The legitimisation of demand-side policies under deregulation: lessons learned from the IRP era

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1. SYNOPSIS

The key to successful demand-side policies under deregulation is the public perception of legitimacy which can be best demonstrated through formal analysis of their distributive impacts.

2. ABSTRACT

In this era of rapid changes in the electric power industry driven by deregulation and restructuring, the challenge of developing a substantial demand-side agenda to address efficiency, environmental protection and sustainability can be overwhelming. The popular international movement to rely on competitive markets for power requirements is in opposition to the traditional energy efficiency agenda for public support through programs, policies and regulations. Support for demand-side initiatives will be determined in large part by the general perception of their legitimacy of their impacts, and that is best reflected in the analysis of their distributive effects. The author maintains that what we learned in the IRP era about quantifying the distributive impacts of demand-side policies can be applied to this new era, and, coupled with the success in modelling competitive power markets, can make the case for substantial demand-side efforts. Failure to make the case for the legitimacy of aggressive policies can lead to token efforts or temporary support during crises. Examples from the experience of the Bonneville Power Administration in the Northwest U.S. are used to show that the analysis of these issues is tractable and ultimately essential for public support.

3. ORGANISATION OF THE PAPER

The paper discusses: legitimacy and its links to the politics of energy policy analysis; the nature of demand-side management (DSM) planning in the era of integrated resource planning; a description and examples of the analytic methods used by utilities for designing and justifying DSM programs tools and results from the IRP era; the impact of utility deregulation on the DSM efforts; and how to address the new challenges to policy analysis in an era of competitive power markets.

4. LEGITIMISATION AND THE POLITICAL PROCESS

At the 1973 Growth and the Quality of Life Conference at Oregon State University the noted economist Kenneth Boulding spoke about the inability to measure the quality of life in general and the inadequacy of economists to measure it. Economists tend to measure the things that matter least in the quality of life, i.e., material goods and services. He went further to assert that the most important force in society is what he called the “Legitimisation Function,” i.e., without legitimacy the best-conceived plans will inevitably fail, but with legitimacy the weakest proposals may be adopted and lauded. What is seen as legitimate by society is virtually impossible to stop, no matter how foolhardy; what is seen as illegitimate cannot be brought about no matter the opinions of the expert elite. His gave an example from the Middle East.

> Any mediocre economist could easily demonstrate that the Middle East as a whole, and the countries individually, could be much better off if there was peace and co-operation in the region. But it would be virtually impossible to make it come about because there would be no support for it from any quarter. (paraphrased)

It is an exceptional economist who will first castigate his own profession for its inability to produce meaningful, fundamental measures of the well being of society, and secondly promote an abstract notion like the societal legitimisation function as a key concept missing from a profession which likes to be seen as a scientific.

Ironically traditional welfare economics provides some support for Boulding's ideas. Everyone is familiar with (or inured to) societal cost-benefit analysis, and it is used widely to justify public programs and policies. The idea is that there may be projects, programs or policies that are a net benefit to a society that may not be adequately provided through a market economy or even a centrally-planned economy. Further the criterion for distributive equity is that if a program produces a greater overall value to society compared to present conditions, and if "everyone can be made no worse off," then it is preferable to pursue the new course even if it takes strong government intervention to achieve it.

The problem for economists is that such a "no losers" test is not very useful since it requires consensus. Also the analytic and empirical challenges for meeting the test are dumbfounding. However, the distributional effects are key measures, whether measured explicitly or subjectively, in the general perception of legitimacy for society. In the field of utility and public policy analysis, the problem of demonstrating the distributional effects in order to inform society of the "fairness" of programs or policies are paramount because of the need for legitimacy. As Boulding said in 1965:

> Environmental impact statements, difficult and ineffective as these sometimes are, nevertheless represent a very important mutation in the whole political information system, and they will undoubtedly give rise to a variety of other forms of impact statements. We need, for instance, distributional impact statements which will throw some light on the question of who is benefited, who is injured, and who is unaffected by a particular proposal or action. ("Policy Implications of Evolutionary Economics," *Evolutionary Economics*, Sage, 1981, p. 182.)

There are two levels in the fairness calculus: (1) the measurement of the proposed re-allocations of goods and services (physical or psychological) and (2) the application of values to that re-allocation by individuals or groups, i.e., fairness is in the eyes of the beholder. The public policy analyst can shed light on the former. The latter question, who is benefited, can be anticipated through good survey research and public participation efforts, but it is ultimately played out through individual evaluations voiced through an open political process.

5. GOVERNMENT'S ROLE IN ENERGY POLICY AND THE UTILITY CONNECTION

Through most of the 20^{th} century the electric utility business was considered a natural monopoly, both in electric generation and transmission/distribution. In the U.S. utilities were customarily given a monopoly franchise with an obligation to serve all consumer power needs within a defined geographic area. If the company was publicly-owned it had its own governing board, and, if privately-owned, it was regulated by state and federal commissions which set rates and service quality standards. Utilities were expected to recover all their costs with an appropriate return on investment for all prudent investments.

In the late 1970s there was growing and vocal resistance to nuclear power in the U.S., both in terms of environmental threats, cost and financial risk. In the U.S. the decentralised approach to plant design and construction, the often absence of effective cost controls and delays in plant construction made nuclear power very expensive. Under the Carter administration the U.S. Congress passed the a law which required utilities to offer to buy alternative generation from external sources at their "avoided cost."

Soon there were efforts to also require the acquisition of DSM as an alternative power resource. Beginning about 1980 many states began to require DSM programs. These efforts ranged from information programs for consumers, to loan programs, to the outright purchase of DSM as a resource compared to generation. Typically the lowest cost programs were expensed, but major "acquisitions" were sometimes financed through long-term borrowing. This was seen as a natural outgrowth of the natural monopoly role of the utility to provide the power needs of its consumers at least cost.

6. OPTIONS FOR ENERGY POLICY

A key proposition is that the authority (and legitimacy) for publicly supported DSM derives from the sovereign power of the government; in the U.S. that can be either the federal or state governments. Whether it is direct financial support from general government or regulatory intervention, it must begin with a legitimate finding that it is in support of the public interest. The government may have a variety of reasons for wanting to intervene or direct the energy sector to encourage DSM for national interests, including environmental, national security, economic efficiency, sustainability, market failures or simply cultural values. Ideally the cost justification and fairness should be evaluated both in terms of benefit-cost analysis and distributional effects of policies or programs. Even if implementers are far removed from the general government and receive a great deal of discretion in fashioning the methods of intervention, the origins of the formal legitimacy rest on the responsibility of general government to enable or mandate the actions for the public good.

Even though power markets are moving to competition there are still many actions that general government can take to intervene for DSM. In each country or circumstance the degree of the intervention needs to be perceived as commensurate with the severity of the problem and the distributional impacts need to be seen as appropriate, both for benefits and costs. Government actions could include a range of actions (see also Bull 1993, p. 20):

1. General government tax incentives or subsidies
2. General government restrictions on certain energy sources or technologies
3. General government mandates, e.g., building or appliance standards, metering
4. General government information or labelling programs, e.g., Energy Saver stickers
5. Regulatory requirements, e.g., portfolio requirements or mandatory sponsorship of DSM programs and services by distribution companies (the remnants of the utility retail-level natural monopoly)
6. Government support of research, development, demonstration and commercialisation of new technologies
7. Surcharge on power sales to fund DSM activities
8. Directives for government procurement and efficiency performance
9. Support of market solutions through information programs, standardisation, encouraging new business types, e.g., energy service companies, and mandating priority use of desirable energy sources
10. Government encouragement and leadership through publicity campaigns and exhortations

A note about the political process for policy making – it can be co-operative or advocacy based. Advocates on any political issue play an important part in the process, but essentially are competitors in the political process. They often participate in a “win-lose” game of political influence, although the outcome is most often a compromise. In countries with have open, participative processes for program design and implementation it usually relies on a co-operative process. This provides a great deal of checks on the program and also enhances its legitimacy.

Advocates do not always rely on open processes to rationalise the policy prescriptions they promote, although the political process may require them to provide analysis to support their cause. Advocates may also succeed in getting their program adopted intact without objective evidence to support it, only to fail when the outcomes fail to produce the desired results, e.g., the privatisation of the electric industry in the U.K.

The co-operative process is open to alternative views and values with a goal of adopting an acceptable compromise. It is more suitable for long-term, stable solutions in a stable environment. Advocates may be needed for emergencies, like Winston Churchill’s mission to prepare for war in the 1930s or for the California energy crises today. Extreme situations may require immediate, extreme actions. Most DSM efforts require substantial, long-term, stable commitments to be effective and prudent – for instance nothing like the dramatic energy curtailments and interruptions we have in California currently. The latter is not so much efficient energy use, but non-use.

Descriptive analysis through the use of simulation models is most amenable to the open, co-operative process for public policy formulation. It should describe the outcomes of policies or programs as they are expected to occur through rigorous research and analysis. The valuation of alternate outcomes can be left to decision-makers, whether they are managers, regulators, legislators or the public at large. It is in sharp contrast to using collective intuition for policy formulation, as is often the case in political debates. It is designed to cope with complexity and yet maintain a holistic design to reflect the dynamics of complex systems. It can be designed to simulate the trade-offs of different strategies under varying scenarios, demonstrating who pays and who benefits, so that the intended impacts of the ultimate decision are clear to everyone. It can be linked to a learning cycle so that, as the effects of the policy are realised, the analysis can be updated or changed to be more accurate for policy or program re-design. This enhances the prospects for public acceptance, legitimacy and patience in support of the policies or programs.

7. ANALYSIS CHALLENGES IN THE IRP ERA COMPLEXITY – DSM AS A MARKET PHENOMENON

In the U.S. during the 1980s DSM posed many problems for conventional utility planners - both system planners and financial analysts. For the first time they had to plan for resources that were market responses, rather than utility installed generation, and pay for measures and practices that were very difficult to measure and problematic to own. Instead of engineers and accountants, they now needed planners, economists and sociologists. They had to reinvent utility planning, budgeting, oversight and finance. They already controlled a complex and sometimes challenging system - now they were confronted with new dimensions of complexity which became vital to their financial success. The challenges were reflected both detail and dynamic complexity (for a discussion of detail vs. dynamic complexity see Sterman 2000, pp. 21-23).

One of the first tools adopted by utilities for DSM was end use load forecasting models. These were engineering-economic models intended to track energy use by consuming class, building type, equipment type, and fuel type, including new construction and existing buildings, and incorporate consumer adoption of new technologies. This allowed utilities to add specific end use detail to their traditional economic load forecasts. Market and load research allowed them to estimate the parameters for the models.

For DSM alternative tools were often developed for program planning. These tools emphasised explicit market penetration estimates that were a function of both market acceptance of program offerings and budget considerations. These "program ramps" were critical in assessing the DSM effects on load requirements to determine the residual generation that would be required to meet load obligations. This meant that the program planning tools had to be co-ordinated with the end use load forecasting tools.

Finally a feedback mechanism had to be created which would pass the DSM expected load reductions and costs to the rate-making process to assure proper rates were set and costs recovered. However when rates were changed, the load forecasting and DSM program plans might require change. And so the planning models were iterated until a "consistent enough" result was obtained. For the early adopters of demand-side programs this new planning process had to be created from scratch.

By the nature of DSM examples of cost-effective measures are fairly easy to identify, e.g., high efficiency lighting or shower flow restrictors, but it is challenging to assemble a comprehensive assessment. Overall it incorporates hundreds of devices and practices, big and small, simple and complex, and cheap and expensive. A simple cost-effectiveness test would compare the estimated cost and energy savings of the DSM measure or package over its life compared to the estimated cost and energy production of alternative generation. On a small and simplistic scale this is the economist's classic cost-benefit test. In the beginning of utility-funded DSM programs in the U.S. around 1980, this test was considered sufficient. But soon many fairness issues cropped up focusing primarily on distributional impacts. These involved both measurement issues, e.g., takeback and natural or price-induced savings, and explicit distributional issues, e.g., who would receive programs, how much would they pay, and how would the utility pay for the program costs.

In the mid-1980s the California Energy Commission (CEC) set out a report on a series of cost-effectiveness tests which was intended to show both the cost-benefit result for DSM programs and the distributional effects from several perspectives: the societal, ratepayer, shareholder, and participant tests. The guidelines were prepared over many months by a committee of experts and produced specific formulas for each test.

In the Pacific Northwest of the U.S. a similar process occurred over several years. Here DSM was defined as a resource by the federal Pacific Northwest Electric Power and Conservation Planning Act of 1980. The law defined cost-effectiveness and mandated DSM and renewables be treated as the priority resources. The distributional effects became issues during program planning and implementation. The implementing agency, the Bonneville Power Administration (BPA), and the Regional Power Planning Council set up by the Act, developed a body of practice and guidelines in the 1981-85 period which approximated the CEC guidelines.[1]

The philosophies differed however. The Regional Council generally emphasised the societal test, i.e., if DSM was beneficial overall, then it should be done. This usually meant a preference for paying the full cost of DSM measures in order to fully develop their full potential. For BPA and its customers, the distribution companies and direct service industries, the cost of the programs was more of an issue. BPA developed a policy called "market-based incentives" which was intended to have the participant pay a portion of the cost based on market research and program experience related to what seemed acceptable for a robust program. The costs were allocated over all rate classes and were financed through long-term borrowing. Usually there was less disagreement between BPA and the Council on the overall DSM target level and more on the payment level for consumers.

8. MEASURING DSM DISTRIBUTIONAL EFFECTS IN THE PACIFIC NORTHWEST IN THE 1980S

As BPA's DSM programs emerged and proliferated, the budgets quickly rose to $100-200 million per year. Cost recovery for BPA was financed over 20 years through federal borrowing and recovered in its rates. Through the rate-setting process a new issue arose: fairness at the wholesale level, i.e., there were differential impacts on the utility customers depending on the amount of self-generation they had. Opponents of a simple pooling of the costs objected both to this effect and the fact that the bulk of the DSM funds were going to the same urban utilities that had the self-generation. For the former problem BPA experimented with a couple of special cost recovery mechanisms, but eventually adopted a "cost sharing" policy with the generating utilities, i.e., depending upon the amount of self-generation they had, they would supplement BPA's DSM funding with their own funds to deliver the same program. For the latter problem BPA offered new programs, e.g., irrigation efficiency programs, which helped stem the objections of rural utilities.

This did not resolve the urban-rural schism however. The rural utilities became some of the most vehement critics of DSM programs and their objections began to show up in the DSM measurement forums created by the Council and BPA. The measurement issues that had confronted program and policy planners in the early program development now became political issues.

As the technical tools emerged for DSM assessment, planning and evaluation as mandated by the Regional Power Act, it became clear to DSM skeptics that the way to minimise the adverse effects they perceived was to attack the planning assumptions on the efficacy, cost and distributional effects (both retail- and wholesale-level) of DSM. Ultimately the analysis covered a long list of issues:

- Price-induced DSM – How much of the DSM would occur naturally? This would reduce the estimated effect on load requirements and increase the unit cost of DSM. Related to the free rider effect.
- Takeback effect – Do consumers increase their consumption after energy services become cheaper with added efficiency. This would cause a further reduction in estimated system savings?
- Long-term resource – How long does the conservation and net savings last? Key to the measurement of DSM's cost-effectiveness, e.g., for the Northwest, building shell measures were assumed to last 70 years.
- Load uncertainty – Were there benefits from cumulative DSM and the problem of load growth uncertainty?
- Peak benefits – This was a big issue for capacity constrained systems and measurement was a new field of investigation.
- Rate or non-participant effect – Were non-participants in DSM programs financially penalised by DSM programs for others?
- Cost sharing at the wholesale level – An issue in the Pacific Northwest: were non-generating utilities adversely affected by allocation of all DSM program costs to a common rate pool?
- Program allocation – Were different consumer groups adversely affected by the choice of which programs to offer, e.g., household, low-income, commercial, industrial, and farming, or information, loans, and direct payment programs?
- Fuel switching – Were other energy suppliers adversely affected by offering electric utility programs? What about consumers with mixed fuel use for different end uses? Did electric programs increase load requirements by encouraging fuel switching, particularly in new construction?
- Building standards – Should building efficiency be mandated through efficiency requirements or encouraged through financial incentives?
- Program operator – Can or should the program be delivered by the utility or contracted out?
- Competitive acquisition – Should the program be put out for bid? Should the bidding process include generation, i.e., all source bidding? Would bidding affect program performance or costs?
- Free driver effect – Do DSM program participants create a demonstration effect which induces non-participants to invest in DSM on their own, thus increasing the net load reduction?

- DSM payment levels – Should the utility payment for DSM be “market based”, the full cost of measures, or a payment based on the avoided cost of generation? Should it include environmental adders?
- Measurement of savings – Should savings estimates be “deemed” in advance, measured by change in usage and/or trued up with ex post program evaluations using surveys and metering over the long run? (The latter was mandated in the Pacific Northwest.)
- Industrial DSM – For energy intensive industry, do programs give an unwarranted competitive advantage to participants? How are increases in production treated in estimating savings and consumer payments, or are they ineligible?
- Supply curves – How to quantify the technical potential available for program planning?
- Program ramps – What’s the appropriate time schedule for delivering savings?
- Lost opportunities – Is it important to capture savings in new construction and replacement equipment at the point of decision when it can be acquired cheaper than as a retrofit?
- Generational cost impacts – Which ratepayers should pay for the utility cost of savings? Usually this is a question of program timing, scale, and method of cost recovery.

The distributional issues were often submerged in the discussion of these “technical” DSM issues. The arguments over technical and policy issues were lengthy, delayed program deployment and diverted important staff resources. Initially BPA did not have tools which could analyse the issues quickly in an integrated framework. This gave opponents many opportunities to compromise DSM efforts by undermining the apparent legitimacy of DSM. And BPA’s mandated program evaluations of DSM typically measured savings, cost and program effectiveness on a programmatic basis but did not deal with distributional outcomes as part of its function.

A historical footnote: generally the discussion of the distributional aspects of these issues occurred in elite planning circles dealing with sophisticated research and program design with BPA’s utility customers and technical advisory committees of the Regional Council. The rate impacts on consumers were diffused through melding the costs in a general rate pool. But in 1983 BPA undertook to stop construction on several nuclear plants, and the furor experienced in the affected communities made the pain of the distributional effects clear. The impact was local and large, and several interests were very vocal. Many of the local opponents blamed BPA’s DSM programs for deflecting the need for the plants. In fact it was the limited need for new resources which drove the decision (demand was flat because BPA’s wholesale rates had increased six-fold in the early 1980s, in part to pay for the nuclear plants). Also, even aggressive DSM programs could not quickly or easily displace the need for large thermal plants. It became a war of vested interests on both sides, but with persistence, determined leadership and open discussion of all viewpoints, BPA was able to make the decision to stop construction and make it stick.

9. THE NEED FOR INTEGRATED, DESCRIPTIVE MODELS FOR PUBLIC POLICY ANALYSIS

There is no doubt that the advance of publicly-mandated DSM added complexity to an already complex planning task. Human reaction to increasing complexity can follow two extremes: relying on intuition when the problems involve so much uncertainty that one feels that analysis is useless; or rationalisation by systematically identifying system components, key drivers and decision factors and doing the research to improve the information on which to act. Both behaviours were seen in the utility and regulatory DSM experience, but as time passed much more emphasis was placed on the latter.

Another dimension of analysis is the split between reductioist and holistic approaches to analysis. The reductionist approach splits problems into their component parts, has subject experts analyse each part, and then combines the analysis. A holistic approach takes an integrated system view and is more concerned with how the components may interact to produce results. Ultimately complex public policy issues drive the process towards the latter since the ultimate distributional effects, which are key to the public policy process, may not be captured by the summarising of component behaviour, i.e., feedbacks are important.

The field of system dynamics has long advocated the use of an integrated, systems approach to problem analysis in business, social and political arena. Peter Senge (see Senge 1990) has noted that humans always model, either sub-consciously or consciously. It is perhaps what sets us apart from other species. Each of us has a “mental model” of any problem, whether personal, social, business or political. Our understanding of the problem or issue is conditioned by our individual model, and the same is true for everyone else. The problem is that our definitions of

the terms we use to communicate about issues are embedded in our mental models. Therefore Senge states that we cannot communicate well until we have the same model.
Jay Forrester, the father of system dynamics, observes that humans are very creative, but have trouble with modelling because they are very poor at computation. Now we have computers at hand that are very powerful and fast computationally, but alas they aren't very creative. However, if we combine these capabilities we have the power we need to build models of complex systems, and we greatly enhance what we can learn about them.
Finally John Sterman goes further to conclude that computer models have three important uses: (1) to build a common, explicit understanding of a system and its behaviour, (2) to exercise the system model to explore its opportunities and threats and how we can respond effectively, and (3) to extend the model to new assumptions and structural changes to learn about possibilities that don't exist today. He is quick to note that all models are wrong – no doubt about that. They are built as simplifications of reality, but they incorporate what we know and our judgements about how things interact. By using the model and checking it against the best research and experience, we can gradually improve it to discover the insights we need.
Finally descriptive tools have a special benefit for public policy debate – they show impacts in concrete, not theoretical terms. Managers and the public alike can relate to concrete outcomes, especially when the distributional effects are displayed, and can more easily determine and express their preferences for outcomes. Even the difficult area of uncertainty and risk analysis becomes more tractable for public debate.

10. NEW TOOLS THE EVOLUTION OF THE BPA RESOURCE POLICY SCREENING MODEL

The DSM planning issues listed above are reductionist in nature – generally each of them was studied independently. But as can be seen above the system planning problem had acknowledged feedback elements which became more controversial as the political debate grew. In 1983 the BPA Office of Conservation addressed this problem by undertaking the development of the Conservation Policy Analysis model (CPAM). The intent was to incorporate all the known elements into a single, integrated model which could quickly sort through DSM alternatives and test them against generation alternatives. It was composed of an end use model for each consuming sector to measure use and savings, a system expansion and operation module which kept track of supply, an accounting module which tracked costs and finance, and a rate-making module which set rates dynamically. All of these modules iterated in real time, rather than passing the results from one module to the other after the end of a 20-year run. So when the issues of DSM's system impact on loads or rates were raised in the rate-making process, BPA could show specific results with the accompanying assumptions that produced them. It was a descriptive approach where actual behaviour was represented and assumptions could be readily changed for sensitivity analysis or with new information.
Initially CPAM was created as a regional model with one centralised utility providing all the region's requirements. By the mid-1980s it was becoming apparent that the region's privately-owned utilities would not rely on BPA, and so it developed a "sub-regional" model to address the issues brought by its wholesale customers on conservation program planning. By 1986 BPA had the integrated capability to test a program in each consuming sector by level of incentive, efficiency standards, and fuel choice, with the ability to alter assumptions for load growth, fuel prices and new generation and show the impact on total energy cost (including gas customer costs), rate impacts and budget requirements. These results were made available to decision makers, customer utilities and the public at large.
As time passed new policy issues and industry developments emerged to challenge BPA's analytic ability. With the emergence of wholesale DSM cost sharing, CPAM was upgraded to reflect individual utilities to test wholesale distributional impacts. Finally with the merger of DSM planning and generation planning staffs in 1988, the model was adapted to simulate the market behaviour of co-generators which were becoming more competitive, either as an alternative source of power or as it affected BPA's load requirements. Cogenerators' behaviour also had similarities to DSM modelling because co-generation was also a market response on the demand side. At this time the model name was updated to the Resource Policy Screening Model (RPSM) to more accurately reflect the changes. In the early 1990s the model was used to estimate the effect of falling costs and size of new generation plants and their effect on BPA's wholesale power sales over the long-term. Finally, before its retirement, RPSM was enhanced to analyse the long-term system viability under the Regional Act given the challenge of competitive power markets and the need to renegotiate long-term power contracts. Impact of alternative contracting strategies on the intra-regional distribution of costs and benefits, as well as the risks to the U.S. Treasury were analysed. However in 1996 the model

was essentially retired because of loss of staff, its size, the advent of deregulation, the concurrent de-emphasis of utility DSM programs, and the dominance of environmental issues (fish recovery in the hydro system).

The CPAM/RPSM tools were initially created on a remotely-accessible mainframe using the DYNAMO programming language. When Professional DYNAMO became available the models were converted for the personal computer. In 1993 the advent of the powerful modelling platform S4, the model was converted to a Macintosh platform. When new models were needed to assess competitive power markets and environmental challenges, they were built from scratch using iThink from High Performance System in Windows – it is a graphically based equivalent of DYNAMO.

Following are examples of analysis performed with CPAM/RPSM and related mini-models during 1983-95 as they evolved to address some distributional issues directly, and others disguised as technical issues:

1. Model Conservation Standards Cost-Effectiveness and Consumer Economic Feasibility (see BPA 1986a).
2. Analysis of general program strategies including incentive levels, incentive types, rate impacts, ramps, and budget impacts (see Bull 1984).
3. Cross-sectoral DSM program analysis for the 1986 BPA Resource Strategy included varying program incentive levels and building standards, including rate impacts and societal benefits (BPA 1986b)
4. Study to test the cost impacts on non-participants from DSM programs– it turned out to be less than $50 total over a 20 year period (BPA unpublished document)
5. Residential retrofit program evaluation (BPA 1986b)
6. Conservation transfers – trading in DSM savings between regions proved impractical generally (BPA unpublished analysis)
7. DSM effect on load uncertainty – a major study which demonstrated the effects of DSM savings on reducing load uncertainty, with variations on the design of efficiency standards and utility participation (see Ford and Geinzer 1988)
8. Wholesale DSM cost sharing – a system dynamic mini-model was used to demonstrate the “fairness” of wholesale cost sharing options under various conditions (BPA unpublished document)
9. Free rider and free driver effects – an experimental model was developed to simulate the extent of these phenomenon to guide evaluation research (see Ford 1992)
10. Scenario analysis of resource alternatives to determine rate impacts and environmental costs of alternative strategies – the study identified the extra financial burden on ratepayers when very aggressive DSM programs were undertaken (see Bloyer and Bull 1992)
11. Wholesale competition – what would happen if BPA lost a significant portion of its contracted load to new competition (see Neubauer Westman and Ford 1997)
12. Long term power supply under uncertainty (incomplete) – the key analysis was to study the allocation of financial risk within the region and between the region and the federal government (Ford and Barton 1995)

The key to all of the analysis was to show decision makers and interest groups what happened descriptively, i.e., simulate the outcomes so that they could evaluate the alternative outcomes on their own. BPA and the regional public participation processes then provided the mechanism for policy feedback. As a result substantial DSM programs were broadly accepted and supported for more than a decade.

As a footnote RPSM, as an energy conservation model, was not deemed adequate to deal with system peaking issues related to transmission needs. In 1989 BPA developed the Sub-Regional Demand Side Management Model (SDSM) as a new model to evaluate a demand-side option to address peaking issues related to the Puget Sound Electric Reliability Study for alternatives to transmission expansion. A parallel study was undertaken with RPSM to evaluate the wholesale-level distributional effects of localised BPA-funded DSM programs.

11. APPLYING WHAT WE’VE LEARNED TO THE FUTURE: DE-REGULATION APPEARS

All of this was prelude. In the U.S. Congress passed the 1992 Energy Policy Act which created competitive wholesale power markets by enabling independent generation and its mandatory access to transmission. Over time high-power-cost states were pressured to open up retail power competition, particularly by energy-intensive industrial customers so vital to their economies.

What caused this? Most would attribute the change to the advent of new, small, modular, clean, easily-constructed, combined-cycle gas combustion turbines - increasingly efficient jet engines developed for the commercial airline industry. This destroyed the precept that electric generation was a natural monopoly. Natural gas prices were so low that these units could easily compete against utilities' existing generation. In one fell swoop the revolution began, not only in the U.S., but around the world. Centralised, government-owned power supply came under attack from multi-national corporations who could promise reliable power at lower cost and provide their own financing. Even third world countries with government-owned and subsidised power fell to the onslaught because of the burden of financing plants for their burgeoning power demand, in part due to artificially low prices.

So what happened to the regulatory compact for vertically-integrated monopolies which allowed for DSM funding in the U.S.? It crumbled. Utilities scurried to down-size or eliminate their DSM programs since these costs now added to their cost of power in face of their unregulated competition. Retail competition would create customer freedom to choose suppliers and require a whole new approach. In the U.S. some utilities formed DSM subsidiaries to beat the competition in market-based programs – with limited success. Many utilities disaggregated their businesses into separate generation, distribution and transmission companies – sometimes under the orders of regulators, other times on their own initiative. The big issue for utilities was how to recover their embedded costs for un-competitive, rate-based power plants. The issue of stranded cost recovery dominated as high-cost utilities scrambled for their financial survival.

DSM was forgotten except for regions with active political interests who advocated a system benefits charge, portfolio requirements and market transformation efforts (see various authors in the Energy Policy Special Issue on "DSM in Transition: from Mandates to Markets," April 1996). Similar interests are pressuring the Congress for such requirements in any new federal de-regulation bills (Cavanaugh 1999). However these approaches diverge from the "scientific" treatment of DSM as reflected in the Regional Act for BPA. It can mean that with enough political support we may be "throwing money at the problem" without knowing whether it's too much or too little and who is bearing the burden.

12. MODELLING ENERGY POLICY FOR THE FUTURE

We have the tools of the past which can model DSM on an integrated basis, but what about competitive market behaviour in the new power markets? There are several descriptive competitive power market models which have taken up the challenge. Several of these are integrated system dynamics models. First BPA's RPSM was adapted in 1993 to look at the effect of competitive power markets on its contracted customers (see Neubauer Westman and Ford 1997). George Backus and Jeff Amlin have updated their energy planning model, ENERGY 2020, to include competitive market behaviour and it has the ability to track conservation by end use, by individual utilities, by political jurisdiction and also account for pollution levels (see http://www.ENERGY2020.com). Andrew Ford has developed macro-level models of the West Coast power market to capture the behaviour of power markets following commodity cycles (see Ford 1999 and EPRI 2000). Derek Bunn of the London Business School and Erik Larsen in the U.K. have published several articles on modelling competitive market behaviour and they compiled a collection of modelling articles (Bunn et al 1997). So with what we know about modelling DSM and distributive effects in the past, and with new determination to couple them with the new competitive market models, we can again serve the policy debate which confronts us. The simulators can be as simple or as complex as the debate requires, but for the full promise of DSM to be realised the analysis on distributive effects and "legitimacy" must be undertaken.

Just as the problems have become more complex, the computer modelling software and hardware have become far more sophisticated and powerful, while becoming easier to use and more transparent. System dynamics models can be created on the fly for interactive group policy debates. Modelling software such as Ithink, Powersim, and Vensim all provide accessible graphic modelling languages that facilitate transparent modelling and friendly, interactive user interfaces. System dynamics is now being taught as a key skill for the 21st century in U.S. high schools and middle schools – can the energy industry be far behind?

The current chaos in the California power market raises new issues about DSM policy. Has the value of DSM just gone through the ceiling? Can DSM solve the crises? Will competitive electricity markets exhibit commodity price cycles, and how can DSM policy be flexible in light of it? Should DSM policy be flexible or stable for the long-run? When in doubt, simulate it, and see which outcomes you like.

Finally the reader may feel that the conclusions offered here are biased towards the U.S. or a Western way of thinking and governing. This paper does not suggest that cost-benefit analysis and distributional impact analysis gives the "right" answer, only that they provide useful and pertinent insight for decision-making about energy policy. Virtually all countries and cultures now see economic progress as a key to their interests.

13. CONCLUSIONS

It is clear that as we approach a new cycle of energy shortages, disruptions and price volatility, DSM and renewables will again become fashionable in the public policy arena. However one of the main lessons that we learned at BPA about DSM in spending well over a billion dollars of ratepayer funds over more than 15 years is the importance of a long-term view for energy efficiency. If one tries crash programs to get it all now, it will waste resources, interfere with peoples' lives and businesses unnecessarily, distribute the program costs and benefits arbitrarily, and ultimately discredit the promise of energy efficiency for our future. To be effective DSM should be treated as a national resource, its associated benefits for the country should be included explicitly and objectively, not just asserted, alternative policies should be tested for their effectiveness and distributive impacts, and the scope of the public commitment of resources should be openly debated in order win lasting support. Then it should be implemented with a long-term, stable commitment, with continuing evaluations to improve it. Deregulation has challenged the institutional linkages which sustained DSM efforts in the 1980s and 90s, and the fluctuating cost of resources confuse the relative merit of DSM, but it is clear that an energy policy without a significant commitment to efficiency is short-sighted and incomplete for any country.

Finally the key to substantial, stable, long-term, public commitments to DSM is the cloak of legitimacy described by Kenneth Boulding. All too often objective analysis of the distributional impacts of major programs have been neglected or omitted, and there commitments fade rapidly after energy shortages pass. Integrated, descriptive modelling provides the best hope for explicitly planning for futures that can be realised. DSM advocates, counting most of the readers of this paper, can understand that in order to get level of commitment that is warranted for the future they want, can see that we (energy planners and policy analysts) must be willing to show the public, consumers, decision makers, and politicians that real savings are available, are competitive in cost to conventional sources, and can be delivered equitably. We have learned a lot, we can use what we have learned, and there are new challenges that we must confront, analyse and explain.

14. GLOSSARY

BPA Bonneville Power Administration
CEC California Energy Commission
CPAM Conservation Policy Analysis Model
DSM Demand-Side Management
EPRI Electric Power Research Institute
IRP Integrated Resource Planning
RPSM Resource Policy Screening Model

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16. END NOTES

[1] The Regional Act also contained several explicit and implicit equity provisions. First it required the use of energy conservation, renewables and efficient generation technologies as priority resources for acquisition. Defining conservation as a resource meant that it had to be assessed with the same scientific analytical accuracy as generation. The Act also included provisions for mandatory efficiency standards, but it required that utility compensate consumers so that the standards would be "economically feasible" to the consumer (see BPA 1986). Programs were to be offered equitably, distribution companies were required to receive credit and payment for DSM independently undertaken, costs were financed over a 20 year period, and programs were to be sustained even when BPA experienced periodic surplus power.