single disrupted line.[99]

India's grid system has multiple failings and as a result, blackouts are daily occurrences throughout the country. Some grid failures are calamitous, such as the massive blackout in July of 2012, in which twenty states and over seven hundred million people were without power for up to twenty-four hours.[100] Thus large companies and private individuals have been forced to bear the cost of improving local grids due to widespread failures.[101]

B. *Storage Issues in Renewable Energy*

Renewable energy sources, such as solar, wind, and hydroelectric, have vast environmental and societal value.[102] However, renewable energy sources also pose unique challenges to an electrical grid, primarily due to the variable nature of their power generation. Unlike fossil fuels, which can be stored and supplied on an as-needed basis, renewable energy sources are intermittent. The sun only provides electricity when its rays hit the earth and wind only provides electricity when it is blowing.

Such variability would not be a problem if there were sufficient storage facilities to capture the electricity generated while the sun is shining or the wind is blowing. However, sufficient utility-level storage capabilities for solar or wind power are currently both financially and technologically challenging.[103] Hydroelectric sources, particularly pumped hydro, can accommodate some water storage for on-demand energy generation, but only for a few hours.[104] Thus, the lack of storage

97. *See id.*

98. *See id.*

99. *See Electricity Explained: How electricity is delivered to consumers*, *supra* note 93.

100. Helen Pidd, *India Blackouts Leave 700 Million Without Power*, GUARDIAN (July 31, 2012), https://www.theguardian.com/world/2012/jul/31/india-blackout-electricity-power-cuts [https://perma.cc/5X4Q-3DGU].

101. Philanthropic organizations have committed millions of dollars to create mini-grids throughout India to stem the problem of blackouts. Most significant of these is the Rockfeller Foundation, which has allocated fifty million dollars and has established over a hundred mini-grids in rural India. *Rockfeller Foundation Seeks PPPs for Mini Power Grid Projects*, TIMES INDIA (Oct. 22, 2017), https://timesofindia.indiatimes.com/business/india-business/rockfeller-foundation-seeks-ppps-for-mini-power-grid-projects/articleshow/61170404.cms [https://perma.cc/HXF2-WNSE].

102. *See* Karambelkar, *supra* note 24, at 361; *see* Sivaram et al., *supra* note 9, at 6.

103. *See* Rob Wile, *Solar Power Could Be a Total Game-Changer – But They Still Need to Figure Out One Thing*, BUS. INSIDER (Nov. 18, 2013), https://www.businessinsider.com/renewable-energy-storage-problem-2013-11 [https://perma.cc/4ZW2-KUA3].

104. *See Pumped Hydropower*, ENERGY STORAGE ASS'N, https://energystorage.org/why-

capabilities limits the extent to which a country can rely exclusively on renewable electricity sources.[105]

C. *Demand and Capacity Concerns*

When evaluating power sources, grid stability, and storage capacity, electricity providers must consider two important features arising from consumer demand. The first is the anticipated demand for electricity on a daily, weekly, or yearly basis for a particular geographic area.[106] The second concern is energy capacity, the "peak" electricity demand anticipated under certain conditions, such as very hot or very cold days.[107] Accounting for peak electricity demand is very important both to ensure sufficient electricity is available when needed and also to ensure that the grid does not fail due to pressures of high demand at peak times.

Demand for electrical power is measured in kilowatts, megawatts, and gigawatts, with each measurement being one thousand times the prior measurement.[108] Most household appliances operate at some level of kilowatts.[109] A town would demand a few megawatts of electricity.[110] A city would likely require one or more gigawatts.[111] For perspective, it would take over three million photovoltaic panels or over four hundred utility-scale wind turbines to generate one gigawatt.[112] An even larger measurement, terawatts, can be used to describe the energy demand of entire countries or even continents.[113] The amount of electricity used over a period of time is measured in watt-hours, such as twenty kilowatt hours.[114] Electricity capacity and generation is universally measured in such terms.

V. PUBLIC-PRIVATE PARTNERSHIPS FOR SOLAR ENERGY IN INDIA

India is currently one of the largest consumers of fossil fuels in the world, being one of six countries which burn about three-quarters of the

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energy-storage/technologies/pumped-hydropower/ [https://perma.cc/NZ6R-9GXB].

105. *See* Alexandra B. Klass & Elizabeth J. Wilson, *Interstate Transmission Challenges for Renewable Energy: A Federalism Mismatch*, 65 VAND. L. REV. 1801, 1808 (2012).

106. *See* Dworkin, *supra* note 2, at 2.

107. *See id.* at 3.

108. *See How Is Electricity Measured?* UNION CONCERNED SCIENTISTS (Oct. 22, 2013) [hereinafter *Electricity Measured*], https://www.ucsusa.org/resources/how-electricity-measured [https://perma.cc/EN8G-88CG].

109. *See id.*

110. *See id.*

111. *See id.*

112. *See* Mikayla Rumph, *How Much Power Is 1 Gigawatt?* U.S. OFFICE ENERGY EFFICIENCY & RENEWABLE ENERGY (Aug. 12, 2019), https://www.energy.gov/eere/articles/how-much-power-1-gigawatt [https://perma.cc/WGN7-9MBA].

113. *See* Dworkin, *supra* note 2, at 4.

114. *See Electricity Measured*, *supra* note 108.

world's fossil fuel usage.[115] It is the third-highest emitter of carbon, surpassed only by the United States and China.[116] Despite this extensive use of fossil fuels, three hundred million Indians lack basic electricity.[117] With a population expected to reach over 1.4 billion by 2030, addressing increased energy demands and providing energy to currently unserved residents is a pressing concern.[118]

The government of India made commitments prior to, and at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (also known as the Paris Climate Conference) to increase its use of non-fossil fuel based power to forty percent of its installed capacity by 2030.[119] As one of the first steps towards this goal, India plans to build 175 gigawatts of renewable energy capacity by 2022.[120] This includes development of biofuel, wind, solar, geothermal, hydro, and tidal electricity resources in a manner which is competitively priced, safe, reliable, and equitably distributed.[121] Under the 2018 planned National Energy Policy, India seeks to provide comprehensive electrical service to all areas of the country.[122]

As a critical component to meeting its renewable energy commitments, India plans to construct grid-connected solar plants and solar mega plants, distributed solar generators, and off-grid solar generators.[123] In fact, the country intends for solar power to fill one hundred gigawatts of India's total 175 gigawatt renewal energy goal.[124] India's emphasis on solar power makes sense when one considers that most areas of the country experience an average of three hundred sunny

115. *See* Dworkin, *supra* note 2, at 21.

116. *See* Annie Gowen, *India's Huge Need for Electricity Is a Problem for the Planet*, WASH. POST (Nov. 6, 2015) https://www.washingtonpost.com/world/asia_pacific/indias-huge-need-for-electricity-is-a-problem-for-the-planet/2015/11/06/a9e004e6-622d-11e5-8475-781cc9851652_story.html [https://perma.cc/GU7F-SCJT].

117. *See id.*

118. *See* Council on Energy, Environment and Water, *Laying the Foundation for a Bright Future: Assessing Progress Under Phase 1 of India's National Solar Mission*, NAT'L RES. DEF. COUNCIL (Apr. 2012) [hereinafter *Progress of India's National Solar Mission*], https://www.nrdc.org/sites/default/files/layingthefoundation.pdf [https://perma.cc/7MF4-V7FD].

119. *See Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 2. India made additional commitments toward carbon reduction in urban design and transportation networking. LealArcas, *supra* note 10, at 845.

120. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 2; *Largest Solar Power Plant*, *supra* note 92.

121. *Introduction*, MINISTRY NEW & RENEWABLE ENERGY, https://mnre.gov.in/about-department/introduction/ [https://perma.cc/3PFR-NHF4].

122. National Energy Policy, planned 2018 (India).

123. Kavita Mohan et al., *India*, 52 YEAR IN REV. ABA 615, 268 (2018); *see Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 2.

124. *Guidelines for Selection of 3000 MW Grid-Connected Solar PV Power Projects Under Batch-II*, GOV'T INDIA MINISTRY NEW & RENEWABLE ENERGY (Mar. 2015) [hereinafter *Guidelines for Selection*]; Sivaram et al., *supra* note 9, at 5.

days each year.[125] The National Institute of Solar Energy (NISE), structured under the Ministry of New and Renewable Energy, is tasked with development of the solar energy sector in India.[126]

A number of laws affect implementation of India's solar power goals. In the early 2000s, India enacted the Energy Conservation Act (2001) and the Electricity Act (2003) which legislated extensive reforms to the power sector in order to launch deployment of a nationwide energy access strategy.[127] Both laws are administered by the central Ministry of Power, which also oversees government owned companies involved in power generation. The 2005 National Electricity Policy then set guidelines for accelerated development of the electricity sector.[128] This was followed closely by the Rural Electrification Policy of 2006 which established a national goal for comprehensive access to electricity.[129] That same year, the government provided guidance under the National Tariff Policy as to methods by which power purchase tariffs would be issued and encouraged.[130]

In addition to the Ministry of Power, there are a number of government entities involved in electricity provision in India, including the State Electricity Boards which have traditionally been responsible for power supply, as well as the Electricity Regulatory Commission and the State Regulatory Commissions which are responsible for setting tariffs and encouraging competition.[131] However, the Ministry of New and Renewable Energy is responsible for achieving the country's renewable energy goals.[132] The Ministry has established criteria for meeting its goals, which emphasize wind and solar generation.[133] The Government of India also launched the National Solar Mission in 2010 to promote solar energy in central and state government policies.[134]

Massive investments in renewable energy generation and transmission require vast financial resources (estimated by Prime Minister Narendra Modi's administration to cost $2.5 trillion over fifteen

125. *See Progress of India's National Solar Mission*, *supra* note 118, at 1.

126. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 8–9.

127. The Energy Conservation Act, No. 52 of 2001, India Code (2001); The Electricity Act, 2003, No. 36, Acts of Parliament, 2003 (India).

128. National Electricity Policy, 2005, Res. No. 23/40/2004 (India).

129. Rural Electrification Policy, 2006, Res. No. 44/26/05 (India).

130. Tariff Policy, 2001, Res. No. 23/20/2001 (India).

131. *See* Karambelkar, *supra* note 24, at 370–71; *see also Indian Power Industry*, INDIAN MIRROR, https://www.indianmirror.com/indian-industries/power.html [https://perma.cc/M6ZH-AN7X].

132. *See Intrduction*, *supra* note 121; Karambelkar, *supra* note 24, at 385.

133. *See Programme/Scheme Wise [sic] Physical Progress in 2019-2020 & Cumulative up to August, 2019*, GOV'T INDIA MINISTRY NEW & RENEWABLE ENERGY (Aug. 2019), https://mnre.gov.in/the-ministry/physical-progress [https://perma.cc/W4H6-YLWB].

134. *See Guidelines for Selection*, *supra* note 124.

years) as well as extensive technical expertise and experience, which necessitate the use of financial and development PPPs.[135] India, like most governments, is not in the business of renewable energy development. Thus, it has neither the extensive technical expertise and experience of private solar generation businesses, nor does it have the assets, equipment, and contacts that private industry possess. Similarly, India does not have sufficient available financial capital available through domestic and international banks and lending institutions. Thus, the Indian government has instituted policies to encourage both development and financial PPPs at the domestic and international level.[136]

A. *Public-Private Partnerships for Financial Investment in India's Solar Energy Development*

In recent years, the cost of renewable energy generation and infrastructure has decreased.[137] Even with falling costs, many governments lack sufficient financial resources to fund the estimated trillions of dollars necessary to meet global sustainable electricity goals and thus must turn to financing partnerships. Financial PPPs with international and domestic lenders assist governments in funding both large and small-scale projects.

Unfortunately, as explored by Stanford's Steyer-Taylor Center for Energy Policy and Finance, Indian banks are often reluctant to finance solar projects due to a local perception that renewable energy generation is an untested or unsound investment.[138] Such perception is reinforced by a history of Indian utilities defaulting on loans.[139] Even when domestic banks will issue funds, they often come with high variable interest rates and short repayment terms.[140]

Thus there is a need for international finance partners.[141] Lower interest rates and longer-term financing offered by international banks make international financing attractive to solar project developers in India.[142] However, there has been some reluctance by international

135. *See* Sivaram et al., *supra* note 9, at 5.

136. *See Progress of India's National Solar Mission*, *supra* note 118, at 10.

137. Global estimates for solar PV are around $0.10 USD per KwH and off-shore wind generation is now around $0.06 USD per KwH, as compared with global fossil fuel-based electricity costs which range between $0.05 USD to $0.17 USD per KwH. *See* Dominic Dudley, *Renewable Energy Will Be Consistently Cheaper Than Fossil Fuels by 2020, Report Claims*, FORBES (Jan. 1, 2013), https://www.forbes.com/sites/dominicdudley/2018/01/13/renewable-energy-cost-effective-fossil-fuels-2020/#685d9a454ff2 [https://perma.cc/VBG7-CCHY].

138. *See* Sivaram et al., *supra* note 9, at 375; *Progress of India's National Solar Mission*, *supra* note 118, at 12.

139. *See Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 13, 123; Sivaram et al., *supra* note 9, at 35.

140. *See* Sivaram et al., *supra* note 9, at 22.

141. *See Sustainable Infrastructure Imperative*, *supra* note 5.

142. *See Progress of India's National Solar Mission*, *supra* note 118, at 15.

lenders to finance Indian renewable energy infrastructure due to concerns that investment in Indian utility companies is risky, in light of exchange rate fluctuations and past failures of Indian utilities to honor agreements to pay for the generated power.[143]

The Indian government has taken extensive steps to encourage international lending towards renewable energy resources. Such financial tools include market-rate loans, low-interest loans, bond issuance, stock issuance, grants, risk insurance, and loan guarantees.[144] In 1997, the central government of India, joined by private financial institutions, created the Infrastructure Development Finance Company (IDFC).[145] This entity provides a variety of financial services to PPPs, including issuance of loans, financial management development assistance, and lobbying efforts to encourage PPP projects.[146] Then, in 2006, the government created the India Infrastructure Finance Company Limited (IIFCL), also authorized to offer direct financial loans and refinancing of loans to eligible PPP projects.[147] The IDFC and the IIFCL enhance funding opportunities, encourage knowledgeable project development, bridge the gap between up-front infrastructure costs and the often long gestation periods for private cost recovery, and reduce overall risk to encourage private development in India.[148]

Governments at all levels in India, central, state, and local, also provide direct financial assistance to project developers through the India Infrastructure Project Development Fund (IIPDF).[149] Such assistance may include a share of the costs of feasibility studies and project management.[150] From the government's perspective, this assistance program encourages more developers to engage in competitive bidding and enhances the quality of projects.[151]

For energy and infrastructure projects deemed to be of great importance to the public welfare, India utilizes Viability Gap Funding

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143. *See id.*; *see also Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 13, 123; Sivaram et al., *supra* note 9, at 22.

144. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 25.

145. *See Overview*, IDFC LTD., https://www.idfclimited.com/our-firm/overview.htm [https://perma.cc/YJ92-MA9V].

146. *See Overview*, IDFC LTD., https://www.idfclimited.com/our-firm/overview.htm [https://perma.cc/4WL6-DEC7]; *Government Support in Financing PPPs*, WORLD BANK, https://ppp.worldbank.org/public-private-partnership/government-support-financing-ppps [https://perma.cc/T7CF-DV5Y].

147. *See Government Support in Financing PPPs*, *supra* note 146.

148. *Public Private Partnership Models in India*, IAS PARLIAMENT (Aug. 16, 2017), https://www.iasparliament.com/current-affairs/public-private-partnership-models-in-india [https://perma.cc/N8Q3-LVK7].

149. *See India Infrastructure Project Development Fund (IIPDF) Scheme*, DEP'T OF ECON. AFFS., https://www.pppinindia.gov.in/guidelines_for_iipdf [https://perma.cc/MES9-L3M6].

150. *See* IAS PARLIAMENT, *supra* note 148.

151. *See id.*

(VGF).[152] This funding is used to encourage private investment in projects which may not otherwise be financially viable. The government may provide a grant of up to forty percent of the project cost, typically at the construction stage, to offset private risk and increase overall financial viability of the private partnership. The government only extends such significant benefits through VGF grants to projects which are initially proposed by the government, have been competitively bid for, and which will be implemented (meaning developed, constructed, maintained, and operated) by the private partner.[153]

Financial assistance from domestic and international organizations is necessary to harness the full potential of India's solar energy commitments. Such private financing can be provided in a variety of forms, such as loans, bonds and grants. In issuance of such financing, lenders are encouraged by government guarantees and policies which limit their exposure to risk as discussed above.

B. *Public-Private Partnerships for Construction and Operation of Solar Energy Facilities in India*

In addition to financing PPPs, development of renewable energy projects requires PPPs for construction and operation of facilities. Some PPPs simply require public assistance in the form of land acquisition, permitting assistance, technical assistance, affordable access to reliable grid infrastructure, and assurance of a long-term customer base.

Solar plants, especially mega-plants, require extensive land resources. For example, ground-based solar plants require five to ten acres of land in solar abundant areas for each megawatt of power produced.[154] Even in a nation with year-round sunshine like India, developers are somewhat constrained as to where such solar plants can be located to both maximize power generation (i.e., areas of reliable and abundant sunshine) as well as ensuring close access to adequate grid infrastructure to transmit the generated power.[155]

While the price of land in India is not often a barrier to project development (it typically represents about five percent of a solar project budget)[156] there are many land issues which can pose a hurdle. Obtaining the land if the owners do not want to sell, clearing title issues, and obtaining environmental and construction permits can pose significant

152. *Scheme for Financial Support to Public Private Partnerships in Infrastructure (Viability Gap Funding Scheme)*, DEP'T OF ECON. AFFS., https://www.pppinindia.gov.in/vgf guidelines [https://perma.cc/2K29-4VF5].

153. *See id.*

154. *Progress of India's National Solar Mission*, *supra* note 118, at 26.

155. *See id.*

156. *Id.* at 26.

delays and difficulties for a private developer.[157] Thus, the central and state governments can provide significant assistance to their private partners in acquiring the necessary land through purchase or condemnation; ensuring clear title; and providing necessary permits for development of the land, or at least expediting the process for permitting.[158]

Allocation of land acquisition responsibilities between the public and private partners has varied in India. Since the 1995 Mega Power Policy Act, the Indian government has had authority to obtain land and secure environmental clearances on behalf of electricity developers for large projects.[159] However, for political reasons (such as to avoid critiques for displacement of citizens) and for financial reasons (to avoid payment of compensation to all property owners whose land was condemned) there are many solar projects in which the private partner is responsible for land acquisition.[160] Indian governments have thus used a variety of land acquisition strategies in PPPs to develop solar facilities, including concession and lease agreements.[161] Typically, the central, state, or local government will retain ownership and final authority with regard to the facility or service while the private partners run daily operations.[162]

An example of such PPPs can be found in the series of partnerships under the Karnataka Urban Water Sector Improvement Project.[163] Planned by the state of Karnataka and funded by the World Bank (which also provided technical assistance) these partnerships also involved city governments in Karnataka and a subsidiary of the French water utility, Veolia Water.[164] Through various PPPs beginning in 2005 and extending over a decade, the water utility has been able to rehabilitate and distribute regular fresh water supply, from multiple water bodies, for drinking and sanitation purposes.[165] These projects benefit approximately two hundred thousand Karnataka residents and businesses.[166]

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157. See *id.*

158. See id.

159. *See* Karambelkar, *supra* note 24, at 371.

160. *See* Sivaram et al., *supra* note 9, at 28.

161. *See* IAS PARLIAMENT, *supra* note 148.

162. *See id.*

163. *See id.*; *India: State of Karnataka gets additional $150 million from World Bank to provide continuous piped water supply in three cities*, WORLD BANK (Dec. 21, 2021), https://www.worldbank.org/en/news/press-release/2021/12/22/india-state-of-karnataka-gets-additional-150-million-from-world-bank-to-provide-continuous-piped-water-supply-in-three-c [https://perma.cc/9DJ9-VHQJ].

164. *India: State of Karnataka gets additional $150 million from World Bank to provide continuous piped water supply in three cities*, *supra* note 163.

165. *See Ilkal, Karnataka*, VEOLIA, https://www.veolia.in/ilkal-karnataka [https://perma.cc/NC3E-D4E3].

166. *See Karnataka Urban Water Supply Modernization Project Brief*, WORLD BANK (Mar. 31, 2016), https://www.worldbank.org/en/country/india/brief/karnataka-urban-water-supply-

India has discovered that under any type of development PPP, a transparent procurement process is key to encouraging private interest and investment.[167] Thus, for renewable energy projects procured by the central government, the Ministry of New and Renewable Energy or the Vidyut Vyapar Nigam Ltd. (NVVN), an Indian power company owned by the government, solicit bids from developers in a transparent reverse auction.[168] In this auction, the lowest-priced bid will be the successful private partner, provided that the bidding business satisfies required technical criteria.[169] Successful bidders are then offered a twenty-five year Power Purchase Agreement under which the bidder commits to produce renewably sourced power by a specific "commissioning" deadline (of which the failure to meet results in a financial penalty) and the government commits to ensuring there will be purchasers, typically utilities, for the power generated.[170] The NVVN serves as the public partner monitoring arm throughout the process to ensure that the private partner complies with their obligations.[171]

The reverse auction is a popular mechanism in India because it achieves lowest-priced renewable electricity provisions and it ensures transparency in the selection process, thus avoiding claims of corruption or bias by the public partner.[172] Critics do complain that oftentimes the Indian government sets selection criteria too low, particularly in state auctions, in order to allow smaller developers to participate in the bidding process.[173] Unfortunately, this can result in unqualified participants winning the bid and then failing to supply the commissioned product.[174] Critics also allege the inexperienced bidders present overly optimistic prices which cannot actually be commissioned but which have the detrimental effect of driving down all bids to unrealistic levels.[175] To limit such concerns, more rigorous selection criteria should be used to ensure that only solvent and capable companies are engaged.[176] Such criteria should include: (1) proof of sufficient capital resources and/or a dedicated

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modernization-project-brief [https://perma.cc/P3ZA-GARN]; *Karnataka Urban Water Sector Improvement Project (KUWASIP)*, INDIA WATER PORTAL, https://www.indiawaterportal.org/articles/karnataka-urban-water-sector-improvement-project-24x7-water-supply-achievable-field-note [https://perma.cc/HT7Y-UUN7]; *The Karnataka Urban Water Sector Improvement Project: 24x7 Water Supply is Achievable*, WORLD BANK WATER & SANITATION PROGRAM (Sept. 2010).

167. *See Progress of India's National Solar Mission*, *supra* note 118, at 5.

168. *See id.*; NTPC VIDYUT VYAPAR NIGAM LTD., http://nvvn.co.in [https://perma.cc/36J6-B4LF].

169. *See Progress of India's National Solar Mission*, *supra* note 118, at 5.

170. *See id.*; *Guidelines for Selection*, *supra* note 124.

171. *Progress of India's National Solar Mission*, *supra* note 118, at 3.

172. *Id.*

173. *See* Sivaram et al., *supra* note 9, at 34–5.

174. *See id.*

175. *Progress of India's National Solar Mission*, *supra* note 118, at 8.

176. *See id.*

funding source to complete the commission; (2) a description of PPP history including successes and failures; (3) a description of similar recent projects, technical expertise, and workforce credentials; and (4) a detailed proposed budget.

C. *Public-Private Partnerships for Development of Solar Parks*

In 2010, India launched a National Solar Mission in furtherance of its National Action Plan on Climate Change.[177] One objective of this mission was to construct and connect one hundred gigawatts of solar power plants to transmission grids by 2022. This goal was expanded in 2017 to forty thousand megawatts across at least fifty solar parks by 2022.[178] Defined as "a large area of land developed with all necessary infrastructure and clearances for setting up solar projects," a solar park is expected to generate approximately five hundred megawatts of capacity.[179] Mega- and ultra-mega solar plants can generate over one thousand megawatts (one gigawatt).[180]

To accomplish its goal, India has established a number of regulatory and policy incentives to reduce costs of solar facility installations and encourage private development in solar, including enhanced tariff policies, reverse bidding auctions, subsidies, regulatory mandates, low-cost financing, and land acquisition assistance.[181] Section 63 of the Indian Electricity Act requires tariff-based competitive bidding in a transparent auction for electricity generation providers.[182] Pursuant to the Act, the central government created standard bidding guidelines to ensure transparency and consistency, providing a stable and reliable market for commercial interests. Solar plant developers submit bids for the cost of a designated amount of power (with a minimum amount of five megawatts and minimum price set at ₹2.67 INR per unit in 2019).[183] Bids may include a solar tariff fixed at twenty-five years or with an annual escalation over twenty-five years.[184] The bidder with the cheapest bid secures government approval and rights to tariffs for long-term electricity

177. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 2.

178. *Id.* at 16.

179. *Id.*; *see also Background*, USICEF, https://www.usicef.org/about-usicef/ [https://perma.cc/XZ5W-YPQ4]; Sivaram et al., *supra* note 9.

180. *Badal Opens Mega Solar Plant at Radha Soami Dera*, TRIBUNE NEWS SERV. (May 18, 2016), https://www.tribuneindia.com/news/archive/features/story-238299 [https://perma.cc/5EFU-3NA8].

181. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 2.

182. The Electricity Act, 2003, No. 36, Acts of Parliament, 2003 (India).

183. *Id.*; *see also* Gurdip Singh, *Foreign Investors on India Is the Platform Bringing Indian Business Opportunities*, FOREIGN INV. INDIA (Aug. 27, 2017), https://www.fiinews.com/tariff-competitive-bidding/ [https://perma.cc/RNQ7-CSAP]; *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 20.

184. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 21.

provision. Through this method, long-term energy supplies at affordable prices are secured for the public while the private energy suppliers are guaranteed tariff rates for the electricity generated. This government assurance of return on investment has led the private sector to invest heavily in utility-level, grid-connected solar across India.[185] Over eight gigawatts of solar power have already been generated through the Standard Bidding Guidelines (SBG) process.[186]

The "State Specific Bundling Scheme," managed by the National Thermal Power Corporation Ltd. (NTPC) and its subsidiary, NVVN, is a state-sanctioned and promoted program by which the NTPC can execute Power Purchase Agreements with various solar power developers.[187] Through these agreements, the public entity commits to purchase a large amount of solar power from the developer over a certain number of years, typically twenty-five years.[188] These agreements can be used to purchase power from existing solar sources or planned solar generation.[189]

In 2017, India also gauged the private sector's interest in developing floating solar plants by issuing Expressions of Interest (EoI) which included an assurance that the government would authorize a long-term Power Purchase Agreement with the developers.[190] Floating solar plants, which literally float solar panels on water bodies, are an innovative, mobile, and less land-intensive method to generate large amounts of solar power and move such power closer to the demand.[191] The central government hoped to gather specifics from the private sector as to the feasibility, timelines, and costs of large scale deployment of floating solar. Unfortunately, the private response to India's EoI was lukewarm at best.[192]

The central government has also employed VGF to assist private parties in development of approximately seven thousand megawatts of grid-connected solar parks (up to ₹13.1 million INR per megawatt, approximately $160,000 USD) under various government incentive

185. *Id.* at 20–21.

186. *See id.*

187. *Impact of Bundling Scheme on Solar Power Companies*, AMPLUS SOLAR (Oct. 23, 2020), https://amplussolar.com/blogs/impact-of-bundling-scheme-on-solar-power-companies [https://perma.cc/M53S-Q7VK].

188. *See* Maria Vagliasindi, *Revisiting Public Private Partnerships in the Power Sector*, WORLD BANK (2017), https://elibrary.worldbank.org/doi/abs/10.1596/978-0-8213-9762-6 [https://perma.cc/3QYG-X6VA].

189. *See Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 20.

190. *Id.* at 4; Tom Kenning, *India's SECI Invites Expression of Interest for 10 GW of Floating Solar*, PV TECH (Dec. 19, 2017), https://www.pv-tech.org/news/indias-seci-invites-expression-of-interest-for-10gw-of-floating-solar [https://perma.cc/EW3Z-TF9U].

191. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 120.

192. *See* Kenning, *supra* note 190.

projects.[193] VGF is usually capped at thirty percent of the project cost.[194] One of the larger solar projects incentivized with VGF was 680 megawatts of solar generation developed across seven states by the Solar Energy Corporation of India (SECI) with gap funding in the amount of ₹1.84 billion INR (approximately $23 million USD).[195]

The Ministry also offers central financial assistance of up to ₹45 lakh INR toward planning and development of each megawatt of solar power, as well as ₹8 lakh INR per megawatt toward development of grid infrastructure.[196] One lakh equates to ₹100,000 INR or approximately $1,500 USD, thus the Indian government offers direct financial assistance of nearly $80,000 USD per each megawatt of solar plant power developed and connected to the grid.[197]

An example of the success of government incentives is one of the largest solar parks in the world, the Kurnool Ultra Mega Solar Park, which is located in the state of Andhra Pradesh.[198] This mega solar park generates one gigawatt (one thousand megawatts).[199] Kurnool was developed through a partnership of the central government of India and the state government of Andhra Pradesh, designated as the Andhra Pradesh Solar Power Corp. Pvt. Ltd. (APSP).[200] The central government provided a grant of $30,000 USD per megawatt to the APSP for project development. The APSP was able to acquire the land for the plant and associated infrastructure and construct necessary roads and drainage facilities.[201]

The remainder of the funding for Kurnool was assembled by private commercial interests selected through a reverse bidding process whereby developers presented their lowest tariffs for a specified amount of solar generation. The resulting private commitments included five hundred megawatts from the Indian power company GreenKo (which acquired the rights from a U.S. energy company, SunEdison, after SunEdison went bankrupt), as well as Indian power companies Azure Power and Adani which won their respective one hundred megawatt and fifty megawatt

193. *See Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 19–20.

194. *See id.*; Sivaram et al., *supra* note 9, at 29.

195. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 19–20.

196. *See id.*

197. *See How Many Dollars Are Equal to One Lakh*, REFERENCE, https://www.reference.com/business-finance/many-dollars-equal-one-lakh-a6df000eea3ae193 [https://perma.cc/D665-WA27].

198. *See* Anjali Jaiswal & Laasya Bhagavatula, *The World's Largest Solar Park – Kurnool, India*, NAT'L RES. DEF. COUNCIL (Oct. 31, 2017), https://www.nrdc.org/experts/anjali-jaiswal/worlds-largest-solar-park-kurnool-india [https://perma.cc/3UKP-LYPF].

199. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 4.

200. *See* Jaiswal & Bhagavatula, *supra* note 198.

201. *See id.*

contracts under India's Domestic Content Requirement.[202] Soft Bank Energy, a Japanese company, and SBG Cleantech Project Co. Construction both won contracts to construct 350 megawatts.[203] Prayatna Developers won fifty megawatts.[204] The APSP solicited additional funding from these private developers, in the amount of $7,700 USD per megawatt, to develop infrastructure to improve local communities, such as roads, drainage, and drinking water supplies.[205] Local residents were also given job training and employment at the Kurnool park during construction and operation.[206]

The Kurnool Ultra Mega Solar Park was an extensive international partnership composed of multiple governments, international lenders, and international private development partners. The result was a high functioning solar park to offset fossil-fuel energy demands and improve the quality of life for nearby residents.[207] The success of the Kurnool Ultra Mega Solar Park has led the government of the state of Andhra Pradesh to partner for development of another 1,500 megawatt ultra-mega solar park in the Kadap region.

D. *Public-Private Partnerships for Development of Distributed and Off-Grid Solar Generators*

Distributed solar facilities are smaller solar generators, such as rooftop photovoltaic solar units and mini-grids, which are designed to generate several kilowatts of electricity, primarily for on-site usage.[208] These distributed facilities may be connected to a high transmission grid, to a mini-grid, or to a macro-grid (which may or may not connect to the transmission grid) to enable the generator to sell surplus electricity to other users or the local utility. Distributed solar is an ideal method by which to provide electricity to currently unserved or underserved rural areas which lack adequate high-voltage grid infrastructure.[209] Distributed solar also enables businesses and homes which are connected to power grids but lack reliable electricity due to weak grid infrastructure to supplement the grid service and thus enhance the overall reliability of

202. Jaiswal & Bhagavatula, *supra* note 198; Ian Clover, *India's 1 GW Kurnool Solar Park on Verge of Grid Synchronization*, PV MAG. (July 12, 2017), https://www.pv-magazine.com/2017/07/12/indias-1-gw-kurnool-solar-park-on-verge-of-grid-synchronization/ [https://perma.cc/7BZ9-6C3X].

203. *See* Jaiswal & Bhagavatula, *supra* note 198.

204. *See id.*

205. *See id.*

206. *See id.*

207. *See id.*

208. *See* Sivaram et al., *supra* note 9, at 35.

209. *See Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 3; Sivaram et al., *supra* note 9, at 38.

their electricity supply.[210] India also plans to develop solar power at lower levels through off-grid installations—very small solar generators which provide electricity to a single home or business.[211]

The majority of Indian consumers of distributed and off-grid solar systems tend to be commercial and industrial interests which either lack sufficient electricity from a central grid or hope for greater electricity reliability and cost savings (as well as potential profits from residual power) from a distributed system.[212] These consumers, as well as the commercial developers of distributed solar, tend to fall into the category of Micro, Small, and Medium commercial entities (MSME).[213] Installation of a distributed solar facility typically requires up-front investment directly from the consumer.[214] Unfortunately, there is a perceived credit risk of lending to MSMEs in India due to lack of credit information or ratings and lack of collateral as security for the financing.[215] Further discouraging lenders are the high transactional costs for individual solar loans relative to their size, increasing risk and lowering profit margins for lenders.[216] Finally foreign exchange rate fluctuations in international transactions can affect projects where the cashflow is issued in Indian Rupees (INR).[217] Thus, obtaining a loan for the upfront costs of the purchase of a distributed system or capital costs to start a distributed solar business can be prohibitively difficult.[218]

The regional governments of India have received international financial assistance in pursuit of the country's goals for distributed and off-grid solar power. In 2017, the World Bank offered $100 million USD in sub-loans to Indian states to finance forty gigawatts of solar development.[219] These sub-loans are administered, in part, by the

210. *See* Sivaram et al., *supra* note 9, at 38.

211. *See id.* at 7.

212. *See* Aparna Khandelwal et al., *Credit Support Pathways for Rooftop Solar Projects in India*, CLIMATE POL'Y INITIATIVE (Oct. 2018); Jolly Sinha et al., *Drivers and Challenges for Rooftop Solar Loans to Small and Medium Enterprises in India*, CLIMATE POL'Y INITIATIVE (Oct. 2018); Derm, *supra* note 29.

213. *See* Khandelwal et al., *supra* note 212.

214. *See* Derm, *supra* note 29.

215. *See* Sinha et al., *supra* note 212; Khandelwal et al., *supra* note 212.

216. *See* Sinha et al., *supra* note 212.

217. *See* Vinit Atal et al., *Transitional Foreign Exchange Debt Platform: Paths to Enable Foreign Currency Debt to the Rooftop Solar Sector in India*, CLIMATE POL'Y INITIATIVE (June 2018), https://climatepolicyinitiative.org/publication/transitional-foreign-exchange-debt-platform-paths-to-enable-foreign-currency-debt-to-the-rooftop-solar-sector-in-india/ [https://perma.cc/HB4B-MURQ]. Risks posed by fluctuating exchange rates may be overcome by routing loans through intermediaries, such as a private Indian financial institution, which can manage the currency exchange risk. *See* USICEF, *Project Developers*, [hereinafter *Project Developers*] https://www.usicef.org/faqs/ [https://perma.cc/4C9B-9NYA].

218. *See* Atal et al., *supra* note 217.

219. Makang & Dobrotkova, *supra* note 9, at 6.

Ministry of New and Renewable Energy.[220] The International Bank for Reconstruction and Development and the Clean Technology Fund (CTF) provided $75 million USD and $25 million USD loans, respectively, toward the India Shared Infrastructure for Solar Parks Project for distributed and off-grid solar power.[221]

In addition, India has deployed various incentives and financial assistance mechanisms to assist MSMEs to find funding sources for the solar development.[222] Three primary financing models have been used to assist in development of distributed solar facilities in India: the capital expenditure (CAPEX) model, the renewable energy supply company model (RESCO), and the Power Purchase Agreement model.[223] Under the CAPEX financial model, the consumer pays one hundred percent of the up-front costs of photovoltaic solar installation.[224] Typically, these consumers take out a personal loan to fund the solar installation so that they can have power supplied directly to their home or business. These consumers have the benefit of ownership of the solar system and may be able to access financial incentives through tax benefits or rebates.[225]

Under the RESCO model, a solar developer pays for the installation of solar photovoltaic units on its client's building pursuant to a long-term lease agreement by which the customer pays the developer back for the installation over time.[226] The solar developer also typically retains rights to any profits from back-fed power to the grid.[227] This model requires a significant amount of capital on the part of the solar developer.[228] Thus, the RESCO model works best for established companies which possess sufficient capital for new projects or can secure commercial loans.[229]

Other sources of funding include the United States-India Clean Energy Finance (USICEF) which seeks to mobilize financial support and technical expertise from both the public and private sectors to develop

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220. *Id.* at 7.

221. *Id.*; THE WORLD BANK, PROJECT APPRAISAL DOCUMENT 1 (2017), https://fifspubprd.azureedge.net/cifdocuments/Project/1844/1844_India_Shared%20Infrastructure%20for%20Solar%20Parks_Updated%20PAD.pdf [https://perma.cc/9P2N-DBEL].

222. The United States-India Catalytic Solar Finance Program (USICSF) has recommended that the Ministry launch a Credit Guarantee Mechanism (CGM) to aid MSME's in securing financing. This mechanism would be based upon a loss-sharing arrangement between certain financial institutions and the CGM Trust. The CGM Trust would extend both loss coverage and a partial credit guarantee to the participating lending institutions to encourage such institutions to finance solar developers under the RESCO business model. *See* Khandelwal et al., *supra* note 212.

223. *See id.*

224. *See id.*

225. *See id.*

226. *See id.*

227. *See id.*

228. *See id.*

229. *See id.*

distributed solar power projects in underserved and rural areas of India.[230] The partnership was created "to accelerate progress towards India's renewable energy and energy access goals" through installation of residential and industrial rooftop solar panels and mini-grids.[231] Through USICEF, a commercial installer of distributed solar facilities could obtain a grant for feasibility and market studies, legal and financial advisory services, environmental and social impact assessments, product development and testing, and engineering costs.[232] If the start-up is funded, the solar installer could seek further grants and technical assistance from USICEF for installation and delivery service and even connection to longer-term financial assistance.[233]

India's political commitment and financial incentives for development of solar-generated electricity have resulted in a total solar power capacity installed of 28,180 megawatts, with additional capacity of approximately 14,041 megawatts under installation as of March of 2019, for a total deployment of approximately forty gigawatts by 2020.[234] These strides toward renewable energy, made in just a few years, are incredibly impressive and meet India's phased goals to reach one hundred gigawatts of solar power by 2022. However, as of 2018, seventy-four percent of India's power is still fossil-fuel based.[235] Yet, the International Energy Agency predicts that continued national efforts to redirect

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230. *See About USICEF*, US-INDIA CLEAN ENERGY FIN. [hereinafter *About USICEF*], https://www.usicef.org [https://perma.cc/77UL-3UP3]; *US-India Clean Energy Finance – Impact Summary*, USICEF, CLIMATE POL'Y INITIATIVE [hereinafter *Impact Summary*], https://www.usicef.org/wp-content/uploads/2019/02/USICEF-Program-Implementation-Impact-Summary-.pdf [https://perma.cc/YED2-53PF]; *US-India Clean Energy Finance Initiative Partners with PTC India Financial Services Limited to Mobilize Debt Financing for Distributed Solar Energy in India*, USICEF (Apr. 9, 2019) [hereinafter *India Fin. Servs.*], https://www.usicef.org/us-india-clean-energy-finance-initiative-partners-with-ptc-india-financial-services-limited-to-mobilize-debt-financing-for-distributed-solar-energy-in-india/ [https://perma.cc/QNM9-FPFL]; *Background*, USICEF, *supra* note 179. *See generally Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 2.

231. USICEF involves a partnership between the Indian Ministry of New and Renewable Energy, the Overseas Private Investment Corporation (OPIC), and several U.S. and Indian foundations, such as the MacArthur Foundation, the Packard Foundation, the Hewlett Foundation. The PTC India Financial Services Limited (PFS), an Indian non-banking financial company which focuses on energy value chains and sustainable development recently joined as a partner in USICER. *See Impact Summary*, *supra* note 230; *About USICEF*, *supra* note 230.

232. *See* USICEF, *Who Should Apply*, https://www.usicef.org [https://perma.cc/WQY2-YJKY]; *Project Developers*, *supra* note 217; *India Fin. Servs.*, *supra* note 230.

233. *See* USICEF, *How to Join* the *USICEF Network of Service Providers*, https://www.usicef.org/service-providers-2/ [https://perma.cc/T2TU-UBE5]; *Project Developers*, *supra* note 217.

234. *Indian Ministry of New & Renewable Energy Report*, *supra* note 8, at 13.

235. Jordan Davidson, *India is Now Investing More in Solar Thank Coal*, ECOWATCH (June 4, 2019), https://www.ecowatch.com/india-solar-power-investments-2638682086.html [https://perma.cc/RR45-4P3U].

investment toward renewables will reduce such fossil fuel reliance to fifty-seven percent over the next fifty years and more aggressive policies could reduce it even more dramatically.[236]

E. *Community Benefits of Solar Partnerships*

There are a wide range of local, state, national, and international benefits arising from solar development which can enhance citizens and businesses. The World Bank has detailed the importance of renewable energy toward reducing carbon and pollution emissions, limiting fuel volatility, and enhancing access to reliable electricity in developing countries.[237] As discussed previously in this Article, India's transition from reliance on fossil-fuels to renewable energy sources has a significant impact on reducing carbon-emissions, which should result in slowing global warming and climate change.[238] Similarly, renewable energy sources result in less local air and water pollution for local citizens.

Beyond environmental benefits, solar-based electricity reduces India's reliance on foreign sources for oil, coal, and gas, thus allowing greater independence from political pressures of foreign nations.[239] Greater energy security and reliability enhances India's national security, it supports the stability and sustainable expansion of India's economy, and it raises the quality of life of India's citizens.[240]

Solar partnerships also increase job opportunities and training for Indian citizens, particularly at the local level when new solar facilities and businesses are opened. As an emerging market, India's mastery of PPPs to develop solar can have great financial benefits to its economy. Sustainable initiatives in California led to a boom in low-carbon technology businesses which became global leaders in the face of limited competition, as compared with the traditional fossil-fuel based industry.[241] Studies estimate that these low-carbon technologies may increase the gross state product by $60 million USD and create over twenty thousand new jobs by 2020.[242] India can similarly reap the benefits of leading the world in solar redevelopment: increased gross national product and increased job opportunities and development of a skilled solar labor force.

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236. *See id.*

237. *See* Gabriela E. Azuela & Luiz A. Barroso, *Design and Performance of Policy Instruments to Promote the Development of Renewable Energy: Emerging Experience in Selected Developing Countries*, WORLD BANK (Apr. 2011).

238. *See* THE WORLD BANK, *supra* note 221.

239. *See* T. Rick Irvin et al., *Kyoto Comes to Georgia: How International Environmental Initiatives Foster Sustainable Commerce in Small Town America*, 36 GA. J. INT'L & COMP. L. 559, 570 (2008).

240. *See id.*

241. *See id.*

242. *See id.*

In addition to new jobs and job training, residents and businesses benefit directly from reliable electricity either through the grid or through distributed technologies. As noted in the Introduction to this Article, reliable access to electricity, particularly for cooking and lighting is vital to achieving gains in education, nutrition, health and other benchmarks of the World Health Index.[243] If India's solar initiatives are successful, the millions of Indians currently lacking sufficient electricity service may soon be brought into the light and comfort of twenty-first century clean energy.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. *India's Accomplishments*

There is a worldwide need to reduce carbon emissions and pollution caused by burning fossil fuels for electricity. A critical tool toward ending reliance on fossil fuels is development of renewable energy infrastructure such as solar plants, distributed solar, and off-grid infrastructure. India's commitment to generate one hundred gigawatts of solar electricity by 2020 was a laudable goal.[244] India's rapid deployment of over forty gigawatts of grid-connected and distributed solar generation in just a few years is an impressive political, legal, financial, and technological feat.[245] These achievements could not have been made without India's strong commitment to PPPs for development of solar and other renewable electricity sources. Thus, there are many lessons the international community may learn from India's approach to rapid deployment of solar energy.

The costs of research and development, land acquisition and permitting, design, construction and operation for solar resources are extensive. Few individuals and businesses have sufficient capital resources to make this investment, even fewer in developing nations. Therefore, both international and domestic investors are needed to provide the necessary financing to renewable energy developers. To limit real and perceived financial risk of such financial investment, particularly with regard to MSMEs, government intervention is critical. Regulations, policies, and incentives promulgated by public entities to reassure private lenders that solar energy is a sound investment play a significant role in development of such infrastructure.

India has addressed the financing challenge in a number of ways. Both central and state governments offer VGF to offset up to forty percent of

243. *See Human Development Data*, *supra* note 2; *Human Development Index*, *supra* note 2.

244. *Guidelines for Selection*, *supra* note 124.

245. *See id.*

solar development start-up costs.[246] Solar projects can also benefit from the India Infrastructure Project Development Fund, which provides government loans for initial expenses such as feasibility studies and project management.[247] The government-controlled India Infrastructure Finance Company offers longer-term loans than private domestic lenders.[248] Policies are also in place so that central and state governments can assist private partners with land acquisition and permitting. India also encourages private debt through use of Indian Infrastructure Debt Funds which reduce taxes on private loans, thereby adding to the profit margin for lenders.[249]

India has also taken strides to encourage private partnership in the development of solar facilities. Transparent reverse auctions are used by the central and state governments to select developers for commission of most solar plants. This process is designed to assure the private sector that the selection process is not "rigged" and all competitors have the opportunity to bid successfully. This transparency is of particular value to international companies which may not have existing relationships with local, state, or central government officials as compared to their domestic competitors. India's reverse auction bidding has the added benefit of determining the lowest prices for solar electricity.

Finally, while PPPs can be designed in many ways, the success of a PPP requires clear allocation of expectations, rights, and responsibilities among the parties as well as independent oversight to identify and remediate problems. As demonstrated in India, when actively pursued and carefully enacted, PPPs can achieve stunning and rapid results toward development of a nationwide renewable electricity supply.

As noted by Miller and Hobbs, most governments will only develop one or two large electricity infrastructure projects during the incumbent officials' term in office and therefore the government does not have much opportunity to learn from the successes and failures of their projects and apply such lessons to future projects.[250] However, India's commitment to rapidly develop all types of solar infrastructure and facilities allows the country a unique opportunity to learn from the rollout of early projects and adjust its laws, policies, and contractual arrangements to many future projects. Other countries seeking to employ private financing, manpower

246. *Scheme for Financial Support to Public Private Partnerships in Infrastructure (Viability Gap Funding Scheme)*, *supra* note 152.

247. *See India Infrastructure Project Development Fund (IIPDF) Scheme*, *supra* note 149.

248. *Government Support in Financing PPPs*, *supra* note 146.

249. Don Lambert, *Under Construction: India's Infrastructure Debt Funds—Their Importance, Challenges, and Opportunities*, 1, 5 (ADB South Asia Working Paper Series No. 29, 2014).

250. Miller & Hobbs, *supra* note 30.

and expertise to develop solar power infrastructure can learn from India's experiences as well.

B. *Recommendations for Additional Measures*

India should enact policies to encourage domestic banks to lend to solar projects, particularly to MSMEs which generally lack access to international funding, both to spur project development and to increase revenues for domestic banks. In addition to policy initiatives, the central government should gather and publicize data on profit and losses, as well as the financial information, for existing PPP solar projects to enable domestic banks to make fact-based evaluations of risk versus reward in these investments.

Indian regional governments can also encourage private interest in the development and operation of solar facilities through expansion of favorable laws, policies, and incentives. For example, government subsidies and tax credits to offset initial development and construction costs are of great value to private developers due to the capital-intensive nature of developing sustainable electricity infrastructure for which the return on investment may take decades. A cap-and-trade system on carbon emissions, with a stringent carbon cap, would also stimulate the solar market.[251] Net metering, through which owners of distributed solar facilities can sell their excess power back to the local utility, would encourage greater individual investment in distributed solar facilities.[252] The government should prioritize expansion and enhancement of the grid system to provide assurance to private financial and development partners that there will be a ready market for electricity service.

Government assistance to private development partners in land acquisition, preparation, entitlements and permitting would alleviate significant hurdles to large scale solar park development.[253] Although use of the power of condemnation may be controversial, the government should consider when such assistance to private solar development is necessary.

Finally, India has been criticized for setting reverse auction bid criteria at levels which allow unqualified developers who submit overly optimistic bids but fail to develop the proposed project to participate. Such red herrings waste valuable time and resources, frustrate qualified bidders, and breed mistrust in the system. Further, unqualified bidders undermine the competitive process by driving prices to unsustainably low prices thereby alienating many qualified bidders from the process.

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251. *See* Azuela & Barroso, *supra* note 237.

252. *See* Ashley Brown & Jillian Bunyan, *Valuation of Distributed Solar: A Qualitative View*, 27 ELECTRICITY J. 27 (2014).

253. Stephen Friedman, ed., *Successful Public / Private Partnerships: From Principles to Practices*, URBAN LAND INST. (2016).

Finally, because reverse auctions place great emphasis on lowest-priced bids, they discourage businesses from proposing higher priced innovative and cutting-edge technologies.[254] Thus, India should include more rigorous standards in their reverse auction bid requirements to ensure solar commissions go to private partners which can successfully complete the project.

C. *Conclusion*

Solar electricity expansion presents great opportunities for India, including preeminence on the world stage for achieving carbon reductions, healthier air and water, enhanced quality of life for citizens through wider access to reliable electricity, and increases to economic prosperity due to the skilled jobs and industrial growth which are generated by solar energy expansion. The renewable energy market is predicted to continue to grow as a multi-billion-dollar industry.[255] As a world leader in the solar electricity market, India can reap the benefits of this massive economic engine through continued use and improvements to its PPP-based market development.

254. *See Resilient Infrastructure*, *supra* note 42.

255. *See* Irvin et al., *supra* note 239.