

MANAGING INNOVATION IN YOUR ENERGY EFFICIENCY PROGRAMS –

PUTTING THEORY INTO PRACTICE

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Energy efficiency evaluation has generally been an ex-post exercise. Pilot programs are implemented, benchmarking occurs, and at some later date, an evaluation (impact, market and process) report is produced. At which point, changes may be made to the program and evaluated in another year. In a dynamic environment evaluators need to provide more real-time feedback than previously.

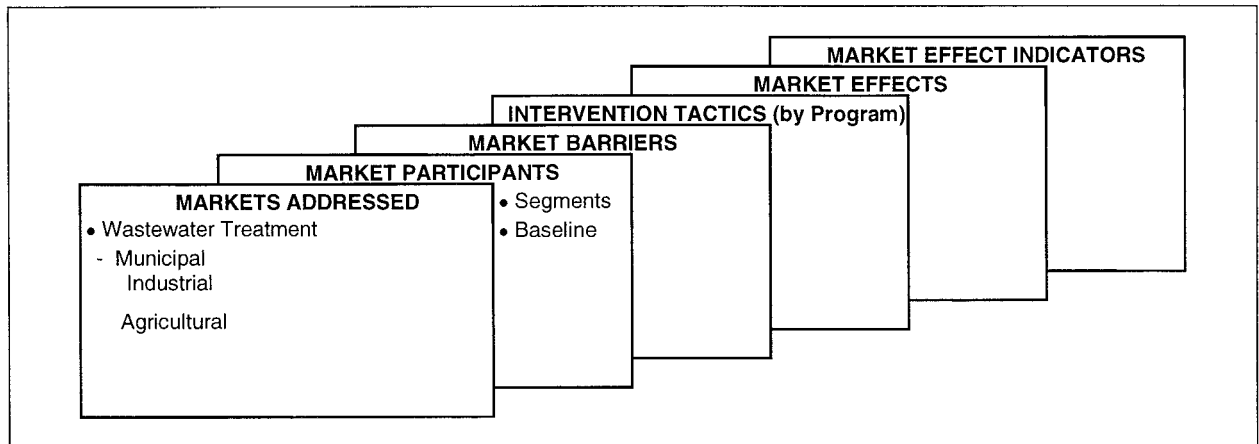
Understanding the motivations of each market actor is key to identifying barriers and potential intervention strategies. Providing continuous feedback to the implementation team is key in maximizing the value of evaluation data – why not provide key results on barriers and intervention strategies as they come in, rather than waiting for a report deadline. The remainder of this paper describes our market assessment methodology - focused on continuous feedback. A case study showing how this methodology works in practice is also presented.

IDENTIFY THE MARKET ACTORS

1.1 QC APPROACH - METHODOLOGY

Our approach to the characterization of the Pacific Northwest wastewater treatment market is founded on establishing and tracking the links between all elements of the targeted market and public and private sector interventions. Central to this approach is the focus on markets rather than programs, where the program is viewed within the context of the market. By analyzing the market structure, we can see how the interactions of individual market actors can either inhibit or promote the adoption of a targeted technology.

Exhibit 1
Elements of Market Characterization



The elements used in this market characterization process are illustrated in Exhibit 1 and the process used is described below.

- Initially, the roles, actions, motivations and relationships of all market actors are described as they exist today (the market baseline). In addition, the “vision” for the future is described, both in terms of potential energy savings and in terms of the new structure that supports energy efficiency in a mature, “self-sustaining” marketplace. Without this integrated “story” of how a market is likely to develop, identifying and measuring market effects becomes most difficult.
- An important element of this step is the identification of the current market size, and the technical and economic potential for energy efficient applications.
- The barriers to the development of the self-sustaining market are then linked to each market actor, as perceived by the market actors themselves, their upstream and downstream trading partners, “enabling” market actors, and end users.
- Market interventions that address the above market barriers are then identified and evaluated for their potential to overcome specific barriers. For each market actor/barrier/intervention identified, aspects of the different technologies you may want to define the bacgen venture as the wastewater project?(as well as any other relevant current and planned public and private sector initiatives) are assessed, areas for enhancement are identified, and:
 - Additional potentially effective interventions are recommended,
 - The key market effects that must occur to allow the sustainable market to develop are identified.

- Finally, once the market effects have been identified, market effects indicators are developed and tracked, so that the success of current programs can be tracked by these indicators and, more importantly, programs can be refined to reflect market realities.

1.2 STEP 1 – MARKET ACTOR IDENTIFICATION

As shown in Exhibit 2, each type of market participant in the wastewater treatment lagoon industry (as an example) is identified. Market participants include all persons or entities affecting the operation of the market, either directly, or indirectly. These market actors are listed in order of importance to the targeted market. In the present example, municipal wastewater facilities are clearly the most important to the operation of the market. Industrial and agricultural wastewater facilities are listed next in part because they are significant potential markets in their own right but also because they are functionally similar to the municipal facilities – even though regulatory agencies or engineering firms may in some sense be “more important” to the success of the project.

Although many market assessments focus primarily on end users, characterizing the entire market and all market participants is extremely important to successful market transformation efforts. Failing to account for the influence of potentially important market participants could result in ineffectual program implementation strategies, and therefore unnecessarily slow market transformation. The correct and complete identification of all primary market participants is therefore essential.

Exhibit 2
Market Actor Identification

Market Participants	Market Barriers							Market Participants	Intervention Strategies						
	Performance Uncertainties	Asymmetric Information	Information and Search Costs	Organizational Practices or Customs	Hassle/Transaction Costs	High First Costs	Market Entry		Case Studies	Training	Market Research	Access to Financing	Decimation of 3rd Party Research	Standards and Practices	Regulatory Changes
Municipal Wastewater Facilities								Municipal Wastewater Facilities							
Industrial Wastewater Facilities								Industrial Wastewater Facilities							
Agricultural Wastewater Facilities								Agricultural Wastewater Facilities							
Regulatory Agencies								Regulatory Agencies							
Community Groups								Community Groups							
Technical Associations								Technical Associations							
Research Agencies								Research Agencies							
Engineering Firms								Engineering Firms							
Technology Manufacturers								Technology Manufacturers							

KEY
 High
 Moderate
 Low

Assessing Importance for Market Barriers, Relevance and Potential Effectiveness for Intervention Strategies

1.3 STEP 2 – BARRIER IDENTIFICATION

Once the market actors have been identified, the barriers to adoption of the technology or measure in question facing each participant are identified and ranked. The rankings indicate how difficult it is for market actors to overcome each barrier; they are based on interview results regarding the barriers *as respondents perceive them*. Respondents were first asked an open ended question regarding the barriers facing their adoption or acceptance of specific technologies or practices; these unprompted responses were given a “high” importance ranking, as indicated by a solid ball in the box under that barrier, as shown in Exhibit 4. Exhibit 2? Respondents were

then asked to rank the importance (high, moderate, or low) of other barriers hypothesized for this group of market actors based on industry knowledge and review of secondary sources. Averages of the resulting ratings were used to assign an importance rating to each barrier, shown by a solid ball (high), half ball (moderate), or circle (low). Analytical judgment of the evaluation team was also used to develop the final ratings where interview data were incomplete or inconclusive.

The specific names assigned to barriers used in this study build upon the categorization developed by Eto et al, cited earlier, of barriers to the adoption of cost-effective energy-efficient practices. Summary descriptions of these barriers are presented in Exhibit 3.

Exhibit 3
Market Barriers Defined

Access to Financing*	The inability of consumers to obtain appropriate financing for the product or service.
Asymmetric Information/ Opportunism*	The tendency of sellers of energy efficiency to have more and better information about their offerings than do consumers.
Bounded Rationality*	The behavior of an individual during the decision-making process that seems or actually is inconsistent with the individual's goals.
Hassle/Transaction Costs*	The indirect costs of acquiring energy efficiency, including the time and labor involved in purchasing or contracting for an energy efficient product or service.
Hidden Costs*	Unexpected costs associated with reliance on or operation of energy efficient products or services.
High Capital Costs	The cost of making changes to production facilities and/or sales methods to sell a new product.
Information/Search Costs*	The cost of identifying energy-efficient products or services or learning about energy-efficient practices.
Lack of Product Knowledge	The ignorance of vendors about their product and the resulting inability to sell it.
Market Uncertainties	The difficulty suppliers and manufacturers face in evaluating the market's reception of the product or service.
Organizational Customs and Practices *	Organizational behavior or systems of practice that discourage or inhibit cost-effective energy efficient decisions.
Perceived Low Value/Cost Ratio	The belief of the consumer that the cost of the product or service outweighs the value.
Performance Uncertainties*	The difficulty consumers face in evaluating claims about future benefits.
Regulatory Constraints	Codes or standards that do not allow the use or implementation of new technologies.
Split Incentives*	The incentives of the agent charged with purchasing energy efficiency are not aligned with those of the persons who would benefit from the purchase.
Unavailability*	The failure of manufacturers, distributors, or vendors to make a product or service available in a given area or market.

*Source: *A Scoping Study on Energy-Efficiency Market Transformation by California DSM Programs*. J. Eto, R. Prahel and J. Schlegel. July 1996.

Note: Remaining market barriers have been defined by Quantum Consulting.

The relevant market barriers are also indicated in order of importance as they apply to the most important market participant (in general, from left to right). Using municipal wastewater

facilities as an example, *Performance Uncertainties*¹ and *Asymmetric Information* are shown here to be the most important barriers. Moderately important barriers shown in the exhibit for this group include *Information and Search Costs*, *Organizational Practices*, and *Bounded Rationality*. This process is repeated for each group of market actors.

Identifying the barriers as they apply to each market participant is the most essential portion of this step in the market characterization. How each group of market participants perceives a barrier determines, in part, the appropriate intervention strategies for those participants.

Exhibit 4
Market Barrier Identification
Illustrative Example

Market Participants	Market Barriers										Intervention Strategies				
	Performance Uncertainties	Asymmetric Information	Search Costs	Organizational Practices	Information and Search Costs	Bounded Rationality	Organizational Practices	Regulatory Barriers	Government Party	Information and Search Costs	Regulatory Barriers	Government Party	Information and Search Costs	Regulatory Barriers	Government Party
Municipal Wastewater Facilities	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Industrial Wastewater Facilities	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Agricultural Wastewater Facilities	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Regulatory Agencies	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Community Groups	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Technical Associations	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Research Agencies	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Technology Manufacturers	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

KEY
 High
 Moderate
 Low

Note: Assessing Importance for Market Barriers, Relevance and Potential Effectiveness for Intervention Strategies

¹ See Exhibit 3 for a full description of these barriers.

1.4 STEP 3 – INTERVENTION STRATEGY IDENTIFICATION

This step in the market characterization not only identifies appropriate intervention strategies, but also links them to the targeted market participant/market barrier combinations. A complete list of intervention strategies defined by QC is provided in Exhibit 5.

Exhibit 5
Generalized Intervention Strategies

Alliances	Vertical integration of market between upstream and downstream market actors (i.e., forming a relationship between contractors and suppliers).
Audit	An assessment of a building's energy efficiency made by a trained inspector.
Contractor Certification	An assurance that a given contractor is knowledgeable about the product or service, verified through training and/or testing.
Demonstration	Providing demonstration of the use/performance of energy efficient technologies to market actors.
Design Assistance	Providing recommendations on building or product design.
Financing	Providing loans to finance the acquisition of a product or service.
Financial Incentives (and Rebates)	Per measure dollars provided to market participants (generally either end users or contractors) to encourage energy conservation measure installation.
Information	Passive provision of information to market participants.
Linking Vendors & Customers	Providing customer contacts to contractors, or contractor/vendor contacts to customers.
Non-financial Incentives	Products, changes in procedures, or administrative consolidation to encourage product or service provision.
Promotion	Active advertising and information made available to the market.
Sales Training	Providing sales, marketing and/or technical training about products or services to individuals responsible for selling it.
Standards, Labeling	Setting specific standard levels for energy efficient technologies. Labeling these technologies accurately for easy consumer/contractor recognition.
Technical Information	Provision of technical information on energy efficient products or services.
Technical Support	Providing answers to technical questions from market actors about energy efficient products/services after installation.
Technical Training	Providing training to trade-allies so that they better understand new or existing practices or procedures
Testing Protocols & Standards	Standardization of testing protocols for installation and repair
Third Party Verification	Inspection and verification provided by an unbiased party on the results of an inspection to insure correct product or service performance.

Note: The intervention strategies have all been defined by Quantum Consulting.

The primary reason for the intervention and barrier linkage step is to ensure effective and efficient barrier reduction. A clear picture of the linkages will show that some barriers can be significantly reduced or eliminated using one intervention strategy, while others may require a combination of interventions to be effective. The goal however is not to make duplicative efforts. For example, as shown in Exhibit 6, both *Case Studies* and *Dissemination of Third Party Research* are perceived by operators to be highly effective in addressing the performance uncertainty and asymmetric information barriers, suggesting that it may be appropriate to target resources to just one of these activities rather than both. Regulatory changes, on the other hand, are perceived to have low effectiveness in addressing performance uncertainty and to be ineffective in addressing asymmetric information.

Considering and identifying all possible combinations and uses of intervention strategies is the goal of this phase of the market characterization. This is an important step in determining where there may be gaps and overlapping efforts in current and planned intervention efforts.

Exhibit 6
Intervention Strategy Identification
Illustrative Example

	Market Participants	Market Barriers										Intervention Strategies							
		Performance Uncertainties	Asymmetric Information	Information and Search Costs	Organizational Practices or Customs	High First Cost	Access to Financing	Bounded Rationality	Market Uncertainties	Land Use Requirements	Promotion	Case Studies	Training	Market Research	Access to Financing	Decimation of 3rd Party Research	Standards and Practices	Regulatory Changes	Financial Incentives
Municipal Wastewater Facilities																			
Industrial Facilities																			
Agricultural Facilities																			
Regulatory																			
Community																			
Technical Assistance																			
Research																			
Technology Development																			

Moderate
Low

Note: Assessing Importance for Market Barriers, Relevance and Potential Effectiveness for Intervention Strategies

Note that each horizontal line indicates the presence of a single specific barrier for a given group of market actors. Reading across that line shows, however, that there may be several

intervention strategies that would – with varying degrees of effectiveness – be expected to address that specific barrier.

In summary, by combining “importance ratings” for market actors and related barriers with “potential effectiveness” ratings for related intervention strategies, the overall importance of an end user/barrier/intervention strategy can be assessed. Analyzing the degree to which the BacGen project plans to address important needs (either in combination with or separate from other activities) provides a good indication of the potential effectiveness of the project in transforming the aerated lagoon wastewater treatment market.

1.5 STEP 4 – MARKET EFFECTS INDICATOR IDENTIFICATION

To determine whether the market interventions are having the desired effect, it is necessary to identify some criteria that will allow us to assess the extent to which underlying market barriers have been overcome. While the ultimate indicator of effectiveness of any intervention is the adoption of efficient solutions as standard practice, different interventions would be expected to have their primary effects at different stages of the awareness-adoption process for different market actors. That is, there are measures that will indicate changes in the market before the technology is actually adopted on a large scale.

For example, information-oriented interventions might have an important function to increase awareness of new technologies not only among plant operators, but among market actors such as community groups and the media. An increased number of positive responses to interview questions regarding awareness and detailed knowledge of different technologies will provide one indicator that the information/search cost barrier may have been overcome. Similarly, if demonstration projects and the diffusion of case studies yield greater interest in and recognition of the scientific merits of a specific technology among engineering companies and regulators, that would provide another indicator of market effects.

1.6 PROVIDING FEEDBACK

The development of innovative energy efficiency programs has gained wide exposure through programs like California’s Third Party Initiative (TPI) program and other efforts at NYSERDA, the California Energy Commission and the Alliance, to mention a few. These programs have sought to increase innovation in the energy efficiency market by looking to a larger pool of resources outside of utilities. In essence programs such as TPI and the Alliance’s Venture projects have provided venture capital seeking a return of sustainability and therefore energy reduction, rather than money - though this could certainly be a byproduct.

As with many ventures, even the most innovative ideas may stumble along the way. As stated above, traditional utility evaluations used ex-post methods to establish impact estimates for program savings. Retrospective evaluation may be less beneficial to “venture” type programs as their environment may be more dynamic. In addition venture projects/startups are more resource constrained, timely evaluation and feedback may be more productive to these firms than retrospective analysis.

Under an “adaptive management” or continuous feedback approach the evaluation and implementation work in tandem to observe and adjust a project’s progress. Through bi-annual reports, (it is more often – there are interim reports, as well as regular discussions so it is more real time than twice a year) progress towards market transformation is tracked and adjustments in project scope and direction are made. In some instances this “real-time” feedback can help project’s narrow in on their goals, in others more drastic changes such as termination may be required. The use of adaptive management has been successful in numerous cases. In one case, the BacGen Biowise (BacGen) project, adaptive management successfully helped redirect the project.

2. CASE STUDY – BACGEN TECHNOLOGIES

Under the original project proposal the BacGen project combined micro-nutrients, monitoring and process controls to deliver significant energy savings in the wastewater industry. However, the project met initial market reluctance (significant reluctance) and was only able to gain one demonstration facility within a year. Twenty-four facilities had been targeted in the proposal. The evaluation revealed that micro-nutrients were the problem. That is, operators referred to these micro-nutrients as snake-oil. Focusing only on them would spell disaster for the project. Armed with this information, the implementation team retooled and focused on process modifications and controls, while micro-nutrients took less of a role. The change resulted in gaining eight sites the following year.

As data were collected for each primary actor, the evaluation team began building a picture of the industry/market. Throughout this process there was open dialogue with the implementation team.

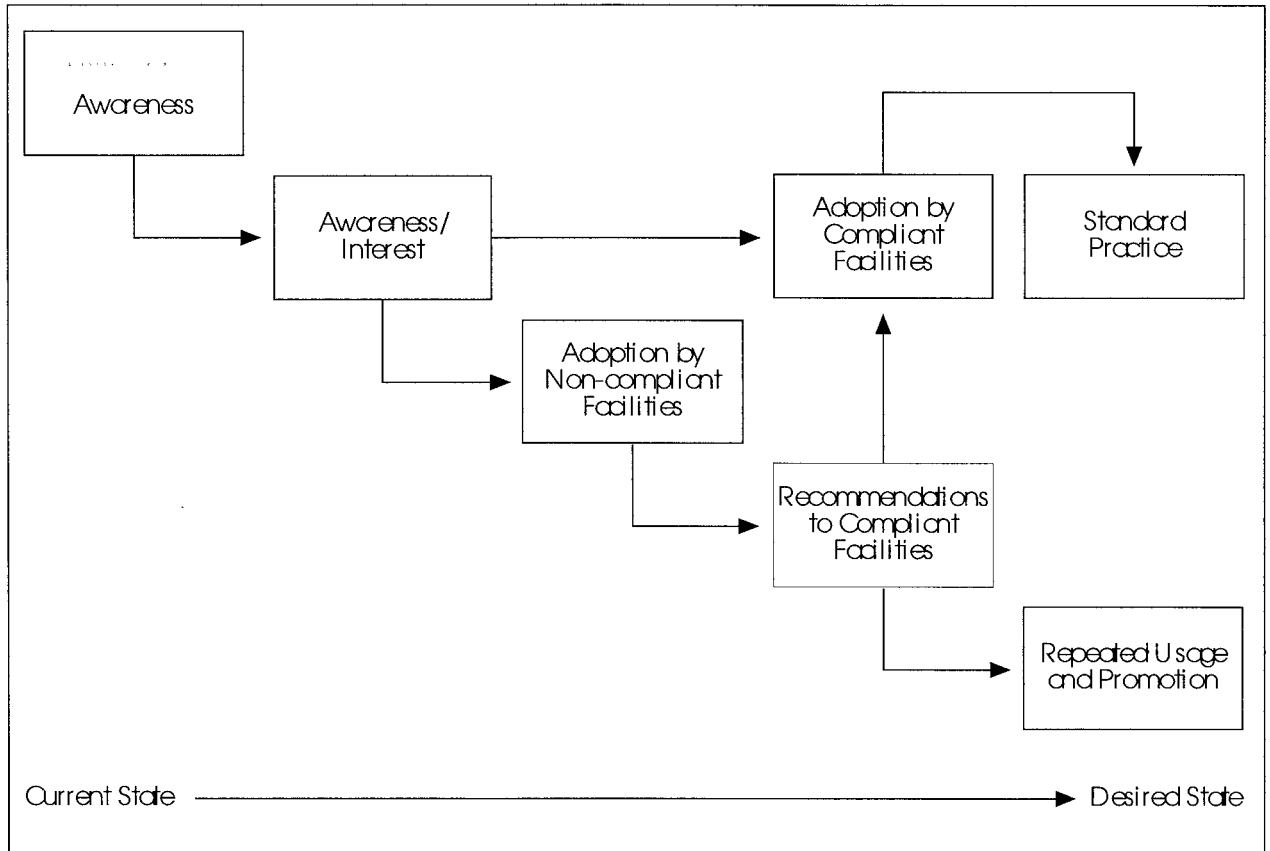
2.1 Tracking Progress

With a clear understanding of the market including actor, barriers, and interventions, the evaluation team moved to develop a series of market effects indicators. The market effects indicators were based on the adoption continuum where the steps from little or no awareness to adoption were identified and tracked. Exhibit 6 provides a graphical representation of the adoption process for biological additives in the wastewater industry. As shown in Exhibit 6, Adoption by non-compliant facilities was a key factor in moving to standard practice. By revisiting the barriers for facility operators (the key market actor) we found stiff resistance to using biological additives. These barriers were discussed with the implementation who reached the same conclusion. Specifically, only non-compliant facilities (those not meeting their discharge permit) were the only immediate market for this product - any compliant facility would not be interested. With the market reduced to non-compliant facilities (a fraction of the facilities in the region), clearly the project needed some way to expand. The solution came in eliminating biological additives from the technology “tool-kit.” This one step opened the door to an eight-fold increase in adoption.

Not all products or services will have that one key barrier, that when removed entirely opens a market. In other cases projects may not be as modular. Even in such cases it will be instructive

to develop a clear goal or measure of success, and then to map the steps from no-awareness to standard practice. It is only with this tool can one adequately evaluate their success.

Exhibit 6
Indicators of Market Effects



In closing adaptive management can be a valuable tool in measuring success and refocusing dynamic projects. Through timely market progress reports and an integrated unbiased-evaluation and implementation, the BacGen project was able to refocus on a more successful and sustainable path.