Zero-Energy Automated Windows

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Scientists
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Robert Hart
Christian Kohler
Demo!
How do we save energy?
The zero-energy concept...
We will help people save on their utility bills...

• Help Linda reduce annual utility bills by 23%
...and will have a significant impact in all U.S. climates

Annual household savings

Salt Lake City, Utah
$166

Minneapolis, MN
$277

Washington, DC
$240

Riverside, CA
$150

Charleston, SC
$152
Currently 10% of US energy consumption is from residential heating and cooling...

U.S. Energy Consumption

- Residential Bldgs, 22%
- Space heating/cooling, 48%
- Water heating, 18%
- Appliances, electronics lighting, 35%
- Commercial Bldgs, 18%
- Others, 60%
... and we can have a significant impact on US energy consumption

- 600 coal power plants in U.S.
- Decommission 14%
- Reduce 212 million metric tons of CO2
- 10% U.S. annual CO2 emission
We will make homes more secure...

Every 14.6 seconds $4.6 billion lost
...and we will also help people sleep better...

$18 billion lost per year
...by regulating sleep cycles...
...and allowing for a more natural wake up experience...
...we can help save on sleep aids

$32\text{ billion/year}$  \quad 10\%  \quad $3\text{ billion/year}$
We are a unique product in the market...

Traditional Windows

Motorized

Integrated
We are a unique product in the market...

<table>
<thead>
<tr>
<th>Motorized Shade Solutions</th>
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<tbody>
<tr>
<td><img src="image1" alt="Motorized Shade Solutions Image" /></td>
<td><img src="image2" alt="Motorized Shade Solutions Image" /></td>
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<table>
<thead>
<tr>
<th>Traditional Windows</th>
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<tr>
<td><img src="image3" alt="Traditional Windows Image" /></td>
<td><img src="image4" alt="Traditional Windows Image" /></td>
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</table>

Motorized

Integrated
We are a unique product in the market...

Motorized Shade Solutions

Traditional Windows

Integrated Shades
We are a unique product in the market...
We decided to focus on the residential market...
... particularly on replacements

Residential Windows Market
Over $6 billion
65% are replacements
Early adopters will help us introduce the product in the market...
Early adopters will help us introduce the product in the market...

Homeowners that are:

High-income, Tech Savvy and Energy Conscious
...and we are in the same price range as the alternatives

Price per Window (2x3 ft)

Early adopter
...and we are in the same price range as the alternatives

Price per Window (2x3 ft)

$600-800

$400-600

Installation

Wood Frame Windows

Early adopter
...and we are in the same price ranges as the alternatives

Price per Window (2x3 ft)

- Installation: $900-1200
- Motorized Shades: $600-800
- Wood Frame Windows: $400-600

Early adopter
...and we are in the same price ranges as the alternatives

Price per Window

- Installation: $900-1200
- Motorized Shades: $600-800
- Installation: $400-600
- Wood Frame Windows: $28

Early adopter
...and we are in the same price ranges as the alternatives

Price per Window

- $900-1200
- $600-800
- $400-600

Price per Window (2x3 ft)

- $1000-1400
- $800-1200*

Installation

Zero-Energy Automated Windows

Early adopter

*Reflects uncertainty in markup from window manufacturers
The **mainstream** market is a different story...
The **mainstream** market is a different story...

Homeowners that are
**Middle Income, Aesthetics** and **Price Driven**
...windows are less expensive in the mainstream market...

Price per Window (2x3 ft)

$200-400

Mainstream
...and we currently have a $300 - $500 price gap

**Price per Window**

- **Mainstream:** $200-400
- **Vinyl Windows**
- **Shades**

**Price per Window (2x3 ft)**

- **Zero-Energy Automated Windows:** $300-500*

*Reflects uncertainty in markup from window manufacturers*
From our survey of 200 US households, 35-50% would upgrade at a premium of $150...
...and energy and security are the most valued features
How could we bring this product to market?
How could we bring this product to market?

**Early Adopters**

**Regular Channels**

- Market share
  - 80%
  - 10%

- Price $/window (2x3 ft)
  - 0
  - 250
  - 500
  - 750
  - 1000

**Mainstream**
- Home improvement stores

**High end**
- Local Specialized Stores

**Other**

**Customized windows**
- Wood Windows Warehouse
How could we bring this product to market?

Early Adopters

Regular Channels

Market share

Mainstream
Home improvement stores

Other

High end
Local Specialized Stores

Customized windows

New Channels - Partnerships

Smart home providers

Control4

iControl Networks

Crestron
How could we bring this product to market?

Mainstream

Regular Channels

Market share

80%

10%

Price $/window (2x3 ft)

Mainstream
Home improvement stores

High end
Local Specialized Stores

Customized windows

Other

Wood Windows Warehouse
How could we bring this product to market?

Mainstream

Regular Channels

Market share

80%

10%

0 250 500 750 1000

Price $/window

Mainstream
Home improvement stores

High end
Local Specialized Stores

Customized windows

Wood Windows Warehouse

New Channels - Partnerships

Utilities

Cable & Security Service Providers
Where should the Lab focus their efforts?

- Share findings with window manufacturers

**Early Adopters**

- Product Prioritization

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Where should the Lab focus their efforts?

**Early Adopters**
- Share findings with window manufacturers
- Product Prioritization

**Mainstream**
- Narrow price gap to $150
- “Super” Energy Star
- Multiple products at different prices
  - Regular:
  - Premium:
- $6 billion market
- Save 10-20% of residential energy use
- Protect your homes
- Improve health
Questions?
Backup
Similar pattern across different income groups and climates

% of people who would upgrade at $X

High Income

Mid to Low Income

CA

IL

CA

IL

$80

$150

$190

$240

$300

$80

$150

$190

$240

$300

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Energy Saving is rated the top feature. Health and security come close

% of people who think it's a top feature

- Energy
- Health
- Security
- Automation

Top 25% Income Households

Bottom 75% Income Households
# Survey Samples

<table>
<thead>
<tr>
<th></th>
<th>Premium – CA</th>
<th>Premium – IL</th>
<th>Mainstream – CA</th>
<th>Mainstream – IL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>52</td>
<td>52</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>Household Income Range</td>
<td>Above $100k</td>
<td>Above $95k</td>
<td>Below $100k</td>
<td>Below $95k</td>
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<tr>
<td>Home Ownership</td>
<td>Own Homes</td>
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Survey Question 1

The smart windows provide these major benefits. Which feature is the most important to you? (1 = most important; 4 = least important)

a. Health – Research has found natural light exposure affects your sleep quality and mood. For example, you can connect the shades with your alarm clock so that you can wake up with natural light. The strong sound insulation also helps you sleep quietly.

b. Security & Privacy – You can preset programs to close shades during hours you are away for work. Forgot to close your blinds while you are traveling? Remotely close your blinds with your smartphone.

c. Energy Saving – The smart windows will save you $140/year in energy.

d. Home Automation - Your windows are connected with the rest of your home appliances. For example, one click, your living room enters theater mode: Your movie starts, lights dim, and shades close.
Survey Question 2

Now you need to make a decision: would you choose to...

a. Stick to the double-paned windows that you have ordered. (ie total cost $36,000)

b. Add another $6,500 (ie total cost $42,500) to upgrade to the smart windows
## Survey Question Variables

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</thead>
<tbody>
<tr>
<td><strong>Annual Energy Savings</strong></td>
<td>$140</td>
<td>$250</td>
<td>$140</td>
<td>$250</td>
</tr>
<tr>
<td><strong>Default Traditional Window Price</strong></td>
<td>$36,000</td>
<td>$36,000</td>
<td>$21,000</td>
<td>$21,000</td>
</tr>
<tr>
<td><strong>Range of Premiums to Upgrade</strong></td>
<td>$3,000 - $14,000</td>
<td>$3,000 - $14,000</td>
<td>$3,000 - $14,000</td>
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## Survey Question Variables

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<thead>
<tr>
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<th>Mainstream</th>
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<tbody>
<tr>
<td>Cost of Traditional Windows</td>
<td>$25,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Cost of Shades</td>
<td>$1,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>Cost of Installation</td>
<td>$10,000</td>
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<tr>
<td>Total</td>
<td>$36,000</td>
<td>$21,000</td>
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