



Integrated Resource Planning Initiative
Part 2: Options for the implementation of an Integrated Resource
Planning (IRP) process in the Indian electricity sector¹

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¹ The first part of this study dealt with the meaning of IRP and focused on its recent practice in the power sector of countries around the world.

Contents:

<i>Abstract</i>	2
1. Basis for IRP for the Indian power sector	3
1.1 Private attempts at IRP	3
1.2 Recent changes affecting the planning structure	4
2. Policy instruments for incorporating IRP	4
2.1. Laws/Regulations	5
2.2 Directives/Policies	5
2.3 Interlinking of departments/programmes	6
2.4 Funding	7
2.5 Pricing/financial mechanisms	8
2.6 Specific focus/designated staff	8
2.7 Capacity building	9
2.8 Standards	10
2.9 Public participation	11
3. Suggested planning agencies	11
3.1 The Planning Commission	12
3.2 The CERC' appointees	12
3.3 The CEA	13
3.4 A newly established national Working Group	13
3.5 The SERCs' appointed agencies	14
3.6 The States' Planning Departments	15
3.7 Utilities (whether serving a state or a region)	15
4. Discussion	18
<i>Bibliography</i>	22

Abstract:

In this document we discuss potential structures and policy measures through which the Indian power sector could employ integrated resource planning (IRP) methods in its planning processes.

*We begin with a summary of the **Indian experiences with IRP** thus far and the recent changes that can contribute to adoption of IRP.*

*On the basis of these, we consider the **policy instruments** through which IRP can be carried out, based on recent legal, policy and institutional changes that have taken place. These include: mandatory requirements (laws/regulations), directives/policies, interlinking of departments/programmes, funding, pricing/financial mechanisms, specific focus/designated staff, capacity building, standards, and encouragement of public participation.*

*Appropriate **policy agents** who could carry out the required planning processes would depend on the extent of integrated planning – ranging from exhaustive comparison of alternative demand and supply options at the national level, to a partial consideration of some alternatives by local utilities. Accordingly, we consider at the national level: the Planning Commission, the appointees of the Central Electricity Regulatory Commission (CERC), the Central Electricity Authority (CEA) through its IRP division, and a new Working Group comprising members from the concerned Ministries/Departments and other experts. At the regional (state or utility) levels, we consider the appointees of the State Electricity Regulatory Commissions (SERC)s, the States' Planning departments, and individual utilities (whether generators or distributors). There are various situations in which utilities could undertake IRP – when proposing tariffs (i.e. tariff-filing), when applying for funding, when securing power purchase agreements, and licensing/franchisee agreements, when proposing energy efficiency programmes, and, if new rules are imposed, to reduce environmental impact costs, and to meet new efficiency norms.*

In conclusion, we consider those aspects likely to contribute to the adoption of IRP as a planning approach.

1. Experience with IRP for the power sector

As applied to the power sector, integrated resource planning (IRP) can be described as a planning method² through which the estimated requirement for electricity services during the planning period is met with a least-cost combination of supply and end-use efficiency measures, while incorporating concerns such as equity, environmental protection, reliability and other country-specific goals. Countries around the world have programmes devoted to promoting efficiency improvements and/or renewable sources of electricity; these are included in power plans, but there are relatively few cases where both supply and demand side options are compared on the basis of costs during the evaluation process. Given that the need for the services that electricity enables – for productive purposes and for domestic use – far outstrips supply, even though demand side management (DSM) and improved energy efficiency (EE) can reduce the demand-supply gap, increased generation – through more power plants and/or increased utilization of existing capacity – is essential. Choices have therefore to be made between alternative options of supply increase and demand reduction; IRP facilitates this selection.

1.1 Private attempts at IRP

There have been a few cases of researchers and NGOs drawing up plans for the power sector, using IRP principles. Least-cost schedules³ were drawn up for the state of Karnataka by researchers (Reddy *et al.*, 1990; 1991). Based on a comparison of the unit costs (costs/kWh) of electricity generated and conserved through a variety of options, it was estimated that several large-scale generation options could be postponed by alternative efficiency-improvement options. Thereafter, similar least-cost estimates were made for other states of India, and the method generalised (Reddy *et al.*, 1995)⁴.

More importantly, workshops were conducted for officials of the State Energy departments and utilities -- the then State Electricity Boards (SEB), with the purpose of introducing IRP into the planning processes of the state-utilities (IEI, 1993; 1994). “Least-cost” plans were drawn up for several states; of these, the West Bengal SEB went ahead with finalising an integrated electricity plan (WBSEB and IEI, 1998)⁵ and also an

² Versions of IRP are referred to as Least-Cost Planning, Long-Term (Resource) Procurement Planning, Integrated Resource Strategic Planning, and Scientific Energy Planning.

³ Worksheets were developed to simplify the projection of demand in different scenarios and the evaluation of options to meet the demand-supply gap based on the costs/unit of generation and conservation.

⁴ While the early studies were conducted at the Indian Institute of Science, the later work was at the International Energy Initiative (IEI), Bangalore.

⁵ Detailed demand scenarios for the five main electricity distribution agencies (public and private) in the state were drawn up to estimate the aggregate demand till 2006-07. These estimates were compared with the Central Electricity Authority’s Annual Electricity Plans. The costs of the available generation/conservation/increased capacity utilisation options to bridge the state demand-supply gap were then estimated, to derive a least-cost-supply stairway. The likelihood of surplus capacity in this state if all the proposed were actually implemented, was also considered.

efficiency-implementation package (WBSEB and IEI, 1999) that led to lighting efficiency improvements.

The study was repeated recently, and once more, it was estimated that investment in large plants⁶ could be avoided during the next decade by increased efficiency-improvements (Ramana and Kumar, 2009). Internationally, the International Energy Agency's Energy Technology Perspectives, 2010, contains scenarios and strategies until 2050, based on varying growth rates, fuel-mix and efficiency levels.

1.2 Recent changes affecting the planning structure

Important changes have been introduced during the past few years that could affect the adoption of IRP. These include: legislation -- the passing of the Electricity Act, 2003; the publication of new policies by the central government -- the Integrated Energy Policy, 2006, National Electricity Policy, 2005 (and amendment of 2007) and the Tariff Policy 2006; the requirement of National Electricity Plans; relevant regulations issued by the Central Electricity Regulatory Commission (CERC) and some state Electricity Regulatory Commissions; the establishment of an Energy Co-ordination Committee; and development of funding options (for example, for DSM activities).

2. Policy instruments to encourage an integrated planning approach

Delivering clean and efficient electricity services in an equitable and sustainable manner requires an integrated assessment of alternative demand and supply options. With the intention of promoting integrated resource planning in India, one must suggest *how* IRP would be carried out, *what* IRP, and *by whom*. This means that one must consider: the *policy instruments/tools* through which those tasks could be accomplished, the *content and purpose* of each planning exercise, and the organisations acting as *policy "agents"* and the roles they could play.

In this section, we discuss a range of these policy measures based on the policy instruments already (or at least partially) in existence, namely:

- **Mandatory requirements (laws/regulations)**
- **Directives/Policies**
- **Interlinking of departments/programmes**
- **Funding**
- **Pricing/financial mechanisms**
- **Specific focus/designated staff**
- **Capacity building**
- **Standards**
- **Public participation**

⁶ These include some coal-based plants.

2.1 Laws/Regulations:

Effective national resource planning needs commitment at the highest level, preferably that of the central government. Even with private participation in power sector activities, the government needs to be involved to ensure that issues of equity and environmental preservation are included. Among other provisions, India's Electricity Act 2003 (GoI, 2003; 2007), requires that the Central Electricity Authority (CEA) of the Ministry of Power co-ordinate planning for optimal resource utilisation and provision of reliable and affordable electricity, although methods of planning have not been specified. Hence, if the Government chose to exert control in order to translate policies to practice, a law -- that required that integrated assessment of both demand and supply options be carried out before investment were incurred -- would be the most binding condition.

Apart from legislation, regulations from the independent regulator could also ensure that IRP is carried out. The CERC/SERCs, in their orders to utilities, could ask for integrated assessment of demand and supply options. Some State Electricity Regulatory Commissions (ERCs) have already begun encouraging IRP. For example, the Karnataka Electricity Regulatory Commission (KERC) released a Staff paper on IRP in December 2008, including estimates of the conservation potential in various consumer categories, their effect on estimates of the state's energy requirements, the consequent benefits (energy saving, peak demand reduction, and carbon fund financing), and the problems of effectively implementing DSM programmes (KERC, 2008). While earlier EE/DSM programmes, such as the replacement of incandescent bulbs with CFLs⁷, were not derived from an IRP process, regulations imposing a DSM requirement are now being extended to require utilities to compare the costs of demand reduction and demand management with supply side options, for example, the Maharashtra Electricity Regulatory Commission (MERC) regulations⁸ regarding DSM programmes.

2.2 Directives/Policies:

Even before laws are passed, directives⁹ could be given regarding the planning approach. There are already such directives from India's Integrated Energy Policy 2006, as drafted by an Expert Committee constituted by the Planning Commission¹⁰. The policy specifically requires "a least-cost planning approach to provide a level playing

⁷ Programmes for the replacement of other bulbs with CFLs have been conducted over the past few years in many states, for example, Maharashtra State Electricity Distribution Company (in Nashik, Maharashtra), Bangalore Electricity Supply Company (one of the four state distributing companies in Karnataka), and Uttar Haryana Bijli Vitran Nigam Limited (in Haryana). A CFL programme was also conducted much earlier (during the 1990s') by the Agency for Non-Conventional Energy & Rural Technology (ANERT) in Kerala.

⁸ <http://www.mercindia.org.in/>

⁹ Part IV of the Indian Constitution has Directive Principles of State Policy that, though not justiciable, recommend the direction in which provisions have to be made.

¹⁰ The Prime Minister had directed that the Planning Commission should constitute an Expert Committee to undertake a comprehensive review and to make recommendation for an Integrated Energy Policy, in order to address the problems of the energy sector in an integrated manner (PC – GoI, 2006).

field to Negawatts and Megawatts so that regulators permit the same return on the investment needed to save a watt as to supply an additional watt”¹¹. Among the medium/long-term initiatives is included: “Adoption of a least-cost planning and policy approach that ensures that energy efficiency and DSM have a level playing field with supply options. The regulatory commissions should invite bids for DSM while approving new capacity additions. Thus, if a state requires an additional peak demand of 1,000 MW over the next five years, the utility can ask for bids from Independent Power Producers (IPPs) as well as Energy Service Companies (ESCOs)”, (PC-GoI, 2006)¹².

There have been other national policies and plans -- spelt out for the first time, as a result of the Electricity Act, namely, the National Electricity Policy, 2005, a National Electricity Plan, 2007 (that will be periodically updated¹³), and a national Tariff Policy 2006. However, as these were to be of use by generating, transmission and distribution licensees/utilities, they concentrate on supply-side issues¹⁴. Energy conservation and environmental issues have been touched on by the Electricity Plan, but there has been no mention of evaluation on the basis of costs/unit vis-à-vis other options.

2.3 Interlinking of departments/programmes:

The International Energy Agency in its assessment of the Indian power sector several years ago recommended “integration of political accountability into a single energy ministry . . . Only an integrated authority can exploit economies of scale through co-operation and integration at the Union level” (IEA, 2002). India’s Integrated Energy Policy had suggested that the Bureau of Energy Efficiency (BEE) and Petroleum Conservation Research Association (PCRA) be merged, as part of an enabling institutional framework for energy conservation (PC-GoI, 2006)¹⁵. Goals from different departments can also be pursued jointly, for example, coal washeries that reduce emissions have been dovetailed into the renovation plans for improving operational efficiency at thermal plants. Similarly, the effort of drawing up an integrated energy plan – with generation and conservation plans -- could be carried out by a committee comprising members from all related fields, and with the combined goals from all these.

¹¹ Overview, section (vii), p. xxi (PC – GoI, 2006).

¹² *Chapter VI: Policy for Energy Efficiency and Demand Side Management*, point 11 (PC – GoI, 2006).

¹³ Section 3(4) of the Electricity Act requires the Central Electricity Authority (CEA) to “frame a National Electricity Plan once in five years and revise the same from time to time in accordance with the National Electricity Policy”.

¹⁴ The National Electricity Policy 2005 specified “ - - development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy” (MoP-GoI, 2005, Section 1.7); further, the “aims and objectives” (Section 2) emphasize the magnitude of electricity use per person and per household (rather than the energy-services delivered). The National Electricity Plan 2007 -- prepared by the CEA and approved of by the Central Government – was intended for a short-term framework of five years while giving a 15 year perspective. It covers the capacity addition in 10th Plan and has estimates of capacity additions during the 11th (2007-12) & 12th (2012-17) Five-Year Plan periods (CEA-MoP-GoI, 2007). It is broadly based on 17th Electric Power Survey and the economy GDP growth rates projected in the Integrated Energy Policy.

¹⁵ *Chapter VI: Policy for Energy Efficiency and Demand Side Management*, Section 6.9.

2.4 Funding:

The activities involved in the preparation of integrated plans would require adequate funding, but funds being created for the promotion of renewable energy sources and efficiency improvements could be utilised for planning too.

National Clean Energy Fund – India’s new National Clean Energy Fund (NCEF) has been created in 2010, on the basis of a cess (of ₹50/metric tonne) on all coal, lignite and peat produced in India and on imports¹⁶. The NCEF is proposed to be utilised for the development and deployment of clean energy technologies in India. The costs of conducting IRP (i.e. the costs of data collection, analyses, forecasting, and so on) through which technologies could be assessed could also be paid for.

Charges on electricity sales – States are also creating funds for improved energy services. In a May 2005 order, the Maharashtra Electricity Regulatory Commission (MERC) created a “Load Management Charge” per kWh for consumption above a prescribed level¹⁷, to be used for DSM programmes (chiefly lighting replacement implemented by the distribution companies). It allowed the planning and implementation costs to be included in the distributing licensees’ annual revenue requirements¹⁸. Delhi’s regulatory commission included a provision for DSM activities with a budget of ~\$7 million. The costs for IRP procedures¹⁹ could be recovered by utilities in a similar manner.

Elsewhere in the world too, public interest programmes have been funded through ratepayers. Thailand has funded its DSM programmes partly through a surcharge on electricity prices, and Brazil’s regulatory agency Agência Nacional de Energia Elétrica (ANEEL) has allocated 1% of the utilities’ net annual operational revenue to energy efficiency and R&D. In industrialised countries too²⁰ programmes have been funded from a surcharge on electricity sales. Another alternative is a “systems benefits charge” on the distribution system. It would be “non-bypassable” because the distribution system is needed to deliver electricity to all types of consumers²¹. Planning activities could also be funded from such charges.

Community service obligations of the government - Some aspects of IRP – such as extending electricity services to un-provided homes – could be viewed as a community

¹⁶ The Union Finance Ministry issued formal orders on the 24th June for the levy of the cess with effect from the 1st July 2010.

¹⁷ The charge of ~2.5 cents/kWh, imposed on consumption above a *prescribed* level, yielded a fund of ~\$17.5 million dollars.

¹⁸ Interview with Mr Pramod Deo, MERC Chairman, available at <http://www.recep.org/index.php?id=830&special=showHotTopic&iHotId=837&sQuiteName=news&iQuiteId=138>

¹⁹ Numerous options for financing DSM and clean energy have been discussed (for instance, Brown and Conover, 2009). This study is focusing on the integrated resource planning and therefore considers funding for the *planning process* only.

²⁰ For example, the UK has the Non-Fossil Fuel Obligation (NFFO) according to which a levy is imposed on fossil fuel based power generation and the funds thus collected are used to promote renewable sources of energy. In the USA, the Public Benefits Charge (PBC) of the Federal Government, collected at 1/10 of one US cent per kWh, funded low-income assistance, energy efficiency programmes, renewable energy, and public interest energy R&D.

²¹ Even consumers who have captive (self-generation) facilities need back-up power; hence, they usually remain connected to the distribution system.

service obligation which should be clearly funded by government in the same way as other services to the economically disadvantaged are (IEA, 2000).

2.5 Pricing/financial incentives:

An integrated perspective at the planning phase would not be effective if prices did not communicate accurate signals of the value of the resources being consumed. Alternative options need to be evaluated on a “level playing field”; this requires evaluation of alternatives on the basis of costs incurred during the “life-cycle” of the equipment. Life-cycle costs include all costs incurred over the working life of the plant/equipment. These affect the unit costs considered, and consequently merit dispatch order, and choices of investment in generating plants. Pricing (tariffs) should reflect the magnitude of use (use-sensitive rates), the peak periods (time-of-the-day), and environmental impacts of generation and delivery. An efficiency “package” could be treated as an “Efficiency Power Plant”, a biddable alternative to be evaluated against generating plants – in terms of monetary cost per unit, and environmental impacts (pollution and water use)²². However, implementation costs and overcoming barriers to implementation (such as additional costs of financing) should also be included with efficiency/DSM options.

Reducing electricity sales through improved EE and DSM could lower²³ the revenues of distributing utilities. Nevertheless, EE/DSM efforts are warranted by the rising costs of fuel and construction of new plants, concerns about system reliability, public opposition to the location of some plants, and looming environmental charges. Therefore, financing EE/DSM programmes and the planning exercises for the same (including IRP) would be economically advantageous. Utilities could then be given financial incentives – e.g. a share in the value of the net benefits of the EE/DSM – to encourage them to be involved in EE/DSM programmes.

2.6 Specific focus/designated staff

Specific focus - A focus on deriving and supporting least-cost options of generating and saving electricity could be established. Budgetary support²⁴ has been provided for the Indian government’s National Mission on Enhanced Energy Efficiency (NMEEE)²⁵ – one of the eight missions under the National Action Plan for Climate Change (NAPCC) – that seeks to strengthen the market for energy efficiency through conducive policy and regulatory measures²⁶. Likewise, the focus on renewables – in particular the Jawaharlal

²² This was done in Jiangsu, China (Jiangsu and NRDC, 2006).

²³ This would occur in India only when EE is implemented among higher-tariff-paying categories of consumers; there continues to be unmet demand around the country, so that efficiency-induced reduction in demand in one category is usually matched by increases in another.

²⁴ The DSM work has budgetary support of ₹ 235.38 crores (≈ US\$ 52.3 million) (*Green Energy*, 2010).

²⁵ As announced in December 2009, the NMEEE is being implemented from April 1, 2010.

²⁶ The implementation plan includes: (i) the country’s first trading in energy efficiency savings through a market mechanism (Perform, Achieve and Trade Scheme) whereby industries could offset their efficiency targets by trading in efficiency certificates, (ii) an Energy Efficiency Financial Platform, which allows for the creation of mechanisms that would help finance DSM programmes by capturing future savings, (iii) the Market Transformation for Energy Efficiency (MTEE) initiative to accelerate the shift to efficient appliances in designated sectors, and (iv) a

Nehru National Mission on Solar Energy -- is encouraging alternatives to traditional generation options. Integrated Resource Planning and Strategic Environmental Assessments, undertaken through open and transparent processes, would be useful tools to integrate these in the assessment and decision-making processes.

Designated cells/divisions –Departments often have several tasks to accomplish, due to which planning for the future does not receive adequate attention. However, specific cells or divisions could be assigned to IRP activities. The CEA has recently created an IRP division and has designated staff for it. If there are clear directions regarding the assessment of demand- and supply-options, integrated plans could be prepared by such designated personnel. There could be directives regarding IRP cells in the states too, similar to the recommendation from the Working Group on DSM and Energy Efficiency (EE)²⁷.

2.7 Capacity building

The implementation of integrated plans requires adequate capacity building at the national, regional and local levels. It also requires overcoming barriers that should be provided for during planning. These include technical barriers (for e.g., adding new generation to the grid involves connection costs and time for system planners and transmission operators to conduct reliability tests and complete the connection), financial barriers (for e.g., purchase of efficient equipment requires reliable ESCOs and/or financing, etc.), operational barriers (for e.g. ensuring competent installation and maintenance), and so on.

Appropriate technical training - Personnel would have to acquire the analytical competence for conducting IRP -- minimizing costs and meeting future demand requirements, by optimizing the use of resources on both the supply and demand sides -- while considering diversity, lead times, financial and operating risks, and the environmental impact of different resources. With sophisticated methods, one can take all these into account, but the required competence has to be developed. Further, while IRP has been practiced at the generation or bulk supply level, advances in automation and geo-spatial information technology have made Demand Response programmes (and consequently IRP implementation) effective (Tram and Elliott, 2004; Black, 2005; NAPP-Utilities, 2010), so that IRP can be practical and beneficial even at the distribution level.

Facilitating institutions - The selection of non-traditional options through the IRP process requires suitable support organisations. For instance, there would also have to be effective energy service companies (ESCOs) that provide financing, technology, and installation and performance guarantees for efficiency measures.

Information collection - IRP necessitates the analyses of detailed information that is not readily available and must be collected from a variety of sources. Updating of plans requires that this database is also updated regularly, or else pertinent information (such as

Framework for Energy Efficient Economic Development (FEEED) that would develop two fiscal instruments to promote efficiency – the Partial Risk Guarantee Fund and the Venture Capital Fund for Energy Efficiency (VCFEE).

²⁷ The Working Group directed that SERCs should direct all the distribution utilities under their jurisdictions to constitute EE cells within their organizations and identify some of their own staff for handling the EE aspects.

the availability of new technologies, or the changing relative costs of alternatives) would not be incorporated. Such databases should be available with independent authorities, e.g. the SERCs.

2.8 Standards

Power system standards - System operators have traditionally focused on supply-side resources to meet reliability requirements for electricity systems, but demand-side resources could possibly fulfil the requirements at lower cost, if standards were adopted as a screening tool on investment decisions²⁸.

Efficiency standards - Energy-efficiency labelling has begun for some devices; this has to be extended to other devices too. Standards have also to be set for efficient replacements, so that the energy conservation achievable can be correctly estimated. Further, without quality control, the replacements would not be readily adopted by the public²⁹ and the planned conservation of energy would not take place.

Environmental standards – Standards with respect to environmental impacts due to power plants -- gaseous and effluent emissions and the consequent measures for air and water emissions control and fly-ash management -- would directly affect the activities at power generation stations. In India, Ambient Air Quality standards are set by the Central Pollution Control Board, under the Ministry of Environment and Forests (MoEF), (CPCB, 1997), standards for flue-gas emissions from coal-fired boilers are set by the Central Electricity Authority (CEA, 2002), and standards of liquid effluents and solid waste by the MoEF (MoEF, 1999). Conventional input-based standards (i.e. quantities of emissions per unit of fuel burned) favour inefficient generators; instead, output-based standards (i.e. emissions per unit of electricity generated) would incorporate performance efficiency. The more stringent the standards, the greater would be the efforts to locate and use less-polluting generating and conservation technologies, and consequently the need for IRP.

Procurement standards - As stated in the Integrated Energy Policy 2006, the procurement process for public sector units that is usually based on the minimum purchase costs, should be modified to be based instead on annualised life-cycle costs that include not only initial costs but operating costs during the working life of the equipment. “- - A manual should be prepared establishing the methodology for annualised life cycle costing with a simple spreadsheet package to enable easy implementation. Though life cycle costing seems particularly relevant for appliance purchase, since appliances are often bought without consideration of operating costs, it should be used for all decision-

²⁸ The “Efficient Reliability Standard” in the USA states that before “socializing” the costs of a proposed reliability-enhancing investment, through tariffs or other cost-sharing requirements, the regulatory authority concerned should check “(1) that the relevant market is fully open to demand-side as well as supply-side resources; (2) that the proposed investment or standard is the lowest cost, reasonably-available means to correct a remaining failure; and (3) that benefits from the investment or standard will be widespread, and thus appropriate for support through broad-based funding” (Coward, 2001, p.52).

²⁹ A program at which incandescent lamps were replaced with CFLs was implemented in Nashik (in Maharashtra), but this association with the poor quality of CFLs provided there has led customers to be suspicious of the EE concept itself (Prayas, 2008).

making and alternatives should be compared in terms of expected present discounted values of life cycle cost”³⁰.

2.9 Public participation

Public awareness of the advantages of IRP, for example, less-expensive energy services or environmental preservation, would spur utilities to consider them. Some measures may not be profitable for utilities due to the transaction costs involved in catering for a large number of small consumers (for example, efficiency retrofits in the residential sector) but may be undertaken to improve customer relations. Regional issues could also be included, for example, the particular knowledge of local rural-based NGOs would ensure that the needs and priorities of people in those regions are considered. In a democratic situation, where civil society is active, public involvement can influence state decisions, just as the publication of drafts of policies – such as the Environment Policy (2004) and the Integrated Energy Policy (2005-06)³¹, elicited feedback from various sections of society. With the establishment of State ERCs, there has been much greater openness regarding the publication of proposed policies and regulations, as well as scope for public opinion to be expressed, and this has been beneficial.

3. Suggested planning agencies

IRP can take different forms, depending on the purpose for undertaking the planning exercise, and on how comprehensively the plans are drawn.

In terms of *content*, integrated resource plans should be comprehensive planning exercises, where all the potential generation and conservation options are evaluated and all costs (both actual and those imputed for negative environmental impacts) are included. However, an IRP-approach could be discerned even in the evaluation of a few alternatives, based on the financial costs (including current incentives or taxes) accruing to a utility. Ideally, the IRPs should take a comprehensive view of energy sources, conversion and transmission options, and the efficiency of utilisation.

Spatially, IRPs could range from country-/state-wide plans, to those for a single utility. They could also be for each regional transmission area, or each distribution region.

The *purpose of planning* would vary from government-initiated “mandatory-IRP”, where the planning is required by law or regulation, to “business-related IRPs” that a utility may choose to draw up for its own strategic planning purposes. Accordingly, the

³⁰ Point 11, Chapter VI: Policy for Energy Efficiency and Demand Side Management, *Integrated Energy Policy* (PC-GoI, 2006).

³¹ The Expert Committee (constituted on the 12th August ’04) finalised its report after a process of deliberation and consultation with various stakeholders between December ’05, when the draft report was placed on the web site of the Planning Commission and comments were invited, and August ’06 when the report was published.

planning process could be conducted by agencies ranging from government-supported organisations at the centre, such as the Planning Commission, to individual utilities serving states or parts of a state. Based on the institutions already in existence and similar “working groups”, we discuss how these entities could conduct IRP exercises.

At the national level:-

3.1 The Planning Commission:

The Planning Commission of the Government of India could undertake the construction of integrated energy plans for the country, as a part of the national planning activities conducted for the development of the Five Year Plans (FYP)s.

Thus far, the special section on Energy³² in the FYP considers only supply increases -- from conventional and new renewable sources. However, the Planning Commission has the advantages of associated personnel with planning experience, and access to data from central and state sources. The FYPs are based on the government’s policies and programmes. An integrated planning exercise would help to ensure equity, sustainability, and environmental preservation, and in so far as the Government proposes schemes to reach its development goals, it could propose an IRP for energy. Such plans would necessarily account for all sources of energy rather than only electricity, and would perhaps be at a much more aggregative level than regional/utility plans. However, to construct integrated energy plans, there would need to be consideration of demand-side measures alongside supply options, and from among the latter, a choice of technologies on a least-cost basis, that has not been accomplished so far.

3.2 The Central Electricity Regulatory Commission (CERC)’s appointees:

The CERC, as India’s national electricity regulator, could call for central power utilities to draw up assessments of both demand- and supply-side options of meeting their requirements. This would be similar to what is done in South Africa, where their National Electricity Regulator has developed IRP procedures and utilities’ performance criteria, and has mandated that the national utility Eskom utilise its capabilities to produce a National IRP (SA-NER, 2002; 2004).

The CERC’s involvement in integrated energy planning is appropriate, as it has the duty of regulating the tariffs of government-owned/controlled utilities and those serving more than one state. The Tariff Policy (MoP-GoI, 2006) has specified a framework for performance-based cost of service regulation with respect to generation, transmission and distribution, in which the CERC has to periodically notify the rate of return on equity and operating norms for generation and transmission projects, keeping in view the assessment of overall risk and the prevalent cost of capital. The CERC could therefore require utilities to present least-cost plans from among demand and supply options, as a part of its tariff-approval activities³³.

³² In the current (Eleventh) Five Year Plan (PC-GoI, 2008), Energy is dealt with in Volume III, Section V-Physical Infrastructure, Chapter 10.

³³ In the USA, investor-owned utilities have been submitting their IRP estimates to the State Public Service (Utilities) Commissions and the state-owned utilities to the State Energy Office. Regulators have been reviewing these plans to identify necessary generation expansions or

In addition, the CERC has the right to establish a Central Advisory Committee on major issues of policy and matters of quality, continuity and extent of service provided³⁴. As such, it could also commission an advisory committee on the assessment of least-cost options of meeting electricity and power demand. Further, the CERC is supposed to be independent of government departments/utilities, and accessible to the public; this would enable it to serve as an acceptable conduit for interaction between stakeholders³⁵. In this capacity, the CERC could appoint a group (from among research organisations and civil society) to work on integrated assessments of demand and supply options, for indicative purposes, until IRPs are actually drawn up by utilities.

3.3 The Central Electricity Authority (CEA):

The CEA under the Ministry of Power has thus far had mainly an advisory role; this continues even with the Electricity Act 2003 which states that the Central Electricity Authority (CEA) shall perform such functions and duties as the Central Government may prescribe or direct, and in particular to “(a) - - - formulate short-term and perspective plans for development of the electricity system and co-ordinate the activities of the planning agencies for the optimal utilisation of resources to sub-serve the interests of the national economy and to provide reliable and affordable electricity for all consumers” (Clause 73). These tasks of formulating plans, co-ordinating between planning agencies for optimal resource utilisation, as well as reliable and affordable electricity for all, would implicitly require IRP. It could therefore be argued that, even in an advisory capacity, the CEA could draw up indicative plans regarding alternatives to the conventional generation options.

The CEA now has a designated IRP division (MoP-GoI, 2009); this has been the first attempt to establish IRP in the central Government’s planning process. Thus far, the cell makes projections based on different sources of electricity generation and the capacities of generating stations. These tasks could be modified and extended to include planning for both generation and EE matters, and thereby IRP. The goals of the planning exercise should be clearly articulated to include comparison between alternatives on the basis of costs/unit generated or saved.

3.4 A newly appointed National Working Group:

Another alternative would be a Working Group for integrated energy plans that could be constituted from those authorities associated with the power sector at the centre -- the Planning Commission, representatives from the Ministries of Power (including CEA), New and Renewable Energy, Petroleum and Natural Gas, Coal, and Environment (and Forests), and the Department of Atomic Energy, and the Central Electricity Regulatory Commission (CERC) -- and others from Research organisations and civil

retirements, reliability-enhancing and economic transmission upgrades, and desirable demand reduction initiatives.

³⁴ Electricity Act 2003, clauses 80-81 (GoI, 2003)

³⁵ At the time of the Californian power crisis, three major consumer advocacy groups suggested the creation of a “public power authority” that would “institute ‘Integrated Resource Planning’ to project demand and identify the appropriate actions needed to meet that demand” (Consumers Union, 2001).

society³⁶. These entities could depute personnel to form a joint committee that planned for both energy supply and conservation, instead of making projections independently. With all the concerned departments involved, related issues could be addressed. For example, more stringent standards for environmental impacts could be imposed.

In 2008, the Forum of Regulators constituted a Working Group on “DSM and Energy Efficiency” to address the lack of coordination between state- and national-level efforts, and to encourage all states to initiate DSM activities. A similar approach could be used for IRP. It has already been accepted that high-level co-ordination is required on energy issues, with an *Energy Coordination Committee* (under the Chairmanship of the Prime Minister) being established to review and approve policies for the energy sector as a whole. For planning too, an integrated approach could be more cost-effective, alternatives to generation could be jointly agreed upon, shortages (e.g. coal for electricity generation) could be avoided, and environmental considerations could be brought into the mainstream.

At the regional/utility level:-

3.5 The SERCs’ appointed agencies:

As the state regulators, the State Electricity Regulatory Commissions (SERC)s could require reports from state utilities, regarding demand and supply options considered when their proposed annual/periodic tariffs are being submitted and in other cases (discussed in more detail in Section 3.7). In each State, the utilities’ plans could be augmented with forecasts of central/interstate agencies, for expected transmission and generation resources that will impact the state. Finally, the IRP process can incorporate all State and Central environmental requirements and targets so that they will mesh with load, transmission, and generation projections. The result should be a comprehensive, unified roadmap for the State.

Alternatively, the planning function could be handled by the State Regulatory Commissions’ appointed panel/working group or a joint group of the state entities (generating, transmitting, and distributing companies). The ERCs could be the repository for information from their state utilities, so that an adequate database for the purpose of analysis is available with independent authorities.

There are also regulations regarding renewable sources of energy that could be “upgraded” to integration of all generation and conservation options. The Electricity Act 2003 makes it mandatory for SERCs to promote renewable energy and has specific provisions for determination of renewable portfolio obligations (Clause 86 (e)). There is even scope for enforcement: Rajasthan and Maharashtra have specified penalties on distribution utilities, in cases where the renewable portfolio obligation is not met; MERC

³⁶ This was done in the case of the development of the Integrated Energy Policy in India. For development/revision of South Africa’s IRP-2010, several committees were involved: the Inter-Ministerial Committee on energy (IMC) -- a sub-committee made up of cabinet members to assess progress made on the IRP as well as other electricity-related matters, the Inter-Departmental Task Team, that reports to the IMC on a regular basis, Working Group 2 (an IMC working group) on the IRP, and the IRP Technical Task Team (IRP TTT), whose role is to advise the DoE on technical IRP matters.

has actually penalized utilities. Similarly, integrated planning, rather than only provision for some aspects such as renewable sources, could also be envisaged.

An IRP process will only realize its potential value if the State can instruct utilities to act in accordance with the plan. Monitoring of implementation is also essential to ensure that the increases in electricity requirements (notwithstanding efficiency improvement), whether due to economic activity or population needs, are matched by scheduled supply increases. In this regard, the SERCs have the advantage of a relatively strong legal framework in India, with clear channels of authority and autonomy, and continuity of staff through overlapping tenures. There are well defined consultation and tariff setting procedures, with open public hearings. These procedures could also be useful for evaluation of the demand and supply options, based on economic and environmental costs.

3.6 The States' Planning Departments:

The Planning department of each state estimates the state's resource requirements and how they will be met – from the state's revenues and from central funding. If it were to be a condition for obtaining financial (particularly central) support, these planning activities can be easily extended to an integrated assessment of the demand and supply options of meeting electricity demand. The assessment could be from the view of the state a whole, an aggregation of the different regions/districts of the state, though not necessarily from the view of the individual utilities. As with the Planning Commission at the centre, the States' planning departments have the advantages of associated personnel with planning experience (in appropriate divisions such as the Perspective Planning Division), and access to data from all departments.

3.7 Utilities (whether serving the entire state or a region):

There are several situations in which IRP could be mandated (by the CERC/SERCs) or else where utilities could have the incentive to voluntarily consider an IRP-approach. For example, generation utilities can be expected to want less expensive new plants to lower their investment requirements, and distribution utilities could be willing to invest in DSM/EE measures that meet consumers' needs at lower costs. These would necessarily be partial IRPs, i.e. assessments of those feasible options in their own service regions that would meet their requirements and improve their profitability. There could be several situations in which the utility undertakes such planning exercises, as discussed ahead.

3.7.1 When filing tariffs for approval -

When filing their requests for tariff-approval, utilities could be asked by the SERC to provide assessment of alternative feasible options of generation and conservation, and their costs/kWh. Utilities are usually burdened with the tasks of regular operation and maintenance. However, as per the multi-year tariffs allowed in the Tariff Policy 2006, proposed tariffs that will now be applicable for five-year periods. It would not be unreasonable if they were asked to draw up integrated plans for this longer-term tariff filing. Other cost-effective options could be expected to emerge from these exercises, and the benefits of lower costs experienced for the multi-year period.

3.7.2 When applying for central/state funding -

When applying for central/state funding – for example, for constructing a new generation station or for extension/upgrading of distribution lines, the utilities applying for assistance submit detailed project reports (DPRs). These DPRs can be required to include cost-comparisons with other options of meeting the need for increased electricity services, on the basis of estimated costs/kWh generated and/or saved. These may be considered “partial” integrated resource plans, but they could indicate whether or not the proposed investment for which funding assistance is being sought is cost-effective.

3.7.3 When applying for approval of PPAs -

Generating companies have to sign power purchase agreements (PPAs) with the transmission/distribution companies, for either new plants or increasing capacity. These have to be submitted to the State ERCs. It would therefore be effective if the SERC included a requirement of comparison with alternatives to justify the PPA terms. Public access is permitted for some of these documents and concerned citizens can raise questions at public hearings; these discussions have had effects on the PPAs ultimately decided upon. The possibility of public discussion on alternatives from an IRP – both alternative generation sources and EE/DSM – would encourage their inclusion.

3.7.4 When securing distributors’ licensing/franchising agreements -

In order to complete a licensing/franchising agreement, potential distributing companies and licensees/franchisees can be asked to assess and report on alternative options to supplying electricity purchased from the existing generators. The franchisee model for improvement of service in rural areas has been established in several parts of the country, as part of the *Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY) electrification efforts³⁷. While it is unlikely that potential small-scale licensees/franchisees would be able to undertake an elaborate IRP, simple cost-comparisons of alternatives can be a compulsory part of participation.

3.7.5 When proposing EE programmes -

When undertaking EE programmes³⁸, utilities could be asked to provide comparisons with other feasible options of conserving electricity. For, example, the Maharashtra Electricity Regulatory Commission (MERC) has, in its February 2010 draft regulations regarding implementation and conducting cost-effectiveness analysis of DSM programmes, included the requirement that utilities undertake planning, designing and

³⁷ Essentially, a distribution transformer (that is installed and maintained by the utility) is assigned to each franchisee. The electricity supplied through it (at a charge per unit) has to be paid for by the franchisee, who has the tasks of metering, billing, collecting payments from all the consumers, and serving new consumers in that area. Pertinent to our study is that agricultural consumers are also metered and billed, with progressive reductions in the tariff rate for efficiency improvements such as installation of ISI-marked pumps, PVC piping and appropriate shunt capacitors.

³⁸ China’s new DSM Implementation Measures, (jointly issued by six commissions and ministries, led by the National Development and Reform Commission) require that IRP plans be drawn up (China-NDRC, 2010).

implementation of appropriate DSM programmes on a sustained basis, and submit 5-year DSM plans along with their multi-year tariff filings³⁹.

Device-replacements that ensure a given reduction in electricity requirement, particularly at a specified time of the day (for example, domestic lighting), could be treated as “efficiency plants” through which additional generation plants can be avoided. Utilities could then be asked to draw up plans that consider EE/DSM as alternatives to increased generation, and the implementation plans could focus on those EE options where costs per kWh saved are lower than that of generation.

There are also programmes through which the benefits/”rewards” of reduced electricity supply could be shared, as in the case of the collaboration between state utilities and ESCOs for the installation of improved irrigation pump-sets and sharing of the value of conserved electricity⁴⁰. Then the consortia of utility/ESCO/consultants could compute the cost of conserved electricity through their proposed schemes and compare these with alternative options.

New regulations may also be imposed by the SERCs, regarding environmental impacts and efficiency standards. Correspondingly, there would be situations requiring IRP, as described below.

3.7.6 To reduce environmental impacts -

If charges were to be imposed for environmental impacts such as carbon emissions and discharge of effluents, these would directly affect the costs of generation from some generating plants, making them less competitive. Electricity providers would then participate in IRP preparation activities, in order to avoid the abatement costs of environmental damage that would otherwise be incurred. Rather than permitting tariffs that included these costs (thereby passing them on to the consumers), the generators could be asked to bear the costs -- on the “Polluter pays” principle. There would then be a serious incentive to find and assess alternatives to the polluting option. Even if tariffs allowed the additional environmental charge to be transferred to the end-users, utilities would perhaps consider alternatives because of the benefits of being “clean” producers (-- a form of Corporate Social Responsibility).

Alternatively, the standards for environmental impacts could be tightened. Conforming to such standards would force utilities to consider less-polluting and more efficient alternatives of meeting their electricity service requirements, for which IRP would be required.

3.7.7 To meet improved efficiency norms -

Utilities would have to consider cost-effective alternatives if the approved operating norms were to be changed. Efficiency norms have already been specified for each type of generating plant – with respect to capacity utilisation (plant load factor), plant efficiency (gross heat rate at corresponding loading), and so on (MoP-GoI, 1992; 1999). Hence, at this time, there may appear to be no incentive to effect improvements

³⁹ <http://www.mercindia.org.in/>

⁴⁰ These are ongoing projects in Karnataka, Maharashtra, Rajasthan, Gujarat, Haryana, and Punjab (MoP and USAID, 2009; BEE, 2009)

and cost reduction, except in so far as the utilities could benefit from reducing their own operating costs while continuing with the existing tariffs.

However, if stricter norms were imposed, it would then be essential for utilities to either improve the efficiency at existing plants, or invest in alternative generation and conservation options. This would require evaluation of the costs of these alternatives and thereby an IRP approach.

In all the cases listed above, the utilities' personnel (and/or consultants) would either require the ability to assess alternative options or else associate with research/academic organisations. These could be involved directly for their technical expertise or indirectly for training personnel in planning methods.

After its IRP is approved, a utility should also be responsible for implementing and administering approved projects in accordance with the timelines specified. Hence, they would require the competence to implement effective programmes and/or acquire resources. Further, they would need to evaluate and report on the progress achieved, and update the IRP, as required.

To summarise, the planning organisations suggested in this Section were

At the National level:

- *the Planning Commission*
- *the CERC's appointees*
- *the CEA*
- *a newly established National Working Group*

At Regional/utility levels:

- *the SERCs' appointed agencies*
- *the States' Planning Departments*
- *the Utilities (whether serving a state or a region)*
 - when filing tariffs for approval
 - when applying for central/state funding
 - when applying for approval of PPAs
 - when securing distributors licensing/franchising agreements
 - when proposing EE programmes
 - to reduce environmental impacts
 - to meet improved efficiency norms

4. Discussion

In the preceding Sections, we described the tools/instruments through which and the organisations by whom integrated resource plans could be drawn up.

The options listed above are not exhaustive, and other variants could be drawn up. To evaluate these alternatives, even at the initial stage, several questions need to be answered.

1. *What motivates the IRP process -- regulation, or a convincing need to assess options?*

Regulation alone could result in integrated plans being drawn up by organisations merely to fulfil the obligation. For seriously evaluating alternative options instead of the conventional supply increases, there should be a perceived need for them.

2. *Who leads the planning process? Could there be an un-biased “integration” of all feasible technologies and resources, or is there a selector-induced bias?*

(a) Are there any state-induced preferences?

Government policies tend to determine the choice of technologies, irrespective of costs of generation. The Tariff Policy, 2006, already permits preferential tariffs for renewable sources (clause 6.4). In particular, as a part of the *Jawaharlal Nehru National Solar Mission* (one of the eight “Missions” of the NAPCC), the CERC has notified a much higher tariff (of ₹17.90/kWh⁴¹ for 2010-11), for electricity purchased through grid-interactive solar photovoltaic power systems. This has obviously not been on the basis “least-cost”, nor is there a “level playing field” for other renewable options and EE/DSM measures to be selected. Further, there is already a target for 1,100 MW during the first phase (ending in March 2013) of the Mission, regardless of the possibility of less expensive alternatives. As such, there would appear to be no practical use for an IRP exercise, unless it were taken as a case of a constrained optimization -- with costs minimized subject to the acceptance of a specified capacity of such systems.

(b) Is there a size- or supply-bias?

Large generation plants are usually considered “easier” to establish and operate, on a per unit basis, than numerous EE replacements at the consumer end (or even small dispersed generation systems). This could be due to the perceived difficulties of administration and quality control with respect to small-scale options. Large generation plants could also be more impressive to report. At the level of national power sector advisory authorities, too, this appears to be the case; at CEA’s IRP division, there is no comparison of generation with EE/DSM options, and costs do not include environmental impacts, as evidenced by presentations from this division⁴² and their projections of demand and generating capacity (IRP-CEA-GoI, 2010).

3. *How are acceptable tariffs computed?*

Thus far, tariffs are computed on the basis of agreed-upon capital costs, rate of return on them and operating norms (plant load factor, station heat rate, etc.) already specified by the Ministry of Power (notifications of 1992 and 1999). Once these have been accepted by the regulator, the tariffs are supposed to be accepted for five-year periods. Further the Tariff Policy states that “once the revenue requirements are established at the beginning of the control period, the Regulatory Commission should focus on regulation of outputs and not the input cost elements” (MoP-GoI, 2006; 5(h)3). On the basis of these, there does not appear to be any incentive to shift to alternative generating options or to invest in demand-side measures. There would have to be new orders from the CERC/SERCs to consider alternative lower-cost options.

⁴¹ This is about US\$ 0.40/kWh.

⁴² Presentation of the Chief Engineer at the National Power Conference, 4th December '09

4. *Will environmental costs be imposed or have they to be merely imputed for estimation purposes?*

Thus far, environmental impact costs (such as a charge on carbon emissions) have not been imposed, and standards are relatively easy to maintain⁴³, so that environmental-friendly options do not provide a financial advantage. If environmental impact mitigation charges were to be included, the method of computing them would have to be decided upon. These costs in turn would determine whether or not polluting plants could enter the reckoning, as optimization (i.e. minimizing costs) during strategic resource planning, is wholly dependent on the costs entering the model.

5. *How will EE costs and benefits be accurately evaluated?*

(a) *Conservation potential* - There is not much data on the extent of actual reduction in electricity use effected through EE, which makes it difficult to accurately estimate conservation. Margins of error would have to be included during the computation, and this would tend to lower the credibility of such options. Once EE programmes are institutionalized (for example, through ESCOs), there would be proven evidence of conservation for comparison vis-à-vis generation stations.

(b) *Unit costs* - Efficiency improvements are being implemented through programmes in which the costs/benefits are supposed to be shared as per agreements between ESCOs and utilities. As these are currently still open to negotiation, even the costs/benefits may not be accurate at this point. Hence, at present, one could only assume an acceptable range of costs/benefits. Further, subsidies (lifeline support) are being provided to some categories of consumers; EE among these categories would be additionally beneficial (because the subsidy support would also be reduced), but such consumers would be in need of financing schemes. These aspects would have to enter the computation of IRPs, thereby making the procedure more complicated.

6. *How often will these IRPs be updated or re-assessed?*

IRPs are usually drawn up for relatively long period – 10-20 years. However, there has to be more frequent re-assessment of options, both to consider increases in costs or fall in supply of resources (e.g. rise in the prices of petroleum products or of imported components, shortages of coal, etc.), and to include longer-term changes (e.g. development and commercialisation of new technologies). There would need to be consistent involvement of personnel at organisations undertaking the planning procedures.

In conclusion, we note that the IRPs actually drawn up would tend to reflect the government preferences because these in turn will determine the content and purpose of the plans, the institutional structure created and the policy instruments used.

⁴³ At about 80m³/MWh based on discharge levels (CPCB, 2001), the use of water at Indian coal-based thermal plants is about eight times the global standard (World Bank, 1998).

However, if electricity services have to be universally accessible, reliable, affordable, efficient and clean – then IRP is required too. In particular, ***IRP would be essential if it were required that:***

- at least a ***minimum level of energy services be provided*** regularly and to all,
- these energy services are provided ***on a least-cost basis*** (so that additional capacity investment costs could be postponed or avoided through less expensive efficiency improvement/DSM),
- the ***efficiencies*** at which electricity is generated and utilised reach at least ***minimum standards***, or are ***improved*** by a specified proportion,
- ***environmental impacts*** (or emissions mitigation costs) are ***minimised***.

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