

## **Incentive-for-Performance: Leaping the “Valley of Death”**

### **Topic Solution Summary**

Incentive- and Pay-for-Performance is a procurement mechanism for forming public-private partnerships to move new technologies over the “Valley of Death.” It is particularly suited to newer technology because it reduces the risk of spending public funds on unproven technologies and enables a low-risk alternative to grant funding. No money is paid out unless the technology produces the specified product. The more product produced, the more money is paid. There is no embarrassment for having given large grants with nothing produced.

Pay-for-Performance is a way for customers to procure service and equipment. Incentive-for-Performance is an additional amount offered by government or aggregations of customers when necessary to make new technology attractive to both customers (generally public agencies) and private investors.

Many innovations flounder in the Valley of Death. The Valley of Death exists between the laboratory and commercialization to full-size. New technologies often stall in the Valley of Death because they cannot offer the first few customers savings worth the customers’ risk while also offering returns worth the investors’ risk.

In either for-Performance agreement, a private team will finance, design, install, operate, and sell the products from new technology at commercial scale for ten to thirty years. The public agency provides a host site and some portion of the Pay in terms of successful output. Successful payment units could include: \$/ton of waste transformed, \$/kWh for electricity produced, \$/Btu for heat produced, etc.

Customers select technologies with a Request for Pay-for-Performance Proposals. The customer selects the winning proposal based primarily on price after a yes-no evaluation of technical feasibility. There is no consideration for previous performance at scale. The technology providers consider the incentive and all possible incomes when proposing. A disruptive technology with a large incentive and exception incomes might propose to pay the customer to try the new technology.

## Submission and Supporting Evidence

### Changing the “grant” paradigm

“New developments often face two market gaps that can potentially delay or even kill them: the “technological valley of death,” in which promising advances hit a technical brick wall, and the commercialization valley of death,” in which an effective technology can’t get to market.”<sup>1</sup> Incentive-for-Performance helps new developments leap both valleys.

Incentive-for-Performance drives innovation much better than grants. Grant administrators have powerful incentives not to provide grants to “unproven” technologies, precisely those where the technology and perhaps the inventor are currently judged to be excessively innovative (i.e. too risky). With Incentive-for-Performance, the administrators’ motivation is reversed. Administrators and politicians would not be evaluated on the success/failure ratio of the grant recipients they select. Instead, they would be evaluated on how little money they turned into how much benefit. The way to do that is to offer incentives to risky inventors for risky but promising technology and perhaps avoid offering incentives for proven performers with a safe (incremental benefit) technology.

The incentive is paid only to cover the difference between the cost to produce and the income from the sale of the product. For example, the sales price for a barrel of oil may only be \$30 at the present time, but the granting agency may allow the technology providers to earn \$50 for bio-oil because of its environmental benefits. In this case, the grant agency would fix the incentive payment at \$20 per barrel for a set number of years.

### Hypothetical incentive examples

The Environmental Protection Agency would post an incentive for nutrient recovery from pig or cattle manure<sup>2</sup>: up to \$200/ton of ammonia-N in the form of a commercial grade fertilizer. The incentive will be paid over ten years not to exceed \$20 million. The EPA might sweeten their incentives by not penalizing new technology customers with fines for excess emissions when an EPA incentive technology fails (or takes a long time to debug).

The Department of Agriculture and the Department of Homeland Security<sup>3</sup> would post an incentive for concentrated fertilizer from wastes (wastewater, manure, foodwaste, etc.): up to \$100/ton of ammonia-N. The incentive will be paid over ten years not to exceed \$20 million.

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<sup>1</sup> Excerpt from “The Conservative Case for Solar Subsidies,” Ben Ho, New York Times, January 5, 2016.

<sup>2</sup> EPA has retained InnoCentive, Inc. 978-482-3300, to run the “Nutrient Recycling Challenge,” ID 9933114.

<sup>3</sup> DHS Prize Competition Manager, Ms. Julie Brewer; 202-254-6454; [julie.brewer@hq.dhs.gov](mailto:julie.brewer@hq.dhs.gov) has retained InnoCentive to run the “National Bio and Agro-Defense Facility Think and Do Challenge,” ID 9933727.

ASCE could contact InnoCentive, EPA, and DHS to discuss applying Incentive-for-Performance on some of entries they received. Ask EPA about the entries: “Complete Resource Recovery: C, N, P, K, & metals” and “Ammonia+ Recovery.” Ask DHS about the entry: “Best Bio-Agro Defense is Resource Recovery.”

The Departments of Energy and Defense would coordinate an incentive for bio-oil from wet biomass (wastewater, seaweed, foodwaste, manure, algae, etc.): up to \$80/barrel. The incentive will be paid over ten years not to exceed \$100 million.

A State Department of transportation might offer an incentive for building with a bridge with new technology. The design/builders would be paid over a decade or so. The Pay-for-Performance component would cover the typical cost of a bridge. The incentive payments might go toward extensive simulated full-scale load testing; long-term integrity sensors (calibrated by the full-scale load tests); and the additional cost of designing and building for the first time. Bridge Pay-for-Performance might be in \$/month. Bridge innovation incentives might be a lump sum after ten years which is calculated as a function of time to construct, how well the load capacity and traffic surfaces hold up over ten years, and the like.

Water Environment Federation (WEF), a water and wastewater professional organization, can aggregate customers for new technologies. WEF members might coordinate an incentive for resource recovery (energy, nutrients, metals, etc.): up to \$50/dry ton of wastewater sludge tipping fee for sludge transformed into a resource and sold. The incentive will be paid over ten years not to exceed \$10 million.

#### How Incentive-for-Performance might work

1. An innovation team finds a few interested customers or a few interested incentive agencies or a few interested investors, one of the three to get three to get started, but eventually all three. Local governments are continuously scouting for solutions to evolving issues. That is why we have organizations like the American Society of Civil Engineers, the American Public Works Association, Water Environment Federation, Water Research Foundation, etc. Each of these organizations has magazines, classes, technical and marketing conferences, etc.
2. The customers verify that the innovation team has an innovation they want that appears to have acceptable price/benefit after it is debugged. (That is, in mass production and having operated at scale with inputs for a few years). The customers also state that the innovation offers a substantial benefit over the state-of-the-art. Customers know the issues with old and new (but proven) technologies from having participated in programs like the Water Environment Research Fund's Leaders Innovation Forum for Technology (LIFT).
3. Customers arrange to procure the new technology as a Pay-for-Performance service in dialog with the incentive agencies, the inventor, and the investors. The procurement approach could involve a request for proposals with these steps:
  - a. The Customers publish an initial request for proposals for a generic solution. (Wastewater treatment plants (WWTP) might want to transform biosolids into new products. Unproven technologies include producing bio-diesel via pyrolysis, producing steam via supercritical water, producing bio-oil and biogas hydrothermal, etc. A state transportation department might want a fast erecting bridge.)
  - b. The innovation teams respond with their preliminary \$ rate for performance (Let's use \$/ton.) and a detailed description of their inputs and outputs. The innovation teams vet

their process by assembling their investors, engineering consultants, and builders. During the RFP process the technology providers would:

- a) Confirm incentive eligibility amounts
  - b) Lock-in robust product sales agreements
  - c) Understand and explain connections and flows from and to the specific customer
  - d) Crunch numbers to make their fee competitive
- c. The detailed inputs and outputs are essential for the customers to compare technologies. Suppose a biosolids transformation technology ‘A’ proposes a tipping fee of \$100/ton, fixed for twenty years, but has output of water with 1,000 mg/L of ammonia. That proposal might be less attractive to some customers than transformation technology ‘B’ proposing \$120/ton, but only 100 mg/L of ammonia returning to the WWTP. The technology providers are kept honest because they need to keep their bid low enough to capture customer interest, but high enough to keep their private investors. Their proposal is likely to be different for each customer.
- d. The customers take the proposals to the incentive agency and say, “I’ll buy technology A *if* the incentive is \$50/ton, or technology B if the incentive is \$40/ton.”
- e. Different customers may suggest different incentives for the same technology. The incentive agency then selects which customers will host which technologies based primarily on which combination gets the technology running with the least amount of incentive placed in escrow. When technologies are sufficiently different the incentive agency might post incentives for several different customer-technology combinations: an East Coast WWTP tries supercritical water and a Mid-West WWTP tries making oil from pyrolysis, a West Coast WWTP tries a hydrothermal process. (Setting the incentives is essentially a low bid process to establish the incentive amount. While ability to perform is self-screened by the inventor and investors.)
- f. Innovation teams who are working with an incentive that processes 20 tons/day WWTP solids may remain eligible for incentives at new scales (2 tons/day or 50 tons/day) or with new features (twice as long between overhauls, 50% more product, availability improved from 70% to 95%, etc.).
- g. The customer, the innovation teams (with their investors), and the incentive agency approve a combination Incentive- and Pay-for-Performance contact. The incentive agency places the incentive in escrow for the appropriate time period.

### Miscellaneous issues and pointers

Incentives may overlap such that one technology may be eligible for the incentive offered by all the agencies and aggregations of customers. The incentive agencies might or might not coordinate with each other.

Incentive providers and customers may want to set aside funds for customers to produce and approve initial environmental documents and as decommissioning insurance. Investors and inventors are easily paralyzed by the uncertainty of time and cost involved with environmental documents. Customers can use the data provided in proposals to publish environmental documents for any of several technologies. Incentive agencies can place incentives in escrow as each customer-technology completes their environmental documents. That is: the first customer to complete environmental documents may be the only customer-technology combination to have an incentive. Decommissioning insurance could supplement bonds posted by the technology providers.

The Incentive-for-Performance motivates customers to try new technology. The first few customers of any particular technology have a chance for substantial outside funding via the incentives.

In the resource recovery example, the customers might take the price break of product sales income without the burden of marketing the products. Most customers' procurement rules require they find the high bidder every few years for the recovered resources. The customers' aversion to entering the product sales business, favors providing some new technologies as a service, not as an equipment sale.

Most financial and technical risk of non-performance with an untried technology is nullified by the Pay- and Incentive-for-Performance procurement. Much of the environmental documentation for a failed technology is likely to be applicable to a second or third technology.

#### Technologies appropriate for Incentive- and Pay-for-Performance

- Plug and play wastewater equipment – paid a tipping fee plus whatever it can generate from resource recovery<sup>4</sup>.
- Plug and play water desalting equipment – paid by the acre-foot and quality.
- A 3D building printer – paid by the square foot over time.
- A temporary movable bridge – leased by the event.
- A fleet of driverless public transit vehicles – paid by the passenger-mile and the parcel-mile.
- Portable inflatable dams – leased by the year.
- Offshore flood capture curtains<sup>5</sup> – paid by the acre-foot and the ton of captured debris.

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<sup>4</sup> See Mark Capron's entry, "Complete Resource Recovery" for a description of plug and play hydrothermal biomass-to-bio-oil and biogas, and Ammonia<sup>+</sup> Recovery.

<sup>5</sup> See page 4 of the Sustainability Committee entry, "Designing Water Law for Future Innovation" for a description of Offshore Flood Capture.