CASE STUDY

Dürr Environmental, Inc. Air Pollution Control Systems

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Background

The Federal Clean Air Act Amendments of 1970 represent the principal source of statutory authority for controlling air pollution in the United States. In addition, a wide array of local, state, national, and international agencies has promulgated their own regulations. Because of these regulations, and general community concerns, every manufacturer has had to explore ways to reduce the pollutants that are released into the atmosphere from their factories.

Volatile Organic Compounds (VOCs) and Nitrogen oxides (NOx) are among the major pollutants released into the atmosphere. VOCs are carbon-containing compounds that evaporate into the air. They contribute molecules to a complex chemical reaction with oxygen and sunlight to form ozone (O3), a major component of smog. Nitrogen Oxides are typically created during combustion processes. They are major contributors to smog formation and acid deposition problems such as acid rain.

A complete air emission control system for VOCs typically accomplishes three major functions: (1) filtering, i.e., removing the particulates from the exhaust air, (2) adsorption, i.e., concentrating the removed particulates within a small volume of air, and (3) oxidizing, i.e., converting the hydrocarbons into Carbon dioxide and water vapor. The oxidizing process can either be done at high temperatures (thermal oxidizers) or at lower temperatures (catalytic oxidizers). In this study, we focus on a new air emission control system with a thermal oxidizer being designed by Dürr Environmental, Inc.

In purchasing an air emission control system, potential customers consider various factors such as maximum volume of exhaust air the system would be able to process, the flow rate, the concentration of pollutants, the efficiency of the system (how much of the heat generated is recycled), and of course, business terms such as the total cost of ownership of the system, and delivery terms.

In early 2007, Dürr Environmental Controls, a German conglomerate with capabilities in this arena and extensive industrial operations in the US, was considering entering the US with one or more offerings. Through other divisions, the firm had access to US distribution channels. Most importantly, through some closely related divisions, it had an extensive network of US-based service representatives who could be called upon to provide a higher level of service to their customers and prospects in this marketplace. Dürr also had reason to believe that its product was less likely to need costly service than those of competitors. In fact, some of its product development engineers and managers had been urging Dürr to consider a warranty of up to two years. However, the company had no current understanding of how much customers would be willing to pay for such a warranty (60 days was industry standard).

In addition, some new technical developments in Germany permitted Dürr to credibly offer a system that exceeded EPA targets by up to 9%. The most popular size and capacity for such systems is 50,000 SCFM (Standard[1] Cubic Feet per Minute), a size targeted to the larger manufacturers, and was a basic design decision across the offerings. Market research indicated that there would be about 300 units of that size sold in the US each year over the next decade.

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[1] At sea level.

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Durr faced the following questions:

Question 1
Does it make economic sense to enter the US market?

Question 2
If so, what would be the best offering to make?

Question 3
Would it be better to provide two different offerings? If so, what should they be?

Question 4
Which segment(s) of the customers should they target, with what selling proposition for their new offering(s)?

Develop a business case to address these issues. Assume the following: The business must generate marginal revenue of $4MM/year to justify entry, and it will cost Dürr an additional $3MM/year to support a second offering.

The Market and Competition

While competitive products differ along a number of attributes, extensive visits with customers and prospects identified four main dimensions that were the key ones that customers used when selecting suppliers.

1. Efficiency: Percentage of heat re-cycled – current EPA target is 90%. Many companies seek to install systems with higher efficiencies than EPA target because EPA targets are likely to be revised upward in the future or because they wish to project an image of environmental leadership.
2. Delivery Time: Months required for building, testing, and delivering equipment (from date of firm order).
3. Price: List price for 50,000 SCFM unit.
4. Delivery Terms: (a) Installed at location or shipped skid-mounted with integrated instrumentation, piping, and controls; (b) Service contract based on annual fee, subject to annual renegotiation. (All existing products provide a 60 day warranty).

There are three major competitors in the US. The three competing products can be described as follows:

Competitor	Efficiency	Delivery Time	Price	Delivery Terms
Waste Watch	Exceed by 5%	9 Months	$600,000	FOB Seller, Service contract
Thermatrix	Exceed by 9%	12 Months	$900,000	FOB Seller, Service contract
Advanced Air	Meets EPA Target	9 Months	$600,000	Installed, Service contract

The company thought each of these three companies was vulnerable; neither Waste Watch nor Thermatrix had developed any extensive service networks; they were purely manufacturing firms. Advanced Air while capable of providing high levels of service, did not have the most advanced technology and was unlikely to be able to provide efficiency beyond EPA targets in the near future. Current market shares for the products were approximately as follows: Waste Watch, 45%, Thermatrix, 5% and Advanced Air, 50%.

Customer Survey and Trade-Off Study

To help guide its decisions, the company decided to conduct a customer survey and a conjoint analysis study to account for the important tradeoffs that different segments of potential customers make in purchasing such systems.

The objective of the conjoint study was to identify attractive target segments and the kinds of features that customers in those segments would prefer to have in the new system. It was to be a main source of information support for the business case that the team was asked to make.

The following tables summarize the various feature levels that Dürr Environmental could potentially offer under each product attribute. The survey was designed to help target the new offering(s) and position them for the appropriate segment(s).

Efficiency	Delivery Time	Price	Delivery Terms
Exceed by 9% (99%)	6 Months	$600k	Installed, 2-Yr Warranty
Exceed by 5% (95%)	9 Months	$700k	Installed, 1-Yr Warranty
Meets EPA Target (90%)	12 Months	$800k	Installed, Service Contract
Short by 5% (85%)	15 Months	$900k	FOB Seller, Service Contract

The conjoint study collected data from 31 companies as to their preferences for various bundles of attributes. The companies were a representative sample of the target industries for the offering, focusing heavily on the food and energy sectors, and their responses could be factored up to volume or profit estimate using appropriate weighting factors, provided by the firm' analytical staff. An example of the data collection process is shown in Exhibit 1 (Data Collection Form). Each firm filled out one such form, using a group decision process involving key purchase influencers for products of this type. The data set named "Dürr Data (Conjoint)" contains summaries of these data

along with the part worth importances calculated from the data provided by the respondents (For illustration, Exhibit 2 shows a portion of the Conjoint part worth data).

A separate data set, "Dürr Data (Segmentation)", includes the part worth data output from the Conjoint measurement task and summarizes those data in a format appropriate for cluster analysis.

That same group of purchase influencers was also given two additional tasks:

1. Allocate 100 points in a way that reflects the relative weight the firm places on the following six strategic goals or objectives driving business decisions and strategy:

   Growth
   Profit
   Market Share
   Technological Leadership
   Corporate Citizenship and Environmental concerns
   Government Regulatory Issues

2. Allocate 100 points across the following four job functions in a way that reflects their relative influence in the decision process for purchase decisions of this type:

   Top Management
   Engineering
   Finance
   Purchasing

Finally, Dürr had the following data available to it via standard industry databases:

Industry (Food, Energy or Other)
Sales$2004
Profit%
Return on Equity
Number of Employees
Sales Growth Rate in Past Year

All these data are included in the "Preference partworths" data block within the Durr data on Enginius platform.

Managerial Options

Following extensive meetings between product development and marketing staff, John Harrington, the product manager, tentatively decided to offer a "Base Model" as a way to begin understanding how the US market operated. His assistant, Helen Fox, however felt that there might be a profitable market for an even more rudimentary product with a 2-Year warranty (which she referred to as Servair DX). She also thought that they might consider a product that competes with Thermatrix, (referred to as Premier LX) using Dürr's service network to provide the value she sensed the market felt was lacking in the current Thermatrix offering. She received considerable pushback on these suggestions, the first in particular, as the cost could run up to $150,000/year to provide such a warranty. This line of reasoning lead to the following three options for consideration:

Model	Efficiency	Delivery Time	Price	Terms
Servair Dx	Meet Specs	15 Months	$900,000	Installed with 2 Yr Warranty
Premier LX	Exceed Specs by 9%	12 Months	$900,000	Installed with Service Agreement
Base Product	Exceed Specs by 5%	12 Months	$700,000	Installed with Service Agreement

Careful activity based costing has led to the following estimates of costs of adding components to the base product:

Option	$ Relative to Base
$600k	-$100k
$700k	Base ($0)
$800k	+$100k
$900k	+$200k

In other words, the marginal production cost of the Base Product is $500,000. Hence, the Unit Revenue of the "Base Product" whose price is $700,000 would be $200,000. And you would add $200,000 to that Unit Revenue for a product sold at $900,000 for example.

Similar reasoning occurs for Efficiency, Delivery Time, and Terms below:

Efficiency

Option	$ Relative to Base
Exceed 9%	-$170k
Exceed 5%	Base ($0)
Meet specs	+$70k
Short 5%	+$90k

Delivery Time

Option	$ Relative to Base
6 months	-$40k
9 months	-$20k
12 months	Base ($0)
15 months	+$10k

Terms

Option	$ Relative to Base
Inst_2Yr	-$300k
Inst_1yr	-$100k
Inst_serv	Base ($0)
FOB	+$100k

Note that for Terms, the Installation cost is about $100,000 and the service contract is generally priced to break even for Dürr.

Some Solution Hints:

Conjoint analysis permits us to look at the likely market share of the various offerings if they are offered to the entire market. The economic analyses that drive the recommendations require a profit margin calculation for each product. The case states that the gross margin for the Base Product is $200k/unit. That is using the data above about the relative costs of the alternative offerings, with a reference point as the Base Product with a Price of $700k, costs of $500k or Profit margin of $200k. Other options are additions or subtractions from the items there.

Hence,

Servair profit margin = $200k + $200k (price) + $10k (delivery) + $70k (Efficiency) - $300k (Terms)

A short term profit estimate (under some assumptions) can be calculated for each product as follows:

Profit = Total market size (number of units/year) x Market share estimate (from conjoint) x gross profit margin

Minus

market development costs (for one product).

For two products, the equation should be modified as

Profit = Segment 1 size (total number of units/year in that segment) x Market share estimate for segment 1 (from conjoint) x gross profit margin for the product targeted to segment 1

Plus

Segment 2 size (total number of units/year in that segment) x Market share estimate for segment 2 (from conjoint) x gross profit margin for the product targeted to segment 2

Minus

market development costs (for two products).

Use the "Durr Data (Conjoint)" data set for all market share calculations and the Conjoint model. (Use the Maximum Utility rule).

For the one product analysis, use all the respondents (and be sure to weight them---see the last column (S) in the Respondent Preference Part Worths matrix (B13-S44).

For the two-product analysis, segment the customer base and select for analysis (target) only those customers for whom a product will be offered. To do so, use the data set called "Durr Data (Segmentation)". In that sheet, the data in B4-R35 in the Segmentation tab are the SAME data as are included in the "Durr Data (Conjoint)" data set. This is the data matrix that you will be using to segment the customers. Use the Segmentation and Targeting Program

under the ME>XL menu (Run Segmentation) and use the Discrimination option to determine who (what types of firms) are in each cluster, who is involved in the decision process in each cluster, and what the firms in those clusters see as their strategic options. These data are found in the Discrimination tab of the "Durr Data (Segmentation)" data set.

Exhibits

Bundles

Attributes / Bundles	Bundle 1	Bundle 2	Bundle 3	Bundle 4	Bundle 5
Efficiency	Exceeds 9%	Exceeds 9%	Exceeds 9%	Exceeds 9%	Exceeds 5%
Delivery time	6 months	9 months	12 months	15 months	6 months
Price	$600,000	$700,000	$800,000	$900,000	$700,000
Delivery terms	Installed, with 2-year warranty	Installed, with service contract	FOB, with service contract	Installed, with 1-year warranty	Installed, with 1-year warranty

Respondents' Ratings

Respondents' ratings for each bundle (use consistent scale, e.g., between 0 and 100)

Attributes / Bundles	Bundle 1	Bundle 2	Bundle 3	Bundle 4	Bundle 5
Respondent 1					
Respondent 2					
Respondent 3					
Respondent 4					
Respondent 5					

Exhibit 1 – Portion of Conjoint Analysis Data Collection/Entry Form (5 of 16 bundles).

Respondents / Attributes and Levels	Exceeds 9%	Exceeds 5%	Meets Specs	Short by 5%	6 months	9 months	12 months	15 months	600000
Chev	20	5	0	0	20	10	5	0	20
TXU	50	40	10	0	10	8	3	0	10
AEP	10	10	10	0	10	6	4	0	35
GenMills	28	20	13	0	40	28	18	0	11
KrispyKreme	15	10	3	0	45	40	5	0	10
Dean	29	19	10	0	39	17	4	0	29
Duke	6	2	2	0	20	10	5	0	50
Molson	50	30	40	0	20	10	5	0	20
EnergyEast	13	4	3	0	24	10	4	0	24
Pepsi	20	10	5	0	50	45	10	0	10
BrownForman	40	35	5	0	40	30	20	0	10
Xerium	40	30	10	0	45	25	20	0	15
PG&E	20	10	5	0	12	10	10	0	43
Mohawk	21	13	6	0	45	26	2	0	14
GAPac	20	7	6	0	11	9	7	0	31
Fab	34	11	10	0	44	36	7	0	9
AveryDenn	27	17	14	0	37	14	5	0	2
SealedAir	35	10	4	0	31	15	8	0	18
Champion	35	28	19	0	25	15	15	0	15
ConGraph	35	29	17	0	45	21	10	0	8
Citgo	15	5	5	0	20	20	15	0	5
HollyCorp	14	10	0	0	55	40	16	0	12
Coffeyville	15	15	6	0	44	13	12	0	10
Monsanto	48	34	6	0	22	21	6	0	15
Scotts	14	8	3	0	42	17	17	0	9
Lubrizol	45	30	17	0	22	20	7	0	12

The numbers in each cell reflect the part-worth for each attribute level for each firm. The data set also includes as the last column (not shown here) weights to use to project the results from this sample to the entire population. The last row (also not shown) provides the average part worth for that attribute across the population.

Exhibit 2: Portion of the Conjoint Part-Worth Data Matrix.