Building 6 Star Homes in Southcentral Alaska

“Promoting and advancing the development of healthy, durable, and sustainable shelter for Alaskans and other Circumpolar people.”

Research • Innovation • Education

COLD CLIMATE HOUSING RESEARCH CENTER
CCHRC
OVERVIEW: Building 6 Star Homes in Southcentral Alaska

- What is a 6 Star Home?
- Why build one?
- How are Southcentral builders achieving 6 Star Homes?
- Cost-effective ways of getting to 6 Star
- Tips for Achieving a 6 Star Home in Southcentral Alaska
- Valuing energy efficiency in homes
- Marketing
What is a 6 Star Home?

- Alaska’s version of “High Performance” home
- Highest level of Alaska Energy Rating Score
  - AkWarm 6 Star: 95 points
- 20-35% reduction in energy relative to BEES
Why Build a 6 Star Home?

- People care!
  - “Eco-friendly” features vs. luxury items: 49%
- Customers are paying more
  - 73% of builders thought people will pay more for high performance homes

### Additional Amount Customers Are Willing to Pay for Green (According to Firms Building New Single Family Homes)

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 10%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>5% to 10%</td>
<td>25%</td>
<td>16%</td>
</tr>
<tr>
<td>1% to 4%</td>
<td>44%</td>
<td>40%</td>
</tr>
<tr>
<td>Won’t Pay More</td>
<td>16%</td>
<td>30%</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>11%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Why Build a 6 Star Home?

- The market is growing
  - National research
    - Growth rate has outpaced general construction in recent years\(^1\)
    - Projection: 15%
    - ‘Green’ construction market expected to continue growth\(^2\)

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\(^1\)USGBC economic impact study
\(^2\)U.S. construction outlook report
Why Build a 6 Star Home?

U.S. Single Family Housing Green Residential* Market
(Billions of Dollars)


- Green Market: Upper Estimate
- Green Market: Base Estimate

$6 Billion
2% of Market

$10 Billion
8% of Market

$17 Billion
18% of Market

$37 Billion
23% of Market

$80–$101 Billion
26%–33% of Market


* MHC defines a green home as one that is either built to a recognized green building standard or an energy- and water-efficient home that also addresses indoor air quality and/or resource efficiency.
Why Build a 6 Star Home?

- Be part of the solution. Energy Efficient Homes:
  - If built properly, are more durable and have better indoor air quality
  - Save homeowners money
  - Contribute fewer greenhouse gases

Healthy

Durable

Sustainable
How are Southcentral Builders Achieving 6 Star Homes?

Efficient windows
The median u-factor is 0.23

Heat Recovery Ventilation Systems
96% of 6 Star Homes have an HRV
How are Southcentral Builders Achieving 6 Star Homes?

Very efficient hot water systems
The median energy factor in 6 Star homes in Southcentral is 0.90

Efficient heating systems
The median AFUE of heating systems is 95% in Southcentral 6 Star homes

They don’t use electricity for heating or hot water
95% did not use electricity; the other 5% ALL use heat pumps
Builder survey:

- Most report increase in costs between 1-10%
- More green building experience = Lower expected costs
But it can be worth more

- “High Performance” homes research: 2-9% sales premium over comparable homes in different U.S. markets
  - Data suggests proper marketing is important part of getting premium
- Anchorage research:
  - Sales premium increased by between 1.3% and 1.8% for each rating step between 3 Star and 5 Star.
  - Premium for 6 Star from 5 Star (2 steps) would be between 2.6% and 3.6%
... especially in tight markets

- High-Performance Homes are Resilient
  - “Data generated on ENERGY STAR homes in western Washington suggests that premiums for homes with third party certifications are higher during depreciating or flat markets than in rapidly appreciated markets.”

[Energy Star logo]
[Zero Energy Certification]
Data from builders in Southcentral Alaska

- 5 builders:
  - Spinell Homes
  - Hall Quality Homes
  - Cook Inlet Housing Authority
  - Jon James Construction, LLC
  - Alaska Community Development Corporation

- Modeled Homes in AkWarm

- Builders estimated costs (increase or decrease)
  - Including Overhead and Profit

- Economic analysis
What are the most cost-effective ways of getting to 6 Star in Southcentral?

- Different for every builder
  - Costs vary
  - Homes have different starting equipment

- From 5 Star to 6 Star: Need 6 points
What are the most cost-effective ways of getting to 6 Star in Southcentral?

- Energy Efficiency Measures: Lowest cost per rating point improvement by builder

<table>
<thead>
<tr>
<th>Home</th>
<th>Size (square feet)</th>
<th>Description</th>
<th>Improvement Cost</th>
<th>Rating Point Increase</th>
<th>Cost Per Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Builder A</td>
<td>1,831 + 280 garage</td>
<td>Upgrade to Triple Pane Windows</td>
<td>$1,384</td>
<td>0.8</td>
<td>$1,730</td>
</tr>
<tr>
<td>Builder B</td>
<td>1,152 + 410 garage</td>
<td>Add 2&quot; blue board to garage floor perimeter</td>
<td>$435</td>
<td>1.2</td>
<td>$363</td>
</tr>
<tr>
<td>Builder C</td>
<td>1,404 + 409 garage</td>
<td>Upgrade ventilation to HRV and foam rim joist</td>
<td>$1,950</td>
<td>1.4</td>
<td>$1,393</td>
</tr>
<tr>
<td>Builder D</td>
<td>875</td>
<td>Increase blown attic insulation from R50 to R77</td>
<td>$579</td>
<td>0.7</td>
<td>$828</td>
</tr>
<tr>
<td>Builder E</td>
<td>1,606 + 560 garage</td>
<td>Upgrade ventilation to HRV</td>
<td>$2,176</td>
<td>1.2</td>
<td>$1,814</td>
</tr>
</tbody>
</table>
What are the most cost-effective ways of getting to 6 Star in Southcentral?

- **Cost** per square foot to reach 6 Star
  - Builder profit margin built-in to all these prices
  - Large range: $3.65 to $11.34 per square foot
  - Percent of total building price: 3.1% to 7.1%
  - Percent of total sales price: 1.8% to 5.4%

- **Potential Benefit**:
  - 2.6% - 3.6% sales premium in AK
  - Alaska average new home price:
    - $379,588 (DOL)
  - Premium: $9,900 - $13,700
  - 2-9% sales premium for high performance homes in other areas
    - 9%: $34,200
Reaching 6 Star Example:

- Start: 92 points
- Upgrades:
  - Ventilation upgrade to HRV
  - Spray foam rim joist for air-tightness
  - Upgrade windows to triple pane
  - Add 4” EPS to floor perimeter (horizontal wing or vertical against crawl walls)
- Cost:
  - $3.65 per square foot (including garage)
  - 2.2% of sales price
6 Star Economics in Southcentral Alaska - Examples

- Reaching 6 Star Example:
  - Start: 93 points
  - Upgrades:
    - Walls -> 2x8, 24” o.c., R25 FG batts, 1.5” interior foam board sheathing
    - Upgrade to triple pane windows
  - Cost:
    - $5.21 per square foot (including garage)
    - 3.2% of sales price
6 Star Economics in Southcentral Alaska - Examples

- Reaching 6 Star Example:
  - Start: 89 points (bigger change)
  - Upgrades:
    - Add 4” exterior sheathing to walls
    - Add 2” XPS to garage slab perimeter down to 4’
    - Upgrade garage door
    - Upgrade windows
    - Install on-demand DHW
    - Blow more fiberglass in attic for R70
  - Cost:
    - $11.34 per square foot (including garage)
6 Star Economics in Southcentral Alaska – Example from a 6 Star home

- Reaching 6 Star Example:
  - Start: 91.4
  - End: 96.0
  - Upgrades:
    - Double to triple pane windows
    - Slab-on-grade: Additional 2” of rigid foam subslab, vertical on perimeter, and horizontal wing
  - Cost:
    - $6.28 per square foot
    - 1.8% of sales price
6 Star Economics in Southcentral Alaska – ACDC Example

- Reaching 6 Star:
  - Self-help home program
  - Building Costs
  - <1% of total cost (building, land, closing fees, etc.)

<table>
<thead>
<tr>
<th>Building</th>
<th>Year Built</th>
<th>Building Cost per sqft</th>
<th>Rating Points</th>
<th>Rating Stars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuller Lakes</td>
<td>2016</td>
<td>$71.01</td>
<td>95.8</td>
<td>Six Star</td>
</tr>
<tr>
<td>Sourdough</td>
<td>2014</td>
<td>$70.49</td>
<td>91.5</td>
<td>Five Star</td>
</tr>
<tr>
<td>Difference</td>
<td>2</td>
<td>$0.52</td>
<td>4.3</td>
<td></td>
</tr>
</tbody>
</table>

Ah Dimmick is happy to own one of the most energy-efficient homes in the state.
6 Star Economics in Southcentral Alaska – ACDC Example

- How?
  - Shallow, frost-protected foundation

<table>
<thead>
<tr>
<th>Building</th>
<th>Foundation Type</th>
<th>Foundation / Floor Costs (per building square foot)</th>
<th>Average R-value of Floor components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuller Lakes</td>
<td>Shallow frost protected slab-on-grade</td>
<td>$17.65</td>
<td>41.6</td>
</tr>
<tr>
<td>Sourdough</td>
<td>Insulated crawl space</td>
<td>$17.80</td>
<td>33.6</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>$(0.15)</td>
<td>8.0</td>
</tr>
</tbody>
</table>
6 Star Economics in Southcentral Alaska – ACDC Example

How?

- HRV
- Additional 6” of blown cellulose in attic
- Double walls w/ Fiberglass batts
Tips to Reaching 6 Star in Southcentral

- **Do Zero Cost Upgrades First!**
  - Several builders reported zero cost for upgrades that made homes more efficient, including:
    - Blow in cellulose in the attic instead of fiberglass
    - Provide more oversight on air sealing details
    - Switch wall framing from 16” on-center to 24” on-center.
### Practice 1

<table>
<thead>
<tr>
<th>Example</th>
<th>Bedrooms</th>
<th>Floor Area</th>
<th>Garage Area</th>
<th>Rating Points</th>
<th>Assessed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchorage - Example 1</td>
<td>3</td>
<td>2,253</td>
<td>663</td>
<td>90.8</td>
<td>$525,200</td>
</tr>
<tr>
<td>UPGRADES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.6 to 3.6% = $13,660 to $18,910</td>
</tr>
</tbody>
</table>
# Practice 1 - Discussion

<table>
<thead>
<tr>
<th>Example</th>
<th>ACH50</th>
<th>Window</th>
<th>DHW</th>
<th>Floor</th>
<th>Doors</th>
<th>Ceiling</th>
<th>Vent.</th>
<th>Assessed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANC – Example 1</td>
<td>3.2</td>
<td>Double pane, U-0.29</td>
<td>Gas tank, EF-0.58</td>
<td>Basement, 2&quot; EPS sub-slab, perimeter around house &amp; garage</td>
<td>Entry R-3.2, garage R-5.3</td>
<td>14.5” blown fiberglass</td>
<td>Cont. exhaust</td>
<td>$525,200</td>
</tr>
<tr>
<td>UPGRADE</td>
<td>Tighten to 2.0 ACH50</td>
<td>Triple Pane, U-0.19</td>
<td>On-demand EF-0.93</td>
<td>4&quot; EPS sub-slab, vertical perimeter AND horizontal wing</td>
<td>Garage w/2&quot; thermal break, 1/2 lite to 1/4 lite</td>
<td>20” blown cellulose</td>
<td>HRV</td>
<td>PRICE PREMIUM: 2.6 to 3.6% = $13,660 to $18,910</td>
</tr>
<tr>
<td>POINT +</td>
<td>0.2</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
<td>0.3</td>
<td>0.4</td>
<td>0.9</td>
<td>TOTAL: 4.2</td>
</tr>
<tr>
<td>UPGRADE PRICE RANGES</td>
<td>$0 - $700</td>
<td>$3,230 - $6,830</td>
<td>$1,500</td>
<td>$3,100</td>
<td>$200</td>
<td>$590</td>
<td>$1,950 - $3,500</td>
<td>COST: 2.0 - 3.1% $10,570 - $16,420</td>
</tr>
</tbody>
</table>
Tips to Reaching 6 Star in Southcentral

- Combine HRVs and air-tightness
  - Synergistic effects
  - +0.4 vs. +1.6
Tips to Reaching 6 Star in Southcentral

- **Domestic Hot Water**
  - ↑ Efficiency, ↑ proportion DHW
  - DHW efficiency limits

![Bar chart showing space heating and domestic hot water reductions for 100-point rating.](chart.png)
Tips to Reaching 6 Star in Southcentral

- **Build a shallow frost protected slab-on-grade foundation**
  - Less expensive*
  - Better insulation value
  - Faster to build

“There’s nothing wrong with a well-built crawlspace, but for me, there’s no question that insulated slab on-grade is less expensive and a better product”

–Jon James Construction

*Depending on soil and site conditions
Tips to Reaching 6 Star in Southcentral

TREATED TIMBER SILL
PLATE W/ 
½" Ø GALV. ANCHOR
BOLTS W/ 2" x 2" x 3/8"
P. PLATE WASHER @ 4’-0"
O.C. X EMBED 7”

STUD WALL
(2)#5’s x CONT
NOTE: AT EXPANSION JT PROVIDE 24”
LAP WRAPPED WITH DUCT TAPE

#4 HOOK @ 2’-8” O.C.

FLASHING

SLOPE
4” IN 8 FT

2” RIGID FOAM, TYP

2’-0”

LIMITS OF EXCAVATION

COMPACTED NFS GRAVEL

2’-8”

SECTION
1/2” = 1'-0”

F.004
Marketing your 6 Star Home

- Benefits are mostly invisible to customers – communicate
- Focus message on what your customers want, rather than on features
  - “Healthy place to live”
  - “Lower operating costs”
  - “Contributes to a more sustainable lifestyle”
  - “Warm and comfortable”
- Communicate to Real Estate Agent too
Getting Price Premiums for your 6 Star Home

- **Green Addendum**
  - Ask for an appraiser with competency appraising high-performance homes
    - Ask for justification for valuation of zero
    - Challenge appraisal
  - Point to research on the value of EE
6 Star Homes – Opportunity for the Future

- Lots of potential for market growth
- Huge opportunity to create competitive advantage
  - **Builders**: Can you build it inexpensively
  - **Builders / Real Estate Agents**: Can you communicate benefits to consumers?
  - **Appraisers**: Do you have competency in appraising high performing homes?
- Need to fix appraisal issue
## Practice 2

<table>
<thead>
<tr>
<th>Example</th>
<th>Bedrooms</th>
<th>Floor Area</th>
<th>Garage Area</th>
<th>Rating Points</th>
<th>Assessed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenai – Example 2</td>
<td>3</td>
<td>1,890</td>
<td>910</td>
<td>90.7</td>
<td>$316,200</td>
</tr>
<tr>
<td>UPGRADES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PRICE PREMIUM: 2.6 to 3.6% = $8,220 to $11,380 9% = $28,460</td>
</tr>
</tbody>
</table>

**GOAL:** 95 POINTS
# Practice 2 - Discussion

<table>
<thead>
<tr>
<th>Example</th>
<th>ACH50</th>
<th>Window</th>
<th>Walls</th>
<th>Floor</th>
<th>Doors</th>
<th>Ceiling</th>
<th>Points</th>
<th>Assessed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenai – Example 2</td>
<td>2.2 ACH50</td>
<td>Double pane, U-0.29</td>
<td>2x6, 16&quot; o.c., R21 FG batts</td>
<td>Frost-Protected Shallow: 2” EPS subslab, vertical on perimeter</td>
<td>Steel u-0.25, garage R-5.3</td>
<td>17” blown fiberglass</td>
<td>90.7</td>
<td>$316,200</td>
</tr>
<tr>
<td><strong>UPGRADE</strong></td>
<td>Tighten to 1.5 ACH50</td>
<td>Triple Pane, U-0.19</td>
<td>2x6, 24&quot; o.c., add ½” interior polyiso</td>
<td>4” EPS subslab, vertical on perimeter, + horizontal wing</td>
<td>Garage w/2” poly core, u-0.16 man-door</td>
<td>17” blown cellulose</td>
<td>95.0</td>
<td><strong>PRICE PREMIUM:</strong> 2.6 to 3.6% = $8,220 to $11,380</td>
</tr>
<tr>
<td><strong>POINT +</strong></td>
<td>0.5</td>
<td>0.6</td>
<td>0.8</td>
<td>1.6</td>
<td>0.4</td>
<td>0.4</td>
<td><strong>TOTAL:</strong> 4.3</td>
<td></td>
</tr>
<tr>
<td><strong>UPGRADE PRICE RANGES</strong></td>
<td>$0 - $700</td>
<td>$2,020 - $4,270</td>
<td>$3,325</td>
<td>$4,500</td>
<td>$300</td>
<td>$0</td>
<td><strong>COST:</strong> 3.2 - 4.1% $10,150 - $13,100</td>
<td></td>
</tr>
</tbody>
</table>
• Thanks!

• Contact info:
  – Dustin Madden
  – dustin@cchrc.org
  – (907)-304-2142
Tips to Reaching 6 Star in Southcentral

- Shallow frost protected slab-on-grade foundation: Considerations
  - Insulation is non-negotiable to prevent frost-jacking
  - Use radiant in-floor heating for maximum comfort
  - Lose potential space for ducting, mechanical systems
  - Be prepared to work with code officials
    - May require engineering work
  - Consider stained concrete for an inexpensive floor finish
Tips to Reaching 6 Star in Southcentral

- **Electric Heating / Hot Water:**
  - Electric heating appliances $\rightarrow$ high efficiency ratings
  - Site-Source Ratio

### Natural Gas

<table>
<thead>
<tr>
<th>Source Energy</th>
<th>Extraction, Processing &amp; Transportation</th>
<th>Generation</th>
<th>Distribution</th>
<th>Delivered to Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MMBtu</td>
<td>7% Energy Loss</td>
<td></td>
<td>1% Energy Loss</td>
<td>92 MMBtu</td>
</tr>
<tr>
<td></td>
<td>93 MMBtu</td>
<td>91 MMBtu</td>
<td></td>
<td>92 MMBtu</td>
</tr>
</tbody>
</table>

*No energy conversion necessary, therefore no energy is lost.*

### Electricity

<table>
<thead>
<tr>
<th>Source Energy</th>
<th>Extraction, Processing &amp; Transportation</th>
<th>Generation</th>
<th>Distribution</th>
<th>Delivered to Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MMBtu</td>
<td>5% Energy Loss</td>
<td>64% Energy Loss</td>
<td>6% Energy Loss</td>
<td>32 MMBtu</td>
</tr>
<tr>
<td></td>
<td>95 MMBtu</td>
<td>34 MMBtu</td>
<td>32 MMBtu</td>
<td>32 MMBtu</td>
</tr>
</tbody>
</table>