

India's Energy Transition:

The Impact of the
Goods and Services
Tax on Solar
Photovoltaic and
Coal Power Costs

ISSUE BRIEF



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List of Abbreviations

AAR	Authority of Advanced Rulings
ACD	Additional Duty of Customs
AD	Benefit Accelerated Depreciation
BCD	Basic Customs Duty
CERC	Central Electricity Regulatory Authority
CGST	Central Goods & Services Tax
CST	Central Sales Tax
DBTL	Direct Benefit Transfer for LPG
EPC	engineering, procurement and construction
GST	Goods and Services Tax
IGST	Integrated Goods & Services Tax
LCOE	levelized cost of energy
NCEEF	National Clean Energy and Environment Fund
O&M	operations and maintenance
PCU	power control unit
ROE	return on equity
SAD	Special Additional Duty of Customs
SGST	State Goods & Services Tax
TPP	thermal power plant
VAT	value added tax



1.0 Introduction

In *India's Energy Transition 2018 Update*, the Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD) and the Council on Energy, Environment and Water (CEEW) published updated estimates of the scale of energy subsidies in India for FY2017, including partial data on the scale of subsidies for FY2018.

One of the biggest causes of changes in India's energy subsidy policy between FY2017 and FY2018 was the introduction of the Goods and Services Tax (GST)—which overhauled a large share of India's taxes, and, in doing so, its tax-related subsidies.

Subsidies and taxation are important because they are the main two tools that governments use to influence prices for different types of energy—and through them, the investment decisions and consumer behaviour that are required to meet their policy objectives.

So how did the GST perform from an energy pricing perspective? Were taxes adjusted in ways that were more or less consistent with India's desired energy future? And how have the final costs of energy been affected? To answer these questions, this brief takes a detailed look at the GST, and in particular, how it has affected the subsidies and pricing of two very different energy sources: coal-fired thermal power; and large-scale on-grid solar power.

KEY FINDINGS

- By removing exemptions and altering tax rates, the extent of preferential treatment for various energy sources has changed under the GST. Total tax subsidies to both solar PV and coal thermal power have been reduced—but the absolute size of the subsidy to coal-based power remains much higher than for solar PV.
- By altering the net tax burden, the GST has also affected the cost of energy production. Our calculations show that, assuming all other factors are held constant, the GST is likely to lead to a significant increase in the cost of generation for new solar PV plants. In contrast, existing coal-fired thermal power plants are likely to experience reduced variable costs under the GST. A lack of data on the fixed costs of new coal plants makes it impossible to calculate the impact of the GST on the overall cost of new coal plants.
- The introduction of the GST therefore appears to provide a relative bias in favour of coal-based power.
- Detailed assessments of the implications of GST on other renewable energy types including wind are needed to determine unintended impact on relative cost against coal.



2.0 Context

India's energy policy aims to achieve at least four main objectives: economic growth, access and affordability, energy security and independence, and sustainability (NITI Aayog, 2017). In particular, India's transition to sustainable energy is driven by the need to address the external costs ("externalities") associated with fossil fuels, including both the damage to public health and their contribution to climate change. As the cost-competitiveness of on- and off-grid renewable energy has improved, it has become an attractive alternative to fossil fuels—but balancing India's multiple objectives and offering a level playing field for various energy types is often challenging.

Many countries use taxation to factor external costs into prices, raise revenues and promote renewables. This includes: removing subsidies like tax breaks and generally increasing taxes on fossil fuels; and direct budgetary transfers, tax credits and tax exemptions for renewables (Gagnon-Lebrun et al., 2018). This helps to drive investments into clean energy sources which might otherwise not be favoured by the market. A database of India's energy subsidies from FY2014 to FY2017 can be found in [India's Energy Transition 2018 Update](#) (Soman et al., 2018).

One of the largest changes to India's tax-related subsidy policies between FY2017 and FY2018 has been the introduction of the Goods and Service Tax (GST). The Central Goods and Services Tax (GST) Act came into effect on July 1, 2017, after 17 years of deliberation and delay. The GST superseded a wide variety of indirect taxes on the supply of goods and services in an attempt to harmonize tax rates, simplify procedures and prevent "tax cascading" (where multiple taxes at different levels all compound to a high final tax burden) (see Box 1 for details). Tax rates were limited to five categories: 0 per cent, 5 per cent, 12 per cent, 18 per cent and 28 per cent. The ultimate goal of these reforms was to improve overall economic efficiency.



BOX 1. KEY FEATURES OF THE GST REFORM

- a. **Harmonization:** Before the GST, there were many taxes at the central and state levels. The GST has attempted to harmonize and simplify the tax system by subsuming many of these into just three core taxes: the Central Goods & Services Tax (CGST), the State Goods & Services Tax (SGST) and the Integrated Goods & Services IGST (IGST). It did not subsume all taxes. Remaining independent taxes include electricity duty, basic customs duty, toll taxes, alcohol tax and property tax (Gagnon-Lebrun et al., 2018).
- b. **Destination-based tax:** In the earlier tax system, states that supplied goods collected taxes. Under the GST, tax is collected in the states where goods are consumed.
- c. **Input tax credit (ITC) mechanism:** ITC permits the claim of credits for tax paid on goods or services that are inputs for further goods or services that will be later taxed again at a point of final consumption. This avoids the “cascading” of taxes, where intermediate taxes accumulate to a high final tax burden. This had become problematic under the earlier regime.
- d. **Clean Environment Cess:** Before the GST, coal was subject to the Clean Environment Cess. This was set at INR 400 (USD 5.7) per tonne and its proceeds fed into the National Clean Energy and Environment Fund (NCEEF). The NCEEF, in turn, used the money to support clean energy technology research and innovative projects (Ministry of Finance, 2011). After the GST, the Clean Environment Cess was merged into the GST Compensation Cess, along with a variety of cesses on other products, such as tobacco and motor vehicles. Under the GST, the Compensation Cess levies the same rate of tax on coal as before—but now, revenues are used to compensate states for losses arising from the removal of state-level taxes. Consequently, the NCEEF was effectively disbanded.



3.0 Impacts: How Did the GST Change Subsidies and Prices for Solar PV and Coal Thermal Power?

3.1 Approach

In order to estimate the impact of the GST, we first estimate how the tax reform affected tax-related subsidies. Then, we explore how the new tax affects the final price of energy for large-scale, on-grid solar power and conventional coal thermal power.

Tax subsidies are calculated by considering whether the tax rate is lower than the one that should formally be applied—a “benchmark” rate. We estimate pre-GST subsidies based on pre-GST benchmarks and post-GST subsidies based on post-GST benchmarks. For example, under the GST, the tax on coal stands at 5 per cent. This is much lower than other products in the ‘mineral’ taxation category, with the highest tax rate being 18 per cent. Therefore, if 18 per cent GST is used as the benchmark then 13 per cent (18 per cent - 5 per cent) of the value of coal consumed is revenue foregone and constitutes a tax subsidy.

It is important to look at final prices as well as subsidies because, with the introduction of the GST, the benchmarks that we use to calculate subsidies have themselves changed—so subsidies going up or down does not necessarily equate to the same change in the net tax burden and the final price of energy. To explore impacts on price, we estimate the Levelized Cost of Electricity (LCOE) for large-scale on-grid solar PV generation and coal-fired generation. This shows the full cost of electricity generation divided by the total amount of electricity generated, over the entire lifetime of the asset, allowing for easy comparison between different technologies.

For more technical details about the approach, see Annex 1 and Annex 2.

3.2 Subsidies: Estimated impact of GST on tax subsidies for solar PV and coal

GST implementation has resulted in a change in the total tax subsidy for solar PV and coal power. Figure 2 shows that there has been a 15.6 per cent and 16 per cent decrease in the total tax subsidy for solar PV and coal thermal power, respectively, as a result of the implementation of GST. While the degree of support appears to have declined by nearly the same percentage for the two energy sources, there is still a significant difference in the total amount of government support offered, with support to coal more than double that provided to solar PV. In comparing these figures, it should be noted that a much larger volume of electricity is generated by coal each year than by solar PV—and also that coal is a fully developed conventional energy technology, with significant social and environmental impacts, while solar PV is a new, clean and emerging energy technology.

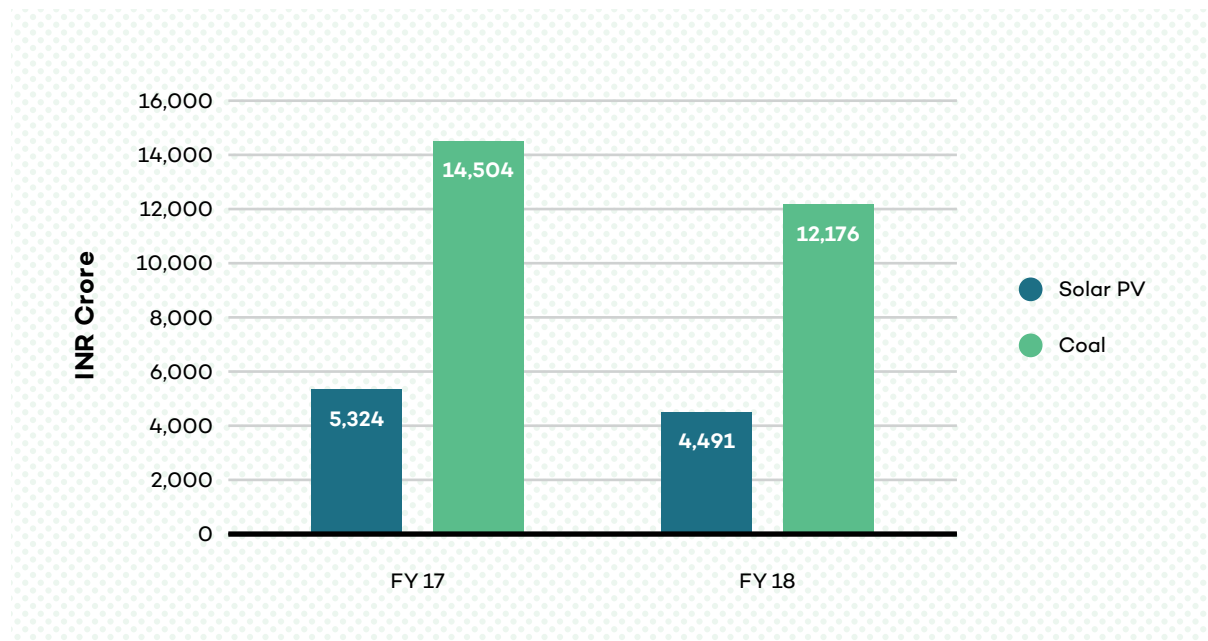


Figure 1. Total tax subsidies for solar PV and coal, pre-GST reform (FY17) and post-GST reform (FY18)

Source: Author's analysis.

3.3 Prices: Estimated Impact of the GST on the Levelized Cost of Electricity (LCOE) for Solar PV and Coal

As noted above, a more complete analysis of the impact of GST requires an evaluation of the change in the cost of generation. Electricity production from different sources—such as coal-fired thermal, nuclear, wind and solar PV—has different characteristics that affect the cost of generation. Upfront capital investment, operational expenses and capacity factors can influence generation cost. The Levelized Cost of Electricity (LCOE) is a metric that permits comparison of the costs of electricity generation across various generation sources. It represents costs on a per-kWh basis accounting for the total lifetime of a project (Comello, Glenk, & Reichelstein, 2017).

The costs of any project consist of two components—fixed costs and variable costs. There is no fuel cost for solar PV, and other variable costs, such as operations and maintenance, are small. As a result,

the LCOE for solar PV generation is driven almost entirely by the estimated capital cost. On the other hand, the LCOE for coal thermal power is sensitive to both the variable cost of fuel and the capital investment required (EIA, 2018).

3.3.1 The Levelized Cost of Energy for Solar PV

Table 1 shows our assumptions about the taxes that are applied to the major components of a solar PV installation pre- and post-GST reform, as well as the assumed share of total cost for each component of capital cost.

Until December 2018, when the GST Council came out with a clarification, there was uncertainty about the exact post-GST rates that would be applicable on Solar Power Generating Systems (SPGS). The GST Council has now stated that 70 per cent of the gross value of a contract shall be considered as supply of goods and attract 5 per cent GST, while the remaining 30 per cent of the aggregate value will be treated as supply of services with 18 per cent GST as the applicable rate (PIB, 2018). This is an arbitrary method of applying taxes since a variety of contracting structures exist for solar PV projects and the share of services is not necessarily 30 per cent of gross value across all contract types. For project developers, there is still uncertainty regarding how taxes will be applied across all contract types for SPGS (see Annex 2 for more details). We have, however, assumed tax rates as per the recommendation of the GST Council in our analysis.

Table 1. Tax breakdown before and after GST for Solar PV

Components	Share of total cost (%)	Taxes Applicable Pre-GST reform		Taxes Applicable under GST
		Tax	Rates	Tax
PV Modules	56	BCD, SAD, ACD ¹	0	70% of the contract value taxed at 5% GST and the remaining 30% at 18% GST.
One-time Solar Park Charges	17	Service Tax	15	
Balance of System	27	VAT	2	

Source: Author's analysis based on consultations with several developers and engineering, procurement and construction (EPC) contractors, and CBIC, 2018; Gambhir et al., 2016; MNRE, 2016; RAAR, 2018.

These assumptions were then used to calculate the LCOE pre- and post-GST reform (see Annex 2 for details). The LCOE analysis was based on costs derived from a 200 MW plant solar park project. Solar park projects constituted the majority of projects awarded in India in 2017 (Chawla et al., 2018). Solar parks allow developers to lower the risks associated with land acquisition and evacuation infrastructure, as these are provided by government authorities for a usage fee. The average solar park project size was 166 MW in 2017 (Chawla et al., 2018).

As summarized in Table 2, below, we find that post-GST introduction, the LCOE increases by 5.8 per cent as compared to the pre-GST LCOE. This significant increase in LCOE can be attributed to the current method proposed for applying taxes by the GST Council. While supply of goods in our calculation constitutes 83 per cent and services 17 per cent of the gross value, as per the GST Council's recommendation, services assume a higher share of 30 per cent. Thus, while in the previous tax regime the higher tax rate (service tax at 15 per cent) applied to 17 per cent of the capital costs and modules were exempt from taxes, under GST 30 per cent of the capital costs attract the higher GST rate (18 per cent GST) and the remainder is taxed at 5 per cent GST.

¹ BCD—Basic Customs Duty; SAD—Special Additional Duty of Customs; ACD—Additional Duty of Customs.

Table 2. Levelized Cost of Energy (LCOE) for solar park projects

LCOE Components	Pre-GST (INR/kWh)	Post-GST (INR/kWh)
PV Modules	0.48	1.14
Solar Park Charges	0.37	
BOS (Balance of System)	0.23	
O&M (Operations and Maintenance)	0.45	0.48
AD (Accelerated Depreciation) Benefit	- 0.22	- 0.23
Debt Servicing	0.91	0.96
ROE (Return on Equity)	0.53	0.56
Final LCOE	2.74	2.90
Percentage Change (%)	NA	5.84%

Source: Author's analysis.

Note: Percentage changes are reported because LCOE values are best estimates and may differ from actuals given changing market and technology costs.

3.3.2 The Levelized Cost of Energy for a Coal-fired Thermal Power Plant

The LCOE calculations for coal thermal power plants were carried out assuming a typical 500 MW capacity. A significant share of plants commissioned between 2003 and 2016 were 500 MW in size (Srinivasan et al., 2018). For such plants, the LCOE is influenced by both fixed costs and variable costs.²

The overall fixed costs were determined based on the average capital costs for seven similar-sized plants, derived from their respective tariff orders (CERC, 2015, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f). However, it was not possible to identify data that would allow for a detailed breakdown of these costs into individual components and associated taxes. As a result, it was not possible to calculate how the GST affected fixed costs.

The overall variable costs were compiled from various government notifications and published reports. Fortunately, it was possible to estimate a detailed breakdown of these variable costs, and therefore an estimate of the impacts of the GST reform.

For India's existing coal thermal power plants, whose fixed costs have already been incurred, the change in variable costs indicates the full impact of the GST on their costs of generation. For new coal plants, it is harder to determine conclusive results. Nonetheless, the analysis shows that variable costs make up around 75 per cent of total costs, so the analysis is likely to capture the majority of changes for new coal thermal power plants as well.

Three main changes introduced by GST reforms have influenced variable costs. First, the net tax burden on domestic coal has been reduced, due to the elimination and rationalization of previous taxes. Second, taxation of imported coal has increased due to the application of the IGST. Finally, the taxation of coal transportation has increased.³

Table 3 shows the LCOE components pre- and post-GST reform, assuming that a plant uses only domestic coal or that 70 per cent of its supply is domestic and 30 per cent is imported. This ratio is chosen based on CERC guidelines on blending ratio (CERC, 2012).

² A description of the fixed and variable costs and the detailed calculations and assumptions employed are available on the IISD website <https://www.iisd.org/sites/default/files/uploads/%20indias-energy-transition-goods-services-tax-coal-solar.xlsx>.

³ A detailed breakdown of the variable costs and taxes can be found in Annex 2.

Table 3. LCOE for coal thermal power plants – domestic and both domestic and imported

LCOE Components	Domestic coal		Domestic and imported coal (70:30)	
	Pre-GST reform LCOE (INR/kWh)	Post-GST reform LCOE (INR/kWh)	Pre-GST reform LCOE (INR/kWh)	Post-GST reform LCOE (INR/kWh)
Coal	1.11	1.06	1.55	1.51
Transportation	0.79	0.79	0.79	0.79
O&M Expenses	0.15	0.15	0.14	0.14
Return on Equity	0.18	0.18	0.17	0.17
Depreciation	0.14	0.14	0.13	0.13
Interest on Loan	0.08	0.08	0.08	0.08
Interest on WC	0.04	0.04	0.05	0.05
LCOE	2.48	2.44	2.90	2.87
% Change		-1.61%		-1.03%

Source: Authors' estimates, based on analysis of CBIC, 2018; Kamboj & Tongia, 2018; Ministry of Railways, 2016; PIB, 2017. For a detailed breakdown of tax rates on the variable cost components of coal thermal power, see Annex 3.

Overall, the variable LCOE of a coal thermal power plant—assuming that it uses only domestic coal—decreased by almost 1.6 per cent post-GST reform. Plants using a mix of domestic and imported coal would see a smaller decrease, 1 per cent, largely due to the influence of higher taxes on imported coal. Figure 3 shows the percentage reductions in the coal component of the LCOE as well as the reduction in the overall LCOE.

**Figure 3.** Percentage change in the variable LCOE for coal thermal power plants using different shares of domestic coal and imported coal

Source: Authors' analysis

Note: Percentage change changes are reported in interpreting these figures because LCOE values are best estimates, and may differ from actuals given changing market and technology costs.



3.3.3 Comparing the Post-GST Levelized Cost of Energy for Solar PV and Coal Power

Our analysis finds that the introduction of the GST increased the LCOE for solar PV by almost 6 per cent per cent and decreased the LCOE for existing coal thermal power plants by 1 to 2 per cent, depending on the share of domestic coal used for generation. This does not take into account the cost of uncertainty for solar PV developers, who have not known how their projects would be treated under the new taxation system until the recent clarification in December 2018 by the GST Council. As such, the introduction of the GST has implicitly favoured coal power relative to solar PV, and incentivized greater take-up of domestic coal sources.

An important caveat is that the analysis was not able to identify how the GST would affect fixed costs for new coal thermal power plants. As a result, we cannot confidently conclude how LCOE costs for new plants would be affected. Nonetheless, variable costs are estimated to make up around three quarters of total costs, so the analysis is likely to capture the majority of LCOE cost changes for new coal thermal power plants. Other limits to the comprehensiveness of the analysis include: i) the pre-GST analysis requires a number of assumptions, due to the complex variation in state-level pre-GST tax structures; and ii) despite the December 2018 ruling by the GST Council on how solar power generating systems (SPGSs) will be treated, there is still uncertainty for some contract types. Finally, it should be noted that other recent tax developments have taken place that will also have a significant influence on the costs (see Box 2). These are not considered, so that the impact of the GST alone can be isolated.

BOX 2. OTHER TAX DEVELOPMENTS AFFECTING THE COST OF SOLAR-GENERATED ELECTRICITY

Two other tax-related developments have had impacts on costs for solar power developers.

In July 2018, India applied a safeguard duty on imported solar PV cells and modules: 25 per cent in the first year; 20 per cent for the following six months; and 15 per cent for the last six months. The forthcoming CEEW publication “What is the Safeguards Duty Safeguarding?” finds that the duty in its current form would not be effective in supporting local manufacturers and has created uncertainty, leading to reduced industry interest in the tenders floated in the first half of 2018. Two important policy developments have roughly counterbalanced the impact of the safeguard duty on tariffs. First, China scaled back its solar deployment targets, leading to a crash in the prices of solar cells, wafers and modules in international markets. Second, several tendering agencies extended the commissioning timelines of solar projects, incentivizing developers to delay the procurement of solar modules to completely bypass the safeguard duty. Even the procurements where the safeguard duty would apply are expected to be granted a pass-through.

Second, the GST has required an adjustment to the payments that solar power developers receive from distribution companies (discoms). A recent Central Electricity Regulatory Commission (CERC) order requires discoms to pay a one-time compensation fee to developers whose project costs are likely to change because contracts were awarded before the GST was implemented. ICRA estimate this will cost around INR 2,000 crore (USD 280 million). The impact for developers will depend on the timely release of payments by discoms (Kondratieva, 2018). This one-off adjustment is important for these projects, but does not relate to our wider objective of estimating the ongoing effect of the GST on relative prices for solar- and coal-based electricity.



4.0 Taxing Energy Production: The role of fiscal policy in promoting sustainable energy

The analysis suggests that tax system changes can have unintended consequences by shifting relative preferences between electricity generated by coal and solar technologies. This raises a wider set of questions about the extent to which India's fiscal system is aligned with the country's energy policy objectives. There are three areas where improvements might be made: setting the tax rate so that it captures the value of negative external costs; the most efficient use of subsidies for social purposes; and the promotion of sustainable energy.

As regards external costs, it is well recognized that coal use in thermal power plants imposes a major cost on society. The combustion and transport of coal contributes to local air and water pollution by the release of fine particulates, mercury, sulphur oxides (SO_x) and nitrogen oxides (NO_x) (Munawar, 2018). Public health impacts include increased incidence of respiratory and cardiovascular diseases. The health benefits from avoiding such emissions are estimated to be INR 9,62,222 crore (USD 134.7 billion) by 2030 (Srinivasan et al., 2018). Coal power is also a major contributor to climate change through the release of CO₂ emissions.

Under the previous tax system, coal was subject to the Clean Environment Cess of INR 400 (USD 6) per ton, as a means to tax the externalities caused by its use. This has now been replaced with the GST Compensation Cess, at the same rate. It is not clear, however, to what extent this tax rate captures the health and environmental costs arising from the use of coal. Ideally, the tax rate should be based on an evaluation of the full costs of coal—including both local air and water pollution and climate change costs—and estimate of the tax rate that would maximize overall welfare for society.

As regards social purposes, it is important to note that a higher tax rate on coal could increase the average cost of electricity and have a negative impact on economically vulnerable groups. An evaluation of the full costs of coal should also consider how different tax rates would affect vulnerable groups and



their access to energy. If necessary, complementary policies could be designed to ensure that any tax rate contributes to India's energy policy and health policy objectives at the same time as protecting the poor. For example, targeted subsidies could be used to ensure that low-income consumers can afford energy, or more robust social assistance policies could be used to reduce living costs in other areas. This might include measures that flexibly top up household incomes, such as cash transfers; or measures intended to reduce costs for specific societally valuable needs, such as healthcare and education.

As regards sustainable energy, it is sensible for the tax system to help encourage investments that are likely to lead to sustainable social “goods,” particularly when more fundamental corrective measures such as broad-based carbon taxation are not likely in the short- to medium-term. The introduction of the GST has resulted in the removal of certain exemptions and increases in the tax on cost components such as PV modules, which increases the cost of generation for solar PV. To some extent, this may reflect the fact that grid-scale solar is increasingly cost-competitive compared to coal power, and, as a result, short-term subsidies intended to incubate a new technology can be phased out. The Economic Survey 2018, for example, has already suggested a reconsideration of incentives to reduce the scale of subsidy support to the renewable energy sector (Ministry of Finance, 2018a). At the same time, ongoing debate about the need for solar power to now meet stringent cost ceilings, and the dampening effect this is having on auctions, suggests that this optimism may be premature—and, again, ought to be subject to a full evaluation.

There are still some large impediments to realizing India's renewable energy targets. For example, by 2022, 40 GW of rooftop solar capacity is targeted for installation, but its uptake has been lacklustre, as it is still prohibitively expensive for homeowners who enjoy subsidized electricity. Similarly, distributed solar, microgrids and small-scale renewable energy are segments of the renewable energy sector that require market structures that drive early deployment to bring down costs by developing more efficient business models, consumer bases and technological development. Likewise, offshore wind, floating-solar and other nascent renewable technologies will not be able to compete without appropriate market mechanisms until they mature as part of India's renewable energy mix.

Given the extent to which the GST has embedded into its structure a consideration of the exceptional role of various energy sources in India's energy policy, it is important, therefore, for the tax system to offer exemptions for new and emerging technologies similar to those extended to utility-scale solar and wind in their early days, or equivalent forms of support. It is also important to recognize the heterogeneity of contract types for solar PV projects—deeming 30 per cent of the project cost as supply of services unfairly imposes a higher GST rate on projects where services may in fact have a smaller share (Mercom, 2019). Since solar PV project development cannot be carried out without associated services such as installation and commissioning, supply of services should be ideally treated as being part of a “composite supply” and attract 5 per cent GST. Additionally, the loss of the National Clean Energy and Environment Fund (NCEEF) for renewable energy technologies is a significant reduction in the available resources for new and emerging technologies in India. The government should find a way of at least maintaining funding for clean energy through the NCEEF or an equivalent body, either by using the GST Compensation Cess or through some other mechanism.

Finally, increasing the share of renewables in the energy mix is accompanied by grid infrastructure costs, balancing costs and the reduced utilization of thermal power plants. Absorbing these integration costs through government support can accelerate the penetration of solar energy in the near and long terms (Chaturvedi, Koti, & Chordia, 2018). Energy storage is a crucial component of grid balancing and is another key technology development area where targeted subsidies could be used to pursue India's energy policy targets.



5.0 Conclusions and Recommendations

A year and a half into the implementation of the GST, there is a great deal of uncertainty about its net impact on the energy sector in India. This policy brief explored the impact of GST on the costs of solar PV and coal thermal power generation.

The GST tax regime has led to a significant increase in the cost of solar PV power generation. At the same time, the variable cost of existing thermal power generation (using domestic coal) has fallen by almost 2 per cent. Thus, the introduction of the GST tax regime is likely to affect the competitiveness of solar PV with respect to coal, which may send signals that influence investment decisions.

The uncertainty about how GST will be applied to the sector has also resulted in delays in the deployment of solar PV. This uncertainty, coupled with other policy shocks for the sector—such as the imposition of a safeguard duty of 25 per cent on imported solar panels and modules—may constrain India's progress toward its target of 100 GW of installed solar capacity by 2022.

The following are the key recommendations to policy-makers:

- 1) **Improve transparency and reporting about preferential treatment under the GST:** This study compared a specific renewable energy alternative against coal thermal power to reveal that the latter has benefited from a lower cost of generation following the GST reform. Similar assessment and reporting should be carried out in an open, transparent manner to understand impacts on other sustainable energy alternatives, including wind energy. Such analysis is essential to shape public discourse on government support to different energy sources. An assessment of the economic, social and environmental implications of changes in the costs of generation should inform decisions on the appropriate tax rates for renewables and fossil fuels.



- 2) **Further clarity on GST rates applicable on solar power generating systems is required:** The current approach to treating 70 per cent of the gross value as supply of goods and the remainder as services is arbitrary, considering the heterogeneity of contract types for solar PV. Ideally, supply of services should be considered to be part of a composite supply, where solar power generating system is the principal supply, and thereby attract 5 per cent GST instead of the current 18 per cent GST. Clarity is also needed on types of solar PV technologies that constitute solar power generating systems.
- 3) **As some types of renewable energy technology mature, ensure that any adjustments to favourable taxation rates appropriately distinguish between technologies that are more mature and those that are continuing to emerge:** Broad-based changes in favourable taxation for technologies like solar and wind fail to recognize the extent to which sub-segments of these technology classes remain in an early development stage, such as offshore wind, floating-solar and small-scale renewable technologies. Even for more mature technologies, public support may be required to help stimulate systems-based investments, such as around balancing large-scale penetration of variable generation. Such incentives can continue to be embedded in the GST or shifted entirely to alternative, dedicated policies, but will remain an important aspect of energy policy in coming years.
- 4) **Reinstate support for clean energy research and innovative projects:** The effective scrapping of the National Clean Energy and Environment Fund (NCEEF), and the redirection of the revenue raised from the GST Compensation Cess toward compensating states, has removed an important support for emerging technologies in clean energy. Development and demonstration of such technologies at scale are critical to India's energy security, climate leadership and addressing air

pollution.

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Annex 1. Methods for Estimating Tax Subsidies

This brief illustrates changes in tax subsidies in FY17 and FY18, the years before and after which the GST was introduced. These estimates are reported from India's Energy Transition 2018 Update (Soman et al., 2018). The update uses the same approach as the previous review by Garg et al. (2017), relying on the subsidy definition from the Agreement on Subsidies and Countervailing Measures of the World Trade Organization. Its estimates have been prepared based on assumptions about the gap between the actual tax rate and an appropriate "benchmark" tax rate. This requires careful judgement, and calculations of tax subsidies can vary depending on the benchmark that is chosen.

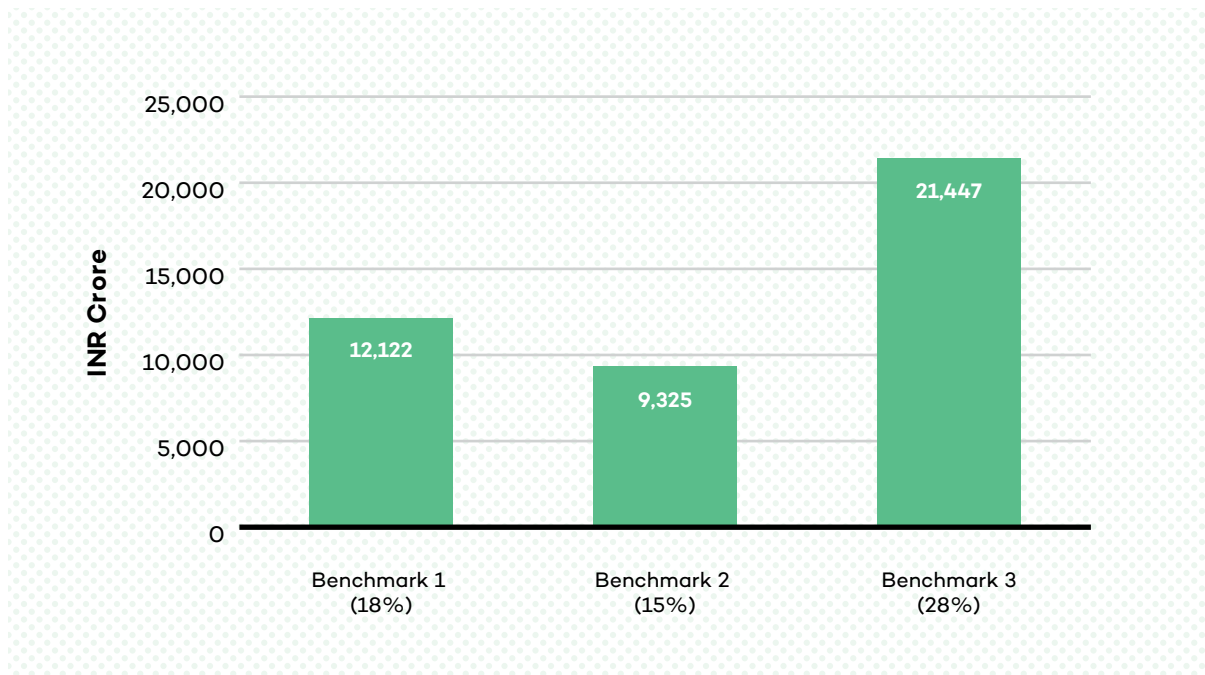
For FY17 estimates, prior to the implementation of the GST, the subsidies are determined in reference to a variety of taxes such as the excise duty, VAT, Central Sales Tax (CST), service tax, entry tax, cesses and levies that were charged on goods at each point along the supply chain. At this time, rates for such policies could vary significantly between states, resulting in a highly complex tax system (ClearTax, 2017; Gupta, 2017). Several products were exempted from taxation and states employed a variety of tax rates for VAT and cesses which made estimation of average tax rates cumbersome. A particular challenge in estimating tax subsidies before GST was the cascading nature of taxes. Since tax was applied at each stage of the value chain, the price of the final product included all the accumulated taxes up to that point. This complexity made calculation of FY17 tax subsidies challenging. As a result, for each relevant policy, a single proxy national benchmark was determined by identifying the gap between the rate that was actually charged and the rate that was charged as standard for typical, similar goods. It was not possible to take into account the impact of tax cascading—only the published tax rates on various goods and services.

The GST reforms have made it possible to estimate tax subsidies more precisely. The reforms merged a number of previous policies and applied tax rates uniformly for different product types across the country, as well as removing a large number of exemptions, with only 7 per cent of products now falling under the nil GST category. Though certain levies, custom duties and the tax on petroleum products remain outside the purview of GST, for the vast majority of goods and services tax subsidy estimation is relatively straightforward.

For FY18 estimates, the tax subsidy estimates are based on the GST rates, which have five main categories: 0 per cent, 5 per cent, 12 per cent, 18 per cent and 28 per cent (Ministry of Finance, 2018b). The vast majority (81 per cent) of goods attract the 18 per cent tax rate. Essential commodities, such as milk, eggs, and unbranded food grains are exempt from the GST (Kotak, 2018).

For both years, a subsidy was identified and estimated if an energy product or service appeared to be subject to a tax rate that was much lower than most comparable goods—rates for these comparable goods being the "benchmark" rate for subsidy estimation. For example, under the GST, the tax on coal stands at 5 per cent. This is much lower than other products in the "mineral" taxation category, with the highest tax rate being 18 per cent. Therefore, if 18 per cent GST is used as the benchmark, then 13 per cent (18 per cent – 5 per cent) of the value of coal consumed is revenue foregone and constitutes a tax subsidy.

The sensitivity of tax subsidy estimates to the chosen benchmarks is illustrated in Figure A1. For FY18 under the GST, as "benchmark 2," it would be possible to argue that the standard tax rate on coal is the one applied to imported coal, set at 15 per cent. Under this approach, the tax subsidy is correspondingly lower. As "benchmark 3," coal could alternatively be classified as a "demerit" or "sin good," on the basis that this tax bracket currently includes goods that have negative impacts on public



health, like tobacco and cigarettes (Times of India, 2018). This attracts a GST of 28 per cent, in which case the tax subsidy estimate would be much larger.

Figure A1. Total tax subsidy estimation for coal under various benchmarks for FY2018

Source: Author's analysis, data from Soman et al. (2018).

Annex 2. Methods for Estimating the Impacts of GST on Solar PV and Coal Thermal Power

This study estimates the impacts that tax changes have had on energy prices by estimating the levelized cost of electricity (LCOE) for solar PV and coal-fired thermal power generation.

The LCOE is the full cost of electricity generation over the entire lifetime of the generation asset divided by the total amount of electricity generated. The LCOE allows one to compare the relative cost of generation from different energy sources. The LCOE estimation methodology and pre-GST tax rates used are based on a previous study by CEEW (Kuldeep & Viswamohanan, 2017). Another approach would be to calculate effective tax rates before and after GST. This study adopts an LCOE approach because this is the measure used by public authorities to award contracts and determine tariff rates.

One of the difficulties in calculating post-GST reform tax rates is that there is still ambiguity about GST tax rates on solar projects. Under the GST law, Solar Power Generating Systems (SPGS) are eligible for the concessional GST rate of 5 per cent. However, the definition of what constitutes an SPGS is unclear. There are several different types of SPGS including ground-mounted, rooftop, floating and microgrid. In addition, a range of contract types exist for solar PV projects: turnkey EPC contract; EPC contract without civil work; supply contract and balance of supply contract (RAAR, 2018). These contract types have different shares for supply of services in the total project costs. However, the GST Council has recommended a formula of deeming 70 per cent of gross value of project as supply of goods and 30 per cent of the aggregate value as supply of services. Therefore, taxes will be applied in an arbitrary fashion and will not correspond to the actual split of goods and services in project costs.



Annex 3. Coal Thermal Power Plant Variable Costs and Taxes

LCOE Components	Taxes Applicable (Pre-GST reform)		Taxes Applicable (Post-GST reform)	
	Tax	Rates	Tax	Rates
Coal	Royalty	14%	Royalty	14%
	Contribution to DMF	30% of Royalty	Contribution to DMF	30% of Royalty
	Contribution to NMET	2% of Royalty	Contribution to NMET	2% of Royalty
	Stowing Excise Duty	INR 10/mt	Subsumed under GST	
	Clean Energy Cess	INR 400/mt	GST Compensation Fund	INR 400/mt
	Basic Customs Duty (BCD) ⁴	10%	Basic Customs Duty (BCD)	10%
	Countervailing Duty (CVD)	2%	Subsumed under GST	
	Excise Duty	6%	Subsumed under GST	
	CST (for inter-state only)	2%	IGST (for inter-state and imported only)	5%
	VAT (for intra-state only)	5%	GST (for intra-state only)	5%
Transport	Development Charge	5%	Development Charge ⁵	5%
	Service Tax	4.50%	GST	5%
	Busy Season Surcharge	15%	Busy Season Surcharge	15%

⁴ We have employed BCD as per latest (2018) CBIC notification. The BCD has been kept constant for pre- and post-GST reform as it is outside the purview of GST.

⁵ The Development Charge and Busy Season Surcharge have been subsumed into the basic freight charge as per the latest IR Pricing released on January 8, 2018. However, because this was not a change made due to the introduction of GST, freight rates have been kept constant for the post-GST calculation to assess the GST-specific impact on LCOE.

