CHANGES IN MARKET DEMAND & REGULATIONS

Section One

Top Triggers (U.S)

• Client demands (44%)
• Healthier buildings (32%)
• "Right thing to do" (28%)
• Environmental regulations (28%)
• Lower operating costs (24%)

Top Challenges (U.S)

• Upfront cost: 73%
  – 2012: 70%
• Misperception that green is for high-end only: 37%
• Split incentive – operational vs capital: 30%

CHANGES IN MARKET DEMAND & REGULATIONS

Section One

Dodge Report: 2018 World Green Building Trends

• Green bldg growing – not always certified
• Business case strengthening
• Demand: client driven > regulations
• Healthy buildings
• Social reasons growing
• Upfront cost remains obstacle

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Source: Dodge Data & Analytics: Smart Market Report "World Green Building Trends"

1. Client demands (44%)
2. Healthier buildings (32%)
3. "Right thing to do" (28%)
4. Environmental regulations (28%)
5. Lower operating costs (24%)

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Source: Dodge Data & Analytics: Smart Market Report "World Green Building Trends"

1. Upfront cost: 73%
2. Misperception that green is for high-end only: 37%
3. Split incentive – operational vs capital: 30%
**Top Social & Environmental Drivers (U.S)**

- **Social**
  - Improve occupant health & well being – 78%
  - Encourage sustainable building practices – 59%

- **Environmental**
  - Reduce energy use
  - Protect natural resources
  - Lower greenhouse gas emissions (GHGs)

---

**Expected OpEx Savings**

<table>
<thead>
<tr>
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<th>New</th>
<th>Retrofit</th>
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<tbody>
<tr>
<td>↓ Y1 OpEx</td>
<td>8%</td>
<td>11%</td>
</tr>
<tr>
<td>↓ Y1-Y5 OpEx</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Payback Period</td>
<td>8 years</td>
<td>7 years</td>
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**Expected Value Impact**

<table>
<thead>
<tr>
<th></th>
<th>New</th>
<th>Retrofit</th>
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<tbody>
<tr>
<td>&gt; 5%</td>
<td>54%</td>
<td>41%</td>
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<tr>
<td>&gt; 10%</td>
<td>30%</td>
<td>14%</td>
</tr>
<tr>
<td>Payback Period</td>
<td>7 years</td>
<td>6 years</td>
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</tbody>
</table>

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**New Solar Mandate in CA**

- Rooftop solar **REQUIRED** on all new homes & MF (3 stories or less) starting Jan. 1, 2020
- Driven by state goal of all new residential being NZE by 2020

---

**NZE Cost & Projected Growth**

- De Young Properties estimates +$10K for ZNE homes (Fresno)
  - Approx 2.5 to 3% of sales price
- NZE Coalition projects new CA mandate to U.S. total of NZE SFH
  - 5,000 to 100,000 in 2020
  - Works to "scale" solar cost
Green as the New Normal

- Building codes “bake in” green features and energy efficiency
- General plans & zoning changing
- Resilience planning
- Effect on appraisal process
- Obsolescence
- HBU

Top 14 States Solar PV Installations

<table>
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<tr>
<th>State</th>
<th>2017</th>
<th>2018</th>
<th>Q1 2019</th>
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<tr>
<td>Florida</td>
<td>5</td>
<td>6</td>
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<td>California</td>
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<td>12</td>
<td>5</td>
</tr>
<tr>
<td>New York</td>
<td>12</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>New Jersey</td>
<td>11</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Arizona</td>
<td>7</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Minnesota</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Virginia</td>
<td>10</td>
<td>9</td>
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<tr>
<td>Colorado</td>
<td>20</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Hawaii</td>
<td>17</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Tieds</td>
<td>4</td>
<td>2</td>
<td>14</td>
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</tbody>
</table>

Source: U.S. Solar Market Insight Executive Summary 1st Quarter 2019

Buildings with solar photovoltaic systems are complex

- Polycrystalline Panel
- An Array is a grouping of panels
- How many directions do these arrays face? How many analysis to estimate the energy?
Comparison of 1 Analysis versus 3 Analysis

<table>
<thead>
<tr>
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<th>1 Analysis</th>
<th>3 Analysis</th>
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</thead>
<tbody>
<tr>
<td>PV Value® Inputs</td>
<td>5 kW System</td>
<td>3 kW, 1 kW, 1 kW</td>
</tr>
<tr>
<td>Age 7 years</td>
<td>8 cents/kWh</td>
<td>14 cents/kWh</td>
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</tbody>
</table>

Energy Production 5,997 kWh annually

KWh costs at location 8 cents/kWh

Value of solar PV $6,000

$3,400 difference could make a difference between PMI and no PMI

Could cause renegotiation of sale price.

Solar PV Ownership Matters

- Leased – Personal Property - Usually has a UCC-1 Filing
- Power Purchase Agreement (PPA) – Personal Property – Usually has a UCC-1 Filing
- Solar Loan with UCC Filing – Holds system as collateral and has UCC-1 Filing making it personal property

Solar Cost

- Current (residential) renewable energy tax credit – 30% through 2019 then steps down to zero by 2022
- CA Energy Commission estimates solar requirements +$9.5K upfront and save $80/month in energy costs – + $47/month mortgage (@ 4.25%) vs $80/month utility savings

Net Metering

Net metering allows residential and commercial customers who generate their own electricity from solar power to sell the electricity they aren’t using back into the grid. Many states have passed net metering laws. In other states, utilities may offer net metering programs voluntarily or as a result of regulatory decisions. Differences between state legislation, regulatory decisions and implementation policies mean that the mechanism for compensating solar customers varies widely across the country

https://www.seia.org/initiatives/net-metering

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Solar Panels Produced 800 kWh this month

House used 600 kWh this month

Utility company puts 200 kWh this month in a credit bank.

On Average – 20% to 40% of Solar Energy Produced goes to the grid.

Net Metering & Incentives Illustrated

Performance Based Incentive Payment

<table>
<thead>
<tr>
<th>Bill Credit</th>
<th>Total PB Payment</th>
<th>S10</th>
<th>$334.94</th>
</tr>
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<tbody>
<tr>
<td>Distribution Energy Charge</td>
<td>0.045 x 483 kWh</td>
<td>20.77</td>
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<tr>
<td>Energy Efficiency Programs</td>
<td>0.01002 x 483 kWh</td>
<td>4.99</td>
<td></td>
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<tr>
<td>Renewable Energy Tax</td>
<td>0.00965 x 483 kWh</td>
<td>4.75</td>
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<tr>
<td>Transmission Charge</td>
<td>0.00719 x 483 kWh</td>
<td>19.36</td>
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<tr>
<td>Transition Charge</td>
<td>0.0057 x 483 kWh</td>
<td>0.27</td>
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<tr>
<td>Energy Charge</td>
<td>0.00515 x 483 kWh</td>
<td>40.95</td>
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<tr>
<td>Total Bill Credit</td>
<td>$95.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other Charges/Adjustments

Paperless Billing Credit | $0.94 |
Gross Earnings Tax | 0.307 x 483 kWh | 99.56 |
| Total Other Charges/Adjustments | $3.40 |

Solar Energy Storing Batteries

- Cost $400 to $750 per kWh
- Battery sizes are typically based on kWh of storage. Most homeowners choose a 2-3 days storage size.
- Unless the battery comes with a specialized inverter, you will need an inverter that will work with the battery and the grid.

Solar PV Installed Cost Has Declined

- Annual Solar PV Installations and Installed Average PV Prices

- Solar PV Installed Cost

- Solar PV Installed Cost Trends

- Solar PV Installed Cost Has Declined
Solar Batteries are important in areas like Puerto Rico where the utility grid is not stable. Photographs are by Marlin Barreto of Puerto Rico.

Net Zero Energy

Reduced Energy Use  Generate Energy On-Site

Zero Energy Ready Homes (ZERH)
- Created by DOE
- Builds on ENERGY STAR for Homes v3
- 40-50% more energy-efficient than conventionally built home (HERS = low-mid 50s)
- 3rd-party certified

Zero Energy Commercial Buildings
2019 Zero Energy Buildings Count Near 600

Habitat for Humanity - Dream Creek Subdivision in Stockton
- 3 bedroom/2 bath SFR
- 1-story, 1,200 SF
- $270,000 +/-
Advanced Framing Techniques

Walls = 2x6 studs 24" oc instead of 2x4 studs 16" oc

Engineered wood headers eliminate double header

Rigid foam insulation b/w studs & exterior plywood

60% less lumber: 13% framing factor vs. 25-35%

Window placement eliminates jack studs

Envelope

Foundation: controlled vent crawl space (0.5 ACH50) vs. slab

Walls: R-26 vs. R-11

Pre-drilled electric run at mudsill vs. 2' off floor

• more efficient insulation
• easier to install

Roof: R-42 (cellulose, radiant barrier, vented attic)

Glazing

• WWR: 6.4% vs. 13% conventional
• 0.27U/0.24 SHGC vs. 0.5U/0.25 SHGC conventional

Envelope integrity: 1.53 ACH50 vs. 4.75 ACH50 conventional

HVAC – System

H4H Green Building
• Ducted mini-split heat pump
• ¾ ton cooling
  – 75%
• 12,000 Btu heating
  – 80%
• Located in conditioned space

Conventional Building
• Gas-fired furnace + A/C
• 3 ton cooling
• 60,000 Btu
• Furnace in attic

HVAC, cont.

H4H Green Building
• 2 Energy Recovery Ventilators (ERVs)

Conventional Building
• None
• Ducts in attic insulated with foam (R-8)
• Reduced duct run = 50'

Lighting/Plug Load

• 100% LED
• ENERGY STAR appliances
• EV circuit in garage
• Home Energy Management (HEM) system with lighting indicators

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Performance Impact

- Energy use/SF ↓ 60+%  
- Required solar PV ↓ 2/3  
- Net cost ↓ $2,863

Silicon Valley NZE Renovation

- 35,000 SF  
- 1970s CTU construction  
- $250/SF renovation to NZE (net of $27/SF grant)  
- Includes construction of new 2nd floor/mezzanine

Envelope – Roof

Batt below + foam cover = R-40

“We made no compromises at all to our lifestyles to try to save energy. The house did it for us.”
Steve and Gina  
(owners of previously built ZNE home)
**Envelope - Walls**

- 5 ¾" foam to exterior (R-20)
- Exposed 6" concrete interior

**Envelope - Glazing**

Electrochromic glazing on S, W & E

**HVAC – Mixed-Mode System**

- Natural ventilation
- + High-Efficiency Heat Pump
- Operable windows controlled by BMS
- Night flush uses prevailing winds, marine influence
- Ceiling fans

Reduced HVAC tonnage by 80%

**Lighting**

- Skylights for core areas
- 100% LED, Direct Digital (DD) controls
- Automated Daylighting (occupancy, daylight sensors)
- High reflectivity surfaces

**Plug Load**

- Green Lease
- ENERGY STAR equipment required
- Night time, Occupancy, Plug Load Controls

**Plug Load - EV Charging Capacity**

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Distributed Generation

Rooftop solar PV:
• 172 kW DC

Design load:
• 80% of demand
• 100% of cost

Performance Impact

• Design EUI < 29 kBtu/SF vs. 60-70 kBtu/SF
• Cost apx $50/SF (20%) premium to conventional, including PV
• Pre-leased before demo started
  – Saved >$57/SF based on projected 12-18 month absorption
• Net effect = apx $46/SF before considering any rent premium

Performance Metrics

• Energy use
• Water use
• Materials use
• Site use
• Occupant experience (air quality, lighting, etc)
• Resilience

Healthy Buildings

So if we are spending 90% of our time indoors...
And 70% in our homes...

What is the effect of our homes and buildings on our health, well-being and productivity?
Healthy Buildings

Study: "Direct human health risks of increased atmospheric CO2"

- Atmospheric CO2 levels
  - 250 ppm historically => projected to be 936 ppm by 2100
  - Urban CO2 domes reported at 500-600 ppm
  - ASHRAE ventilation stds meant to keep indoor air <700 ppm above outdoor air

- Relevant threshold for health risks = 1,000 ppm
  - Avg home/office levels = 600-1,000 ppm but can exceed 2,000 ppm
  - Schools = >1,000 ppm
  - Personal CO2 bubbles = 1,200 ppm (vs 650 ppm)

CO2-related health risk

- Systemic inflammation
- Bone demineralization & kidney calcification
- Behavioral changes & psychological stress
- Adipogenesis

How is building design addressing this issue?

Study: "Spending at least 120 minutes a week in nature is associated with good health and wellbeing"

- Previous studies showed positive impact of exposure to nature on human health/well being
  - dating back to 1850s – Central Park
  - Robust studies since 1980s

- But how much is enough?
  - Study threshold = 120 min/wk

Appraisal Implications

- Access to green space in new developments
  - Condo project example
- Re-development
  - WSJ article "What Do You Do When the Golf Course Shuts Down?"
    - Blythewood, SC
    - 25% drop in home values
    - Adjacent homeowner: "We were buying so much more than a home. We were buying peace and quiet and serenity."
    - Rights of property owners
Resilience

- More push/pull assoc with human interaction with natural environment
- Resilience is the ability “to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.”

Threat of fire

- CA now considered a “catastrophic state” by insurance underwriters
- Merced Prop & Casualty out of business – started in 1906
- Lloyds stopped writing new homeowners policies 6-30-19

Fire Insurance Rates Skyrocket

Example: 6,000 SF house insurance history:
- 5 yrs ago: $1,300
- 4 yrs ago: $2,400
- 3 yrs ago: $3,300
- 4 yrs ago: $7,800
- Last yr: CANCELLED

Appraisal Implications

- Greg Sharp, broker, Coldwell Banker: “Even though demand is strong, fire insurance rates in the rural areas (and we are starting to see rates go up in town as well) are affecting affordability and ability to qualify for payments. This is keeping a lid on appreciation in the lower end.”
- Transactions cancelled
- Effect on new development

Not just a fire problem and not just California...

- Nashville, TN: Homes being bought back by the city in flood-prone areas using fed, state and local funds
- Success in Beatrice, NB: Flood waters filled a park that included 40 acres of cleared lots and no homes or businesses in town were damaged – program started in '73

http://fema.maps.arcgis.com/apps/MapSeries/index.html?appid=b37a1bf5c4914d64b5a4d25a18c2331

Not just a fire problem and not just California...

“Rebuilding out of harm’s way can help avoid future devastation in a way that flood insurance cannot.”
(David Maurstad, director of Nat’l Flood Ins Program)

Back to appraisal issues of obsolescence and HBU
USPAP Competency Guidelines

- Be competent to perform the assignment;
- Acquire the necessary competency to perform the assignment; or
- Decline or withdraw from the assignment.

Lender Competency Guidelines

<table>
<thead>
<tr>
<th></th>
<th>USPAP</th>
<th>Fannie Mae</th>
<th>Freddie Mac</th>
<th>FHA</th>
<th>VA</th>
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<tbody>
<tr>
<td>Before Accepting</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Before Completing</td>
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<td></td>
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</table>

AI Green Addendum

The ultimate Cheat Sheet!

What’s on the Green Addendum?

- Energy label – HERS, DOE Energy Score, LEED, etc
- Green features: envelope, water effc’y, Walk Score, etc
- Solar PV
- Energy storage
- HVAC

RESNET Portal

- Available to AI members
- The RESNET Appraiser Portal
  Secured Portal URL: https://portal.resnet.us/
Quantifying Market Demand
Brand new article by Sandy Adomatis:
Appraisal Journal, Winter 2019
http://adomatisappraisalservice.com/Market_Reaction.pdf

AI Green Courses
• Intro to Green Buildings
• Residential & Commercial Valuation of Solar
• Case Studies in Appraising Residential Green Buildings
• Practical Applications in Appraising Green Commercial Properties
• Valuation Resources for Photovoltaic Systems

Textbooks
Residential Green Valuation Tools
(Adomatis, 2014)
The Valuation of Green Commercial Real Estate
(Runde & Thoyre, 2017)

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