



**ZERO ENERGY HOUSING:  
SECURITY & THE GLOBAL VALUE CHAIN**


APP ZEH Flagship Project  
Nov. 4, 2010




Prepared by:



0



**Zero Energy Buildings  
& Security**



THE SHIFTING ENERGY AND SECURITY LANDSCAPE

Energy is the foundation of industrialized society.

Our institutions, businesses, and the provision of basic human needs depends on a reliable supply of affordable energy.

2

THE SHIFTING ENERGY AND SECURITY LANDSCAPE

*“Predictable supply of energy is one of the top policy priorities for business and governments in the major global economies.”*

*- Business and Industry Advisory Council to the OECD, 2006*

*“Historically, energy security has been understood as defence against supply disruption and price instability... Yet the sharp rise in demand from newly industrialising economies, carbon-dioxide induced global warming and the growth of alternative energy technologies, mean that protecting traditional energy practices will make us far less secure, and less competitive, in the future.”*

*- Lloyd's 360° Risk Insight: Sustainable Energy Security, 2010*

3

## THE SHIFTING ENERGY AND SECURITY LANDSCAPE

Energy is the foundation of industrialized society.

Our institutions, businesses, and the provision of basic human needs depends on a reliable supply of affordable energy...

**...that does not unduly affect our economic, environmental and social security.**

4

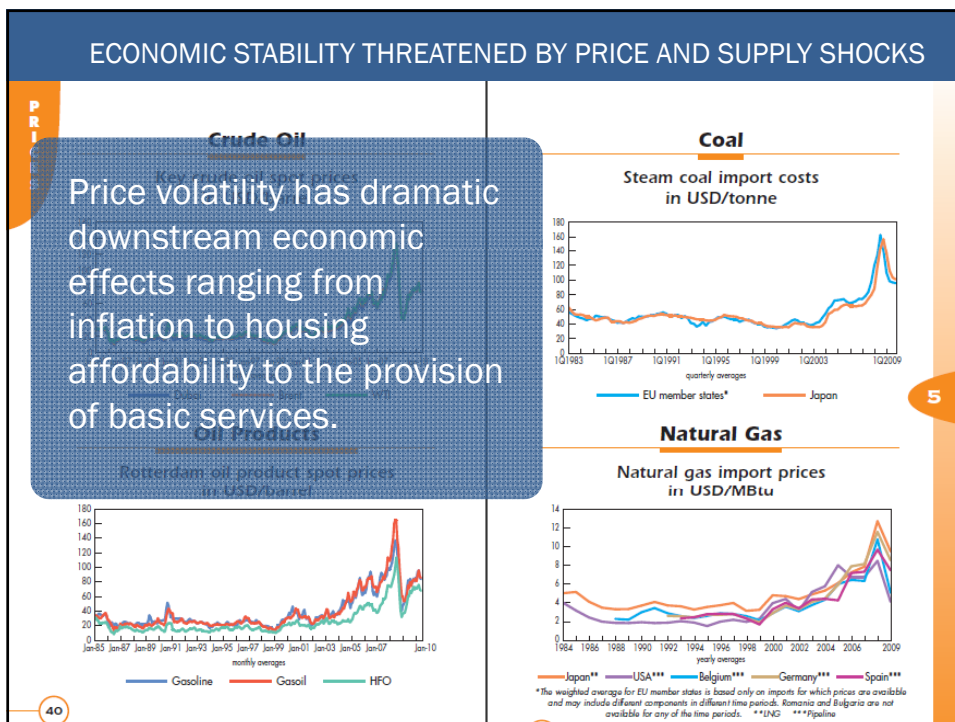
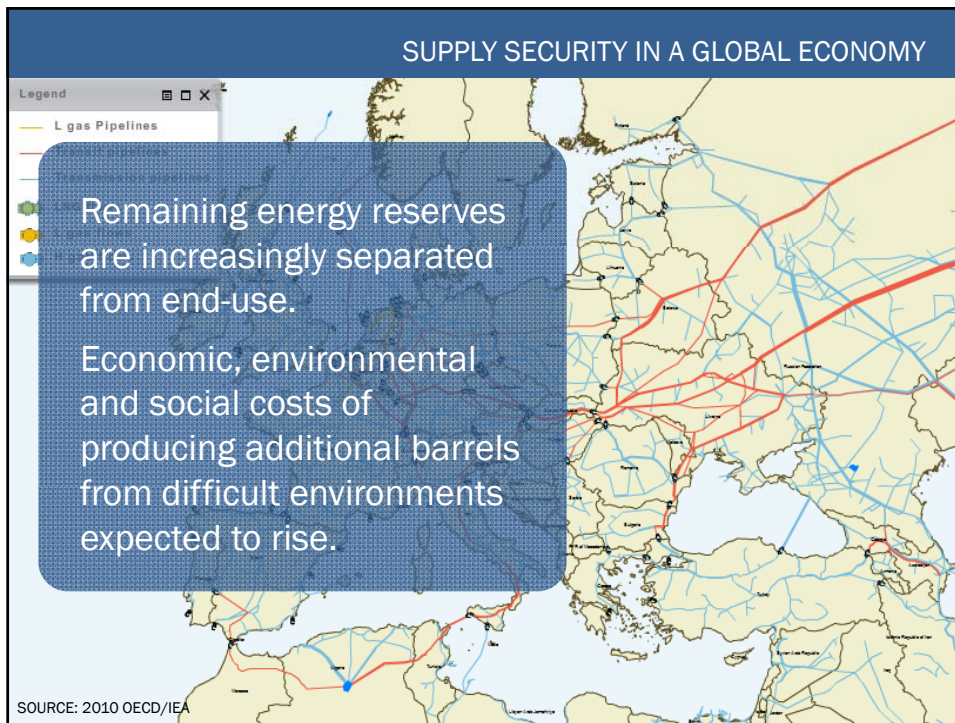
## BUILDING-RELATED ENERGY USE: A THREAT AND OPPORTUNITY

Buildings account for close to 40% of energy used in most countries.

SOURCE: International Energy Agency:  
<http://www.iea.org/subsites/energy/buildings.asp>

Energy demand growth is exceeding production growth, leading to increased supply scarcity.





## ENVIRONMENTAL STRESS A LIABILITY TO HUMAN/ECONOMIC HEALTH

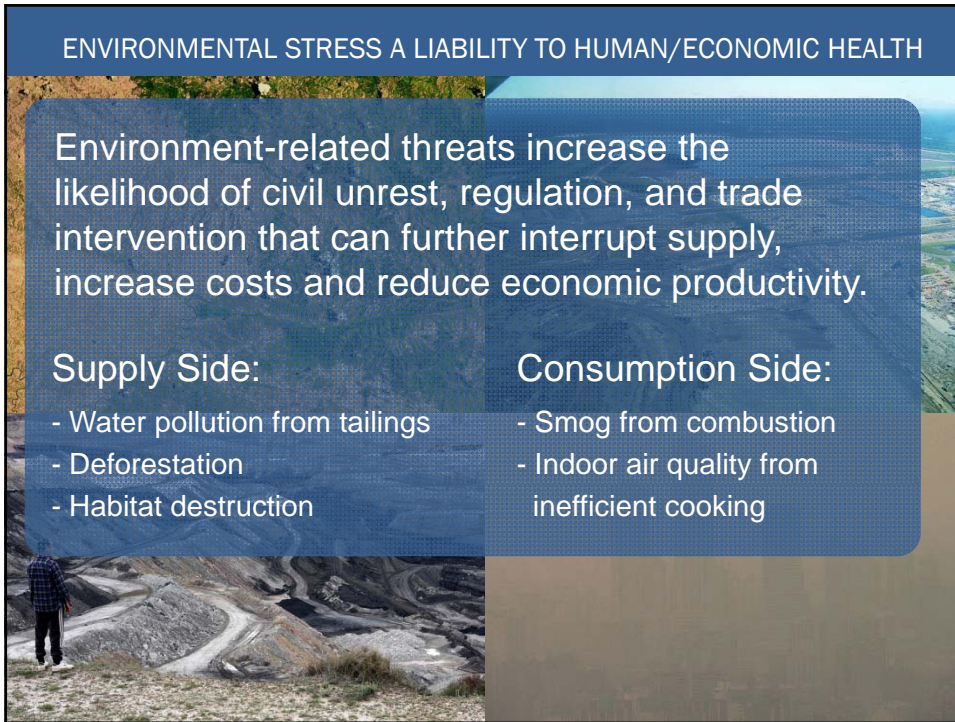
Environment-related threats increase the likelihood of civil unrest, regulation, and trade intervention that can further interrupt supply, increase costs and reduce economic productivity.

## Supply Side:

- Water pollution from tailings
- Deforestation
- Habitat destruction

## Consumption Side:

- Smog from combustion
- Indoor air quality from inefficient cooking

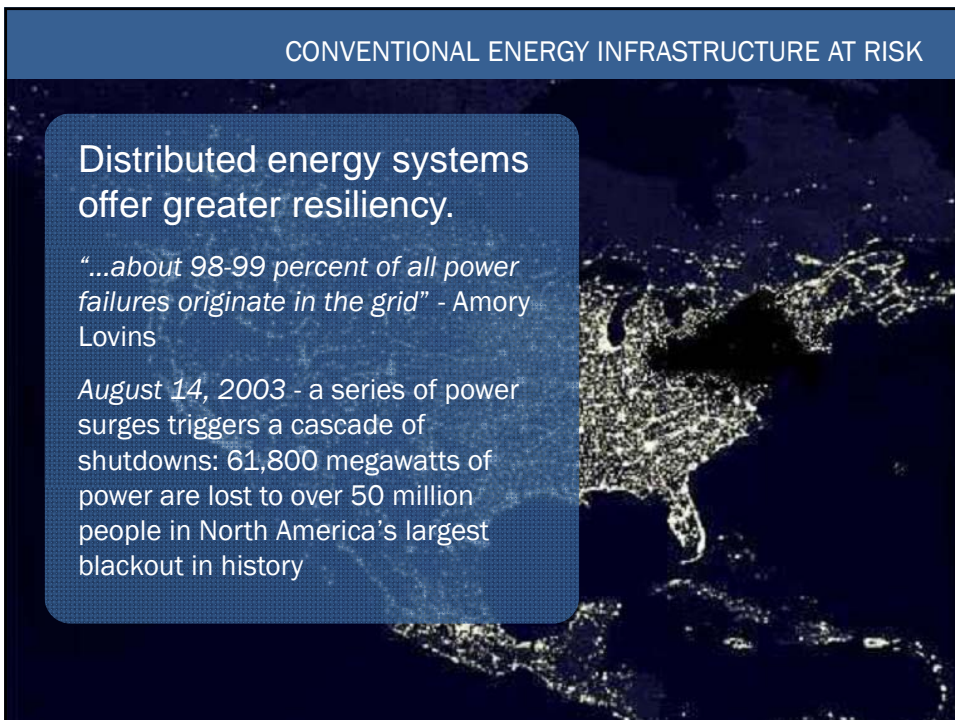


## CONVENTIONAL ENERGY INFRASTRUCTURE AT RISK

Distributed energy systems offer greater resiliency.

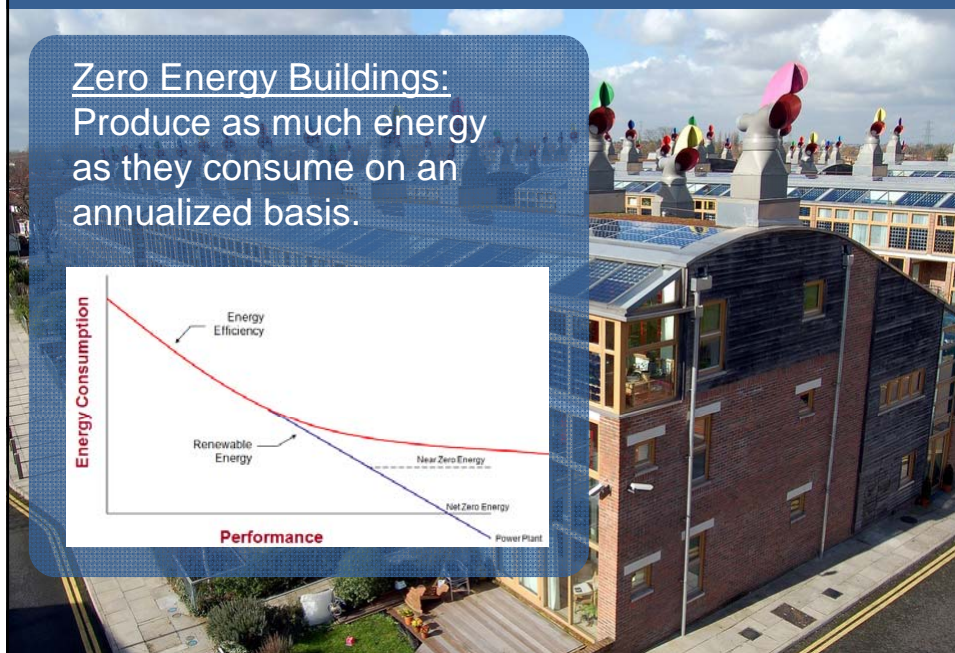
*"...about 98-99 percent of all power failures originate in the grid"* - Amory Lovins

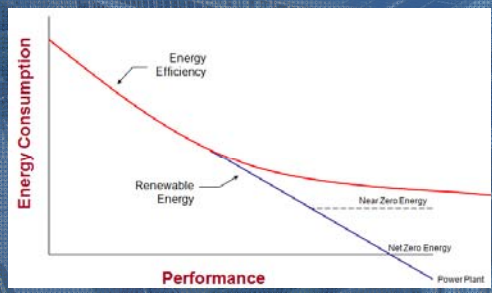
*August 14, 2003* - a series of power surges triggers a cascade of shutdowns: 61,800 megawatts of power are lost to over 50 million people in North America's largest blackout in history



### ZERO ENERGY BUILDINGS (ZEB): OPPORTUNITY ON THE HORIZON

**Zero Energy Buildings:**  
Produce as much energy as they consume on an annualized basis.





THE ZEB-SECURITY NEXUS					
SECURITY ISSUES					
	Supply SECURITY	Economic STABILITY	Environmental STRESS	Infrastructure RESILIENCY	
<b>THREATS</b>	<ul style="list-style-type: none"> <li>- Supply disruption</li> <li>- Diplomatic brinkmanship</li> <li>- Trade disputes</li> </ul>	<ul style="list-style-type: none"> <li>- Price instability</li> <li>- Operational &amp; supply chain risk</li> <li>- Civil unrest</li> </ul>	<ul style="list-style-type: none"> <li>- Habitat destruction</li> <li>- Compromised ecosystem services</li> <li>- Resource conflict</li> </ul>	<ul style="list-style-type: none"> <li>- Infrastructure efficacy &amp; efficiency</li> <li>- Climate change impacts</li> </ul>	
<b>OPPORTUNITIES</b>	<ul style="list-style-type: none"> <li>- Strengthen energy independence</li> <li>- Decouple energy &amp; diplomacy</li> <li>- Decrease supply chain risk</li> </ul>	<ul style="list-style-type: none"> <li>- Decrease operational risk to business &amp; consumers</li> </ul>	<ul style="list-style-type: none"> <li>- Reduce emissions in grid energy generation</li> <li>- Minimize ecological footprint of buildings</li> </ul>	<ul style="list-style-type: none"> <li>- Smarter, more efficient energy systems</li> <li>- Diversification through renewables</li> <li>- Load balancing</li> </ul>	
ZEB CONTRIBUTIONS					

## ZEB-SECURITY: KEY RESEARCH THEMES

**Supply  
SECURITY**

- Issues emerging from current/future global energy mix
- Assess 'risk exposure' for key regions; map against ZEB developmental stage
- Map/quantify 'demand side' & 'primary' energy pain points
- Track new supply risks from ZEB approaches (e.g. rare earth metals)

**Economic  
STABILITY**

- Track historical economic impacts of oil price spikes and supply shocks
- Project costs from future carbon legislation, environmental regulation

**Environmental  
STRESS**

- Map resource conflicts/threats
- Assess environmental risk from planned 'unconventional fossil fuel' extraction
- Assess 'new environmental risks' from ZEB approaches

**Infrastructure  
RESILIENCY**

- Assess vulnerability of energy supply chains/logistics
- Project cost of energy infrastructural renewal
- Assess state of 'adaptation/resiliency planning' in key regions
- Building stock conditions/trends

12

## ZEH and the Value Chain Approach

ACHIEVING PRO-ZEH OUTCOMES THROUGH VALUE CHAIN ANALYSIS

**Value Chain Objective:**

To examine the value chain of home building in the APP countries as it relates to ZEH adoption, with a view to strengthening regional understanding of how market conditions may be influenced to achieve positive ZEH outcomes.

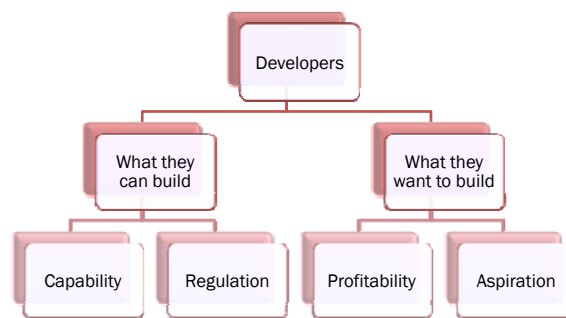
**Value Chain Defined:**

For the purposes of this analysis, the value chain of a national housing industry is comprised of all activities that influence, and are involved in the development of housing.

TAKING A DEVELOPER PERSPECTIVE

**Framing the Value Chain**

With new construction being the focus of the ZEH roadmap, this analysis is based on a developer-centred framework. All factors are evaluated on the extent to which they hinder or enable ZEH development.



**Housing industry factors that support ZEH should:**


- Increase knowledge
- Increase availability of technology
- Provide legal frameworks
- Mandate performance
- Promote transparency
- Ensure compliance
- Lower cost
- Increase demand
- Increase accessibility
- Lower risk
- Improve perception
- Increase desire

### BUILDING ZEH: VALUE CHAIN OVERVIEW

The *Value Chain Map* is anchored in key activities of the development cycle - from **project conception** to **product end of life**. Activities and influencing factors are organized across two dimensions:

**Support Factors**


Issues that affect the achievement of ZEH throughout the development process



<b>A. MARKET FUNDAMENTALS</b>							
<b>B. MARKET DRIVERS</b>							
<b>C. EDUCATION</b>							
<b>D. FINANCIAL ENVIRONMENT</b>							
<b>E. CODES &amp; STANDARDS</b>							
<b>F. DEVELOPMENT DRIVERS</b>							
<b>G. TECHNOLOGICAL CAPACITY</b>							
<b>H. ASSURANCE CONDITIONS</b>							
1. PLANNING	2. DESIGN	3. CONSTRUCTION	4. SALES	5. OPERATION	6. RE-SALES	7. RETRO-FITS	8. DEMOLITION

**Development Activities**

Key activity areas in the development cycle (*primary*) and ongoing activities associated with the development (*secondary*)



16
16

## ZEH Convergence Areas

## KEY ISSUE AREAS

- 10 distinct *ISSUE AREAS* for knowledge sharing and collaboration emerged from the value chain analysis.
- *MOBILIZATION TACTICS* are opportunities for action on advancing ZEH. These may involve leading new programs, supporting existing efforts, or creating partnerships with external organizations.

1. FINANCIAL MOBILIZATION
2. LOCALIZED BUILDING APPROACHES
3. BUILDING PERFORMANCE ASSURANCE
4. CONSUMER EDUCATION
5. TRAINING & CAPACITY BUILDING
6. POLICY FRAMEWORKS
7. ADEQUATE HOUSING
8. INFRASTRUCTURE INTEGRATION
9. FACILITATING PROCUREMENT
10. RECOGNIZING SUCCESS

18

## KEY ISSUE #1: FINANCIAL MOBILIZATION



The US Capital Markets Partnership has released a Green Building Underwriting Standard



Grameen Shakti provides low interest loans for solar installations in rural villages  
Source: www.powergenworldwide.com

### OPPORTUNITY AREAS

- Increase capital available to ZEH: *construction financing, mortgages, retrofit loans, renewable energy project financing, etc.*
- Reduce the financial carrying costs of ZEH: *insurance premiums, loan interest etc.*
- Address the “split incentive” for rental/leased properties.

### MOBILIZATION TACTICS:

- Green Building Underwriting Standards
- Green Building Lending Products
- Green Leases
- Micro-Financing Solutions

19

## KEY ISSUE #2: LOCALIZED BUILDING APPROACHES



Photo: Santa Barbara Garden, Shanghai, China



Photo: URBI Hacienda Santorini, Mexicali, Mexico

### OPPORTUNITY AREAS

- Support innovation for localized ZEH approaches and technologies.
- Focus on cost reduction of ZEH to increase affordability.
- Continue to develop regional best-practices and guidelines for ZEH based on measured performance and industry experience.

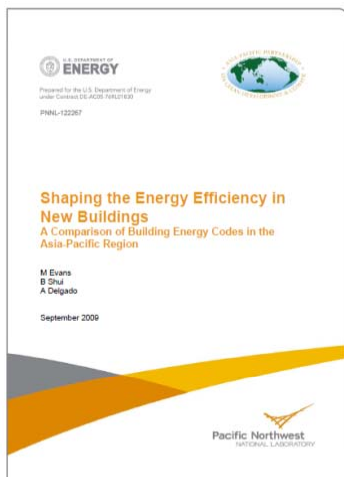
### MOBILIZATION TACTICS:

- Pilot Projects
- Performance Testing
- Clarifying Regionally-Appropriate Approaches

20

20

## KEY ISSUE #3: BUILDING PERFORMANCE ASSURANCE



Led by the US Dept of Energy, the APP produced guides to building energy codes for all 7 APP countries.

### OPPORTUNITY AREAS

- Integrate energy performance auditing and monitoring within residential construction.
- Enforce compliance to building energy codes.
- Improve data transparency around energy usage and costs to influence policy and consumer decision-making.

### MOBILIZATION TACTICS:

- Building Energy Codes
- Building Inspection Standards
- Energy Labelling
- Energy Monitoring & Reporting Standards

21

21

## KEY ISSUE #4: CONSUMER EDUCATION



Source: Minto Inspiration, Manotick, Canada: Virtual and On Site Tours



### OPPORTUNITY AREAS

- Support market readiness efforts to provide consumers with understanding of ZEH value proposition.
- Increase consumer familiarity with ZEH (i.e. how they look, how they work) to increase buyer demand and confidence.

### MOBILIZATION TACTICS:

- Improved Lifecycle Costing Data
- Demonstration Projects & Tours
- Energy Labelling
- Public Promotion/Outreach

22

22

## KEY ISSUE #5: TRAINING & CAPACITY BUILDING

### National Green Building Councils

Full Member	Emerging Member	Established Non-Member
Australia Canada India Japan Mexico USA	Korea	China Hong Kong

Source: WORLD GREEN BUILDING COUNCIL



The Indian Green Building Congress

### OPPORTUNITY AREAS

- Provide supporting trades with access to design, construction and maintenance skills necessary to service ZEH approaches across a building's lifecycle.
- Disseminate best practices and support knowledge transfer to increase adoption of effective construction techniques and technologies.

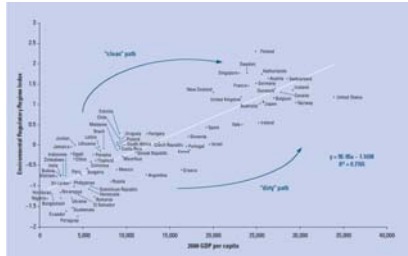
### MOBILIZATION TACTICS:

- Best Practices Database
- Educational Curriculum Development
- Trade-Oriented Training Sessions
- Pilot Projects

23

23

## KEY ISSUE #6: POLICY FRAMEWORKS



Source: Harvard Business Review, Ranking Environmental Regulation and Performance

The screenshot shows the 'Energy Efficiency Policies and Measures' search interface. It includes a search bar and a list of countries (Australia, Canada, China, India, Japan, Korea (N/A), Mexico, United States) and various policy measures such as 'Education and Outreach', 'Financial', 'Regulatory Instruments', and 'Voluntary Agreements'.

24

Source: IEA

### OPPORTUNITY AREAS

- Promote aggressive building energy codes and regional energy targets that raise the bar for building energy performance.
- Clarify the value of ZEH for local, regional and national governments, including sustainability, energy security, job creation and housing affordability.
- Support policies and regulatory initiatives that support or level the playing field for ZEH.

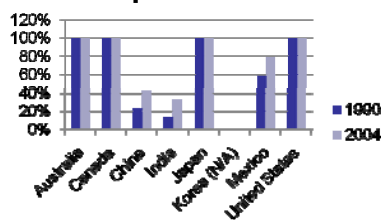
### MOBILIZATION TACTICS:

- Policy Development Support
- Incentives, Penalties & Tax Subsidies
- Economic Development Opportunities
- Energy Autonomy

24

## KEY ISSUE #7: ADEQUATE HOUSING

### Water and Sanitation: Access to improved sanitation



Source: WORLD RESOURCE INSTITUTE



25

Source: BaSIC

### OPPORTUNITY AREAS

- Incorporate ZEH principles into new developments aimed at meeting housing shortfalls.
- Create economic opportunities for low-income communities through ZEH applications: *micro-financing for solar panel leasing, local construction jobs etc.*

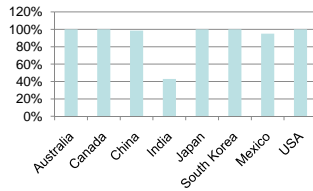
### MOBILIZATION TACTICS:

- Social Housing Development Guidelines
- Affordable Housing Policy
- Social Enterprise Ventures/Micro-Lending
- Local Construction Training/Certification Programs

25

## KEY ISSUE #8: INFRASTRUCTURE INTEGRATION

### Access to Electricity (2000)



Source: UNESCO



Photo: SOLAR POWER METER, from Picasa: reedyoung

26

### OPPORTUNITY AREAS

- Encourage infrastructure development to provide grid connection to those not currently serviced.
- Support grid connection technologies for renewable tie-in and metering.
- Where grid connection is not possible, support local distributed energy networks and district energy systems.

### MOBILIZATION TACTICS:

- "Adaptation-Oriented" Infrastructure Planning
- Improved Metering Capabilities
- Feed-In Tariff Programs
- District Energy Systems

26

## KEY ISSUE #9: FACILITATING PROCUREMENT



Photo: Building Supply Shop in Athouli, India, from Flickr: Sixtybolts



Photo: Container Ship, from Flickr: jdnx



### OPPORTUNITY AREAS

- Facilitate trade of ZEH technologies to improve market accessibility.
- Promote development of local manufacturing capacity for ZEH components and materials.
- Support retail strategies to increase availability of ZEH components for consumers and smaller builders.

### MOBILIZATION TACTICS:

- Trade Missions / Strategic Trade Relationships
- Green Building Product Directory/Database
- Manufacturer Education
- Retail Green Product Strategies

27

27

## KEY ISSUE #10: RECOGNIZING SUCCESS



28

Sources Top to Bottom: Zeroenergyhousing.org, Treehugger, Net-Zero Energy Home Coalition

28

**OPPORTUNITY AREAS**

- Celebrate the achievement of ZEH stakeholders and identify ZEH leaders.
- Continue to foster issue-specific working groups/collaborative networks across APP countries to advance priority ZEH issues.

**MOBILIZATION TACTICS:**

- Online Communities
- Awards/Recognition Programs
- Professional Networks/Directories
- Case Studies
- Media Relations Strategies

## COLLABORATIVE OPPORTUNITIES

Enhanced collaboration to address issue areas could manifest through such forms as:

1. Building networks of existing organizations already working in key areas supporting ZEH development.
2. Fostering enhanced knowledge-transfer between “mature” and “emerging” market clusters to accelerate development trajectories through best-practice sharing and/or country-to-country mentoring.
3. Establishing working groups between nations in similar development phases to advance problem solving through experience sharing and idea exchange around specific issue areas.
4. Augmenting collective capacity to resolve priority issues by dedicating shared, international resources toward solution-oriented research initiatives or programming.

29

29

# International Zero Energy Housing Map

## MAPPING ZERO ENERGY HOUSING

Locate buildings on the **Interactive Map**.

Filter by :

- **Building Type**
- **Number of Units**
- **Size of Development**
- **Electricity Generation**

Partners may log-in to **add and edit their own buildings**.

MAPPING ZERO ENERGY HOUSING

View **Building Details**, including:

- **Builder info**
- **Building Details**
- **Performance Metrics**
- **Building Approaches**
- **Photos**
- **“ZEH Score”**  
(% of energy generated beyond the needs of the building)

$$\left( \frac{\text{Total energy generated} - \text{Total energy consumed}}{\text{Total energy generated}} \right) \times 100$$

**Zero Energy Housing Map**  
Zero Energy Housing Map > AusZEH

Map data ©2010 MapData Sciences Pty Ltd, IBM - Terms of Use

ZEH Score: **0**

**General Information**

Building Name: AusZEH  
 Address: 40 Mabel St, Doreen, Victoria, 3754, AU  
 Brief Description: The Australian Zero Emission House (AusZEH) project has the potential to significantly contribute to GHG emissions reduction from residential buildings in Australia.  
 Builder: Henley Property Group  
 Link: <http://auszeh.org.au/index.html>

**Building Details**

Type of building(s): Detached Homes  
 Year Completed: 2010  
 Size: 242 m<sup>2</sup>  
 Number of Units: 1

32

32

MAPPING ZERO ENERGY HOUSING

View **Country Summary** page, which provides at-a-glance information regarding the status of ZEH projects within the seven Partner Countries.

**Zero Energy Housing Map**  
Zero Energy Housing Map > Country Summary

Country	Total ZEH Score	Total number of units	Total square footage	Total annual fuel consumption	Total annual electricity use	Maximum electricity demand	Total annual electricity production	Maximum electricity production capacity	Annual water consumption
	53	2	651 m <sup>2</sup>	3305 BTUs	14544 kWh	0 kW	31200 kWh	0 kW	0 m <sup>3</sup> /year
	47	90	27443 m <sup>2</sup>	15950206 BTUs	435396 kWh	7 kW	829884 kWh	643 kW	0 m <sup>3</sup> /year
	-90	45	6217 m <sup>2</sup>	18127274 BTUs	73958 kWh	0 kW	41818 kWh	25 kW	3075 m <sup>3</sup> /year
	0	1	242 m <sup>2</sup>	0 BTUs	0 kWh	0 kW	0 kWh	6 kW	160 m <sup>3</sup> /year
	0	1	0 m <sup>2</sup>	0 BTUs	0 kWh	0 kW	0 kWh	0 kW	0 m <sup>3</sup> /year

33

33



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