**Draft**

**Rationale for Financial Incentives for Energy Efficiency**

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**Introduction**

IEP (2006) forecasts a six-fold increase in electricity requirements by 2032 in the base case. Given the constraints on availability of fuel, land and water, such an increase in generation will be difficult to realize. Clearly, the efficiency of use of electricity in India must be improved if we do not want to bump-up against resource constraints. Power consumption has also to be reduced to meet our international voluntary commitment to reduce emissions’ intensity by 20-25 percent by 2020.

One of the drivers of the increasing demand for electricity is the boom in sales of electrical appliances used in households and commercial establishments. In India, we have two large gaps in the efficiency of appliances used: (1) a gap between the highest rated (on efficiency) appliances, carrying a five-star label, and the typically purchased appliance; and (2) a gap in efficiency between a five-star labeled appliance in India and the most efficient appliances commercially available in the world. Together, the two gaps result in the electricity consumption of a typical appliance being almost twice that of the most efficient appliance. A rapid improvement in the efficiency of appliances is required to bridge these two gaps.

**Benefits of Energy Efficiency Products and Programs**

EE programs such as SEEP can play a key role in bringing about this rapid improvement in efficiency and thus help to reduce the rate of growth of our electricity consumption. EE programs have many benefits:

* Efficient products use less energy to provide the same level of service (lighting, cooling, etc.). In fact, often, the quality of service with EE products is better than that provided by regular (non-EE) products.
* The additional costs of producing EE products are often far less than the costs of generating, transmitting and distributing electricity. In the case of super-efficient fans, the cost of saving electricity is about Rs. 0.90 per kWh, only about a quarter of the cost of supplying electricity today. As the cost of supply increases due to inflation over the life of the fans, they will become even more cost-effective.
* Several cost effective EE options also free up capital for other uses. For example, an expenditure of about 40 crores on super-efficient fans, would reduce the peak capacity requirement by about 20 MW and thus avoid capital investment on new power plants and T&D infrastructure of about 120 crores (savings in fuel costs would be extra.) The additional 80 (= 120-40) crores would generate an additional GDP of about 20 crores every year, assuming an Incremental Capital Output Ratio (ICOR) of 4. Furthermore, the additional 20 crores of increased output would increase government revenues by about 4 crore each year (assuming a tax rate of 20%).[[1]](#footnote-1)
* EE will also reduce the usage and cost of fuel, most likely to be imported coal or gas. The Rs 40 crore incentive mentioned above would be able to reduce consumption of electricity by about 82 Million Units (MU) per year at the consumer end, resulting in a fuel-related cost saving of about Rs 16 crores per year. Hence, EE will also reduce our dependence on imported coal.

**Rationale for Financial Incentives for EE**

Even though the energy saving potential of EE products is very large, consumers do not buy energy efficient equipment for several reasons. Financial incentives for SEEP and other EE programs can accelerate the market transformation to more efficient products by: (1) stimulating the development and commercialization of super-efficient technologies for appliances; (2) encouraging early adopters of the more efficient technologies; and (3) incentivizing adoption by the majority. Without the incentives the market transformation, if it occurs, will take an inordinately long time. This will mean foregoing the benefits of the large energy saving for a long time.

In spite of the many benefits of EE, one may ask why the transformation to EE products should not be left to the market, and why the government should intervene in the functioning of the market. It is well-established that the government needs to intervene in the market for merit goods such as education and health-care often providing them for free, for the benefit of society, because they would be under-provided if left to the market. EE is also a merit good because it meets the two requirements:[[2]](#footnote-2) (1) the net private benefit to the consumer is not recognized at the time of consumption; and more important (2) EE generates external benefits for society that are not taken into account at the time of consumption. Both these characteristics result in “consumption” of EE goods that is less than the socially efficient level. A paper by NIPFP titled *Budgetary Subsidies in India – Subsidizing Social and Economic Services*, written for the Planning Commission asserts that merit goods deserve subsidization, although one needs to determine the desirable degree of subsidization. It further classifies non-conventional energy as a Merit II[[3]](#footnote-3) good. On a per kWh basis, EE measures are often much less expensive than non-conventional energy, and provide the same benefits, and therefore should also be considered Merit –II goods and be given some financial incentives.

**Under-Estimation of Private Benefits**

We first look at why an under-estimation of private benefit results in an under-supply of EE products. Refer to Figure 1. In a free-market the amount of a product and its price is determined by the intersection of the marginal private cost curve (supply curve) and the marginal private benefit (demand) curve. However, the consumer’s estimate of the marginal benefit is lower than the actual benefits for several reasons:

* Many consumers lack information about EE products and the level of savings that can be achieved.
* Consumers are very sensitive to the initial cost of an appliance which implies a very high discount rate. While we expect the consumer’s discount rate to be somewhat higher than the discount rates used by private businesses or the government, the consumers’ implicit discount rate is much higher than he/she states. For example, if the interest rate is say 10%, one might expect the consumer’s discount rate to be say 20%, but while making purchase decisions the consumer’s implicit discount rate could be as high as 50-80%. The difference between the consumer’s expected discount rate (~20%) and the implicit discount rate (50-80%) implies that the consumer’s estimate of marginal benefits is much lower than the actual benefits. We cover the difference between the consumer’s expected discount rate (~20%) and society’s discount rate (~10%) when we discuss social benefits later. The implicit use of a higher discount rate results in much lower ‘consumption’ of EE products compared to what would be expected using the expected discount rate of consumers.
* Highly efficient products are often not available in the market. It is possible that the consumers’ lack of interest in efficient products and the unavailability of efficient products reinforce each other to create a low-efficiency equilibrium.

As a result of the reasons given above, the consumer’s expected marginal private benefit from EE products is less than the actual marginal private benefit. As Figure 1 shows under these conditions, the amount of EE products consumed will be less than optimal.

**Figure 1. Effect of Under-Estimated Marginal Private Benefit**



**Unaccounted Social Benefits of EE**

EE products just like other merit goods also have positive consumption externalities. Greater purchases of EE products provide unaccounted social benefits for the following reasons:

* A consumer’s estimate of the monetary savings from an EE product is based on the tariff that he would pay for the avoided electricity consumption. Because the electricity tariffs for residential consumers are often lower than the cost of supply, the consumer’s private benefit is lower than the social benefit, which would be based on the actual cost of supply (ideally the long-run marginal cost (LRMC) of supply).
* The difference between the consumer’s stated discount rate (say ~20% as from earlier discussion) and the societal discount rate (say ~10% ) means that some social benefits are lost if the decision is left purely to the market.
* In the short run, use of EE products, frees up electricity for other uses, thus reducing load-shedding. The social benefits of reduced load-shedding (for example, school-children being able to study, or a businessman being able to run a factory) are much greater than the cost of supply.
* In the long run EE will help the country cope with resource constraints. Once again, because the tariffs for electricity do not generally include the true value of depletable resources, increased use of EE products results in net increase in social benefits.
* Increased use of EE products mitigates local and global environmental problems. As with most other markets, the market for EE products does not include environmental costs and benefits in the purchase decisions.

Consumers do not take into account these additional social benefits when making a decision to purchase EE products. Figure 2 shows the effect of the additional social benefits. As before, Point E2 shows the additional consumption due to unaccounted for private benefits. Point E3 shows the result of adding both the additional private and social benefits (shown as external benefits in Figure 2). As one can see that as a result of accounting for these additional benefits the consumption of EE products increases from Q1 to the socially efficient level of Q3.

**Figure 2.Under-Consumption of EE Products Due to Under-Estimation of Marginal Private Benefits and Marginal Social Benefits**



Because of this market failure and under-consumption of EE products from a societal perspective, the government needs to intervene. Financial incentives given to manufacturers of EE products decreases the effective cost of supply of EE products and consequently the price, and thus moves the equilibrium point where demand and supply intersect closer to the socially optimal level.

Generally, the poor have a higher discount rate and lower tariff relative to the rich. Our analysis above shows that the higher the implicit discount rate and the lower the tariff, the larger the financial incentive needs to be to approach the socially optimal level of consumption of EE products. Therefore, the appliances bought by the poor need greater financial incentives than appliances that are bought mostly by the rich.

**Other Examples of Financial Incentives**

Financial incentives for EE products would be consistent with the special incentives for green technologies that are being contemplated for inclusion in the New Manufacturing Policy. Some of the incentives that are being contemplated are[[4]](#footnote-4):

* Low interest loans for manufacturing of green products;
* Central fund for R&D in green manufacturing;
* Preference to green products during procurement by state or central governments.

Furthermore, other countries also provide upstream incentives for energy efficiency. For example, in the US, a recently amended Federal law provides corporate tax credits *up to $200 per unit produced* to incentivize manufacturers to produce super-efficient appliances. In China, the government gave an incentive for manufacturers of Room-ACs of about USD 1.7 billion to increase the share of highly efficient ACs from 5 to 70% in two years. Today the five-star AC sold in India represents the least efficient AC that can be sold in China.

1. These numbers while realistic, are meant for illustration only. While we have used the average ICOR for the Indian economy over the recent period, the actual ICOR for any investment could be quite different. In addition, we have assumed that the avoided capital investment in power plants would result in some other kind of capital investment. However, it is possible that the avoided investment is spent on non-capital activities or programs. [↑](#footnote-ref-1)
2. http://economicsonline.co.uk/Market\_failures/Merit\_goods.html [↑](#footnote-ref-2)
3. The paper divides merit goods into two sub-categories – Merit I and Merit II. It recommends that Merit II goods be given an intermediate degree of subsidization, in contrast to Merit I goods that should be given a high degree of subsidization. [↑](#footnote-ref-3)
4. National Manufacturing Policy: A Discussion Paper, 2010 [↑](#footnote-ref-4)