Utility Project Portfolios Can Be Managed with Modern Tools

Stephen Chapel

Utilities nationwide are faced with a project portfolio management (PPM) problem. A major reason is the nature of the business and the business situation that they face.

Asset-Intensive Business

Electric utilities are extremely asset-intensive, requiring about $4.00 of capital in place for every $1.00 of annual revenue. This high ratio translates into extra-long periods for capital recovery.

- The market will not allow quick capital recovery.
- Long-period capital recovery requires necessarily long economic lives and significant maintenance requirements.

Pressure to Reduce Costs

Industry restructuring has and will continue to create pressure to reduce costs. At the same time, the delivery infrastructure is aging and, as a result, demanding increasing levels of maintenance and replacement. For many companies, the funds allocated to capital and especially maintenance projects have been and are being reduced. Engineers are starting to be asked to build sound business cases for all significant projects.

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Hundreds of Project Decisions

For most power companies, building and maintaining electric utility infrastructure requires funding and executing literally hundreds of capital and maintenance projects every year. Excellence in managing these assets requires that utility planners and engineers treat fairly and consistently projects with different attributes (including large and small projects, projects with different time horizons, and projects that respond to different needs—financial, environmental, safety, reliability, and customer requirements).

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Second, because of their public responsibility, utilities have a complicated budgeting and portfolio management problem. Electric utilities have many stakeholders and are expected to solve problems that cover the wide range of interests represented by their stakeholders. These interests motivate doing projects that contribute to profitability, reducing costs, improving safety, minimizing environmental impacts, and so on. The value of any project must reflect the potential contribution in each of the key stakeholder areas.

Another complicating factor is that portfolio management is not just a question of developing a business case for each project (doing a project valuation). Because of budget constraints, companies must decide which

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projects to do in the current year and which projects to defer in order to maximize the value of the portfolio of projects. This decision must be based on quantification of the value of each project done and the value that is given up for the projects that are deferred.

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If project benefits or value are known, then with some work, it is possible to identify the projects that maximize total portfolio value. However, measuring project value is not a simple task. It requires measuring benefits of doing and deferring projects, measuring all of the benefits of projects, and, for projects that are deferred, consideration of the risk of bad outcomes.

REQUIREMENTS OF A SATISFACTORY SOLUTION

There are a number of items to be considered.

- *Consequences of Deferring Projects:* At the project level, a system must measure the value contributed by a project and value that is given up if the project is delayed (I like to refer to this as measuring the "pain" of deferral). The fundamental decision is what to do in the current year and what to delay. Project value must be measured in terms of contribution to company objectives.
- *Consequences of Reduced Portfolio Budgets:* At the portfolio level, a system must measure the value of the portfolio and the value of the portfolio under different levels of funding. The value of the portfolio is an aggregation of project values.
- *Project Selection That Maximizes the Portfolio Value:* A system must be based on a project selection method that maximizes the value of the portfolio—value as in value measured by dollars.
- *Transparent Results:* The results of the system must be transparent to all parties involved. This means that project scores must be easily understood and results easily communicated to engineers who sponsor projects, managers responsible for company functional organizations, company senior management, and regulators.

IMPLEMENTATION OF THE SOLUTION

There are a number of factors that make up sound implementation.

Project Valuation Method

Fortunately, a powerful methodology exists for solving the PPM problem. The methodology, based on multiattribute decision theory, allows for the explicit quantification of the consequences of doing or not doing a project where the potential value of a project is from several attribute sources, and the risks of deferring a project because of funding constraints.

At the highest level, the reason projects are done is that they have attributes that contribute to overall corporate objectives (objectives that are determined by the stakeholders that the company serves). The decision maker, when evaluating projects with different attributes, can define measures that allow him or her to trade off competing values. This trade-off is often done implicitly. Decision frameworks based on multiattribute decision theory make these trade-offs explicit.

What are "valid" project valuation methods? Most tools for project portfolio management have shortcomings that make them incapable of accurately prioritizing projects. A typical shortcoming is using measures of project impacts that are too high-level and abstract. Another shortcoming is the failure to use legitimate methods for converting the measures of what projects change into measures of value. To value and compare projects that produce truly "apples and oranges" benefits, you need three things: specific and sometimes detailed measures of what projects actually change in the physical world; scales that convert the physical measures to measures of value (e.g., on a scale of 0 to 1 or 0 to 10); and weights that are the terms of trade (i.e., "monetary exchange rates") among the different dimensions that give rise to value (e.g., monetary, safety reliability, and other factors). Multiattribute utility analysis or decision analysis provides a strict valuation model with these three attributes.

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Implementation Checklist

A good implementation strategy benefits from a checklist. My list is shown in the sections that follow.

Corporate Commitment

Implementing a formal quantitative PPM requires a commitment of significant internal resources in a corporation. It also requires change management—that is, both managers and engineers must embrace both the design of the system and its adoption as the analytic tool for project portfolio management. Resources and change management can only come from the most senior management in a company.

Organizational Change

Experience has demonstrated that to effectively implement a PPM system necessary organization elements include the following:

- An executive sponsor, representing senior management commitment to implementing the project prioritization system
- A system administrator with the authority to administer the PPM system, including performing analysis and working with project sponsors and functional managers to get data and review project scores, and having accountability for the credibility of the analysis process
- Project sponsors, typically engineers, in the functional organizations that are committed to the system and to working with the administrator
- Cross-functional support and participation from the various functional organizations—maintenance, engineering, construction, and operations—as well as management for the implementation of a comprehensive and sustainable asset management program

Design and Testing of the System

The success of a PPM system depends upon a rigorous and credible analytic methodology for performing analysis of project and portfolio value. My guidance for the design phase is the following: use multiattribute decision theory as the underlying methodology; hire an expert in this field to facilitate the design and testing of the system; budget at least six months' time for the design and testing phase; make it your objective to create a system that produces, for all stakeholders, credible project values and rankings; and finally, consider bringing in an outside expert to work with you essentially full-time in-house during this critical phase.

Software Selection

It is my experience that companies tend to view the software selection decision as the linchpin to PPM success. I could not disagree more. System design, testing, training, and corporate commitment are critically important. Software is important but insufficient absent the other elements. That said, there are important considerations and questions when choosing software.

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Good PPM software will have three components:

- A data management component for collecting, storing, and retrieving the information that serves as the foundation for project portfolio decision making
- A decision component for (a) converting project-induced changes into measures of project value and (b) using project value to identify value-maximizing portfolios
- A reporting component that displays the results

There are several questions that should be considered when choosing software.

- Is the supplier set up to handle both the IT and value modeling support that is required for success?
- Is the system designed to support implementation of value models based on a credible method for quantifying value (i.e., multiattribute decision theory)?
- Can the implementation of the tool be easily modified without the help of the supplier and without writing code? In other words, is the system flexible in its setup and

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modification or does it have a prespecified set of project attributes that require software coding in order to modify or expand?
- Does the modeling system support enterprisewide project portfolio management, and is it a general system that enables users to quickly implement and modify valuation models without any custom code development?
- Does the system have a data management system that allows ease of collecting, storing, and retrieving information, including remote data entry and analysis?
- Does the software allow remote data entry via a client-server environment?
- How are reports generated, and can the user create customized reports?
- Can the system export data to other corporate databases? Likewise, can required data be imported into the system?
- Finally, does the system account for deferral risk when valuing projects? The failure of PPM solutions to account for deferral risk is a major limitation for electric utility applications. As far as I know, none of the commercial products have proper algorithms for accounting for deferral risk when valuing projects.

ANALYTIC CONSIDERATIONS

The remarks in this section are taken partially from a short paper.[1]

Project Value

The value provided by a project is based on the incremental benefit the project provides compared with not doing the project, the so-called Do-Nothing alternative. The attribute levels associated with doing nothing must be specified over time. The attribute levels associated with doing the project must be specified over time.

Time Horizon

The practical question is over how many years will a project provide value? There is a time associated with a project such that the project provides incremental benefits compared with the Do-Nothing alternative. Beyond that time, the attribute levels are the same and the project provides no net benefits. Another way to express this idea is that delaying the value provided by the project indefinitely cannot happen and that somehow doing nothing "catches up" to the project—after some point, the project can no longer be deferred and a project must be done. The point here is to report incremental value provided by a project only until the time it takes for doing nothing to catch up.

Optimization

Solving the utility project portfolio management problem requires solving an optimization problem. The optimization problem is one of selecting starting times for all projects so that the sum of the benefits is greatest without exceeding any of the constraints (budget and labor).

- *Decision Variable:* The decision variable in this problem is actually when to begin a project.
- *Objective:* The objective is to maximize the value of the portfolio subject to budget and perhaps labor constraints.
- *Outcome Uncertainty and Risk:* The outcome of this decision problem is value provided by doing a project and value foregone by deferring a project. Values may be predicted with some certainty or in some (many) cases the values of doing and deferring a project may be uncertain and thus risky.

Project Risk and Deferral Risk

The failure of PPM solutions to account for deferral risk is a major limitation for electric utility applications. As far as I know, none of the commercial products have proper algorithms for accounting for deferral risk when valuing projects. To illustrate the importance of this problem, a colleague, Lee Merkhofer, and I have developed an interactive risk demo. The demo makes it clear that, as a result of not properly accounting for deferral risk, available PPM tools incorrectly prioritize utility projects and vastly undervalue the importance of investing in maintenance projects.

QUALITATIVE AND QUANTITATIVE BENEFITS

Finally, what are the benefits of adopting a formal project prioritization system? First, from a qualitative perspective project portfolio management, when based on a valid method

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for measuring project value, produces four types of benefits.[2]

- *Better decisions*—A priority system enables the organization to improve project-selection decisions. If projects generate significant nonfinancial benefits, it's hard to make value-maximizing project choices without having a valid way of quantifying those benefits.
- *Better project options*—A priority system helps project sponsors design and propose better projects. Understanding organization objectives and having the capability to evaluate candidate projects, project sponsors will bring forth better projects.
- *Better alignment of projects with organization objectives*—A priority system enables the organization to make choices that better implement corporate strategy.
- *More persuasive and defensible justifications for funding*—A priority system makes it clear what can be accomplished from desired resources, and what will be lost if resources are overly constrained; provides quantitative documentation of the benefits provided by individual projects; shows how much additional benefit could be gained or lost if funding is increased/decreased by any given amount; provides the basis for building the business case for each project and for the project portfolio; and demonstrates the prudence of spending decisions.

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However, what about quantitative benefits? How much value can reasonably be expected? For some industries, applying multiattribute utility theory to optimize project spending decisions can result in increases in total portfolio value of 30 percent or higher. Increases for utilities appear to be smaller, in the range of 5 to 20 percent. Much of the increased value comes from quantifying nonfinancial project value and incorporating this information into project selection decisions. Limited data suggests an average benefit-to-cost ratio for utility-funded projects of around 5:1.

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While the benefits of PPM to an electric power organization can be significant, realization of the benefits depends upon two factors: (1) using a valid approach for measuring project value and (2) implementing the system at a high level in the organization so that there is "enterprise-wide" optimization of project and portfolio decisions. The second factor is discussed here, and the implication of my argument is that prioritization is really about allocation of the budget across organization units. PPM forces organizational units to quantify and communicate the value of their projects, and it allows for improved enterprise budget level and budget allocation decisions.

At the business-unit level, many times project prioritization is not such a difficult problem. At this level, if projects tend to have homogeneous benefits and the engineers understand the technical details of the projects, there is some evidence that pure "forced rankings" produce reasonable project selections (forced rankings are situations where the project sponsors get in a room and discuss the projects and simply rank the projects without a formal system for quantifying project value). The engineers know which projects can be safely deferred and which projects need to be done.

The more significant benefits of a formal, analytically based prioritization system are at the enterprise level. At this level, project benefits are truly apples and oranges. Enterprise benefits are derived from setting budgets commensurate with benefits and from shifting budgets around so that the money is allocated to the business units with the greatest potential for creating value.

NOTES

1. Feinstein, C. D., & Chapel, S. W. (2004). *Fundamental principles of project prioritization.* Palo Alto, CA: S. Chapel Associates.
2. The list of four types of benefits and the quantitative estimate of 5 to 20 percent is the result of collaboration with Lee Merkhofer of Lee Merkhofer Consulting.

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