



# FIG Working Week 2012

Rome, Italy 6–10 May

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## Climate Change Risks and Changing Face of Real Estate

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Contribution of Real estate to climate change  
Targets for reduction of emissions leading to climate change  
Framework : direct and indirect effects of climate change on to Real estate  
Changes in Real estate in different countries  
Ranking of different countries. Measurement methodology  
Conclusion  
Extension of Research  
References  
Author information

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## REDUCTION REQUIREMENTS

Scenario category	Region	2020	2050
A-450 ppm CO <sub>2</sub> -eq <sup>a</sup>	Annex I	-25% to -40%	-80% to -95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions
B-550 ppm CO <sub>2</sub> -eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO <sub>2</sub> -eq	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and Middle East, East Asia

Regional breakdown and distribution of the actual emission reduction requirements (Source: IPCC 2007b, Fourth Assessment Report: Working Group III, Mitigation of Climate, Box 13.7, p. 776)

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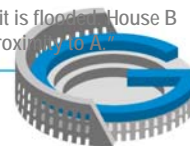
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## Managing Risks

- (a) The Fallacy of Replication: "Properties that currently experience floods are of type x and not type y. Therefore, properties that experience floods in the future will also be of type x, and not type y."
- (b) The Fallacy of Composition: "Significant financial safety nets are viable if a single area is flooded. Therefore, significant financial safety nets will be viable if all areas are flooded." With respect to climate change, there are two important fallacies of composition worth highlighting, those with respect to (i) insurance markets, and (ii) state bailouts
- (c) The Fallacy of Linear Scaling: "The impact of a flood of severity is of magnitude z. Therefore, the impact of a flood twice the severity of y, will be twice the magnitude of z." Labour market effect, Social network effect, Psychological and informational effect
- (d) The Fallacy of Isolated Impacts: "The price of house A is reduced because it is flooded. House B is not flooded and, therefore, its price will not be reduced, irrespective of its proximity to A."

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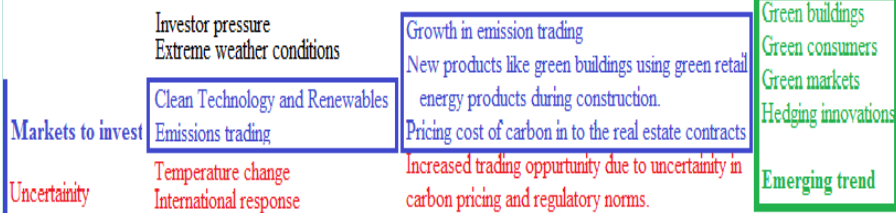
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## Risks, Opportunities in Real estate

### Risks, opportunities emerging in real estate



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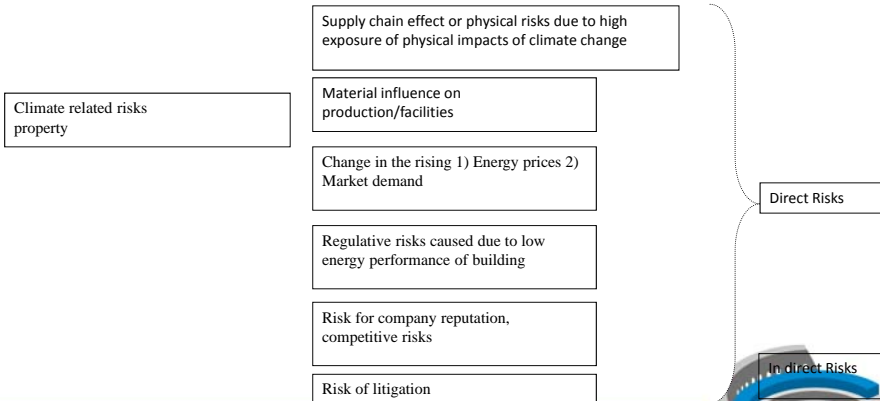
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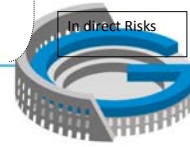
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## Types of Climate change risks



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## Real estate allocation

### Scenario 1 : Regional Divergence

Most likely scenario  
 Cost of Carbon \$110/t CO<sub>2</sub> e globally

#### Relevance to Real estate:

Policy changes and regulatory environment needs strong leadership for execution of emission reduction targets. So Real estate prices might be affected due to new policies, rules and regulations. Property taxes might include carbon tax.

### Scenario 3: Stern Action

Market anticipates smooth adjustments and this is planned action to reduce the emissions. Cost of Carbon - 110 / t CO<sub>2</sub> e globally.

#### Relevance to Real estate :

Policy and regulations impact on Real estate is less. Green consumers are aware of climate change. The stress to act under rules for emission reduction is less on property owners. Stern action is a planned action, however implementation has been difficult.

### Scenario 2: Delayed action :

Business as usual until 2020  
 Cost of carbon 15/ t CO<sub>2</sub> e to 2020 then dramatic rise to \$220/ tCO<sub>2</sub> e

Global policy Schock most likely.

#### Relevance to Real estate :

Investors panic and prefer investing only in green buildings. Tenancy agreements will be biased to new constructions rather than existing constructions.

### Scenario 4 : Climate break down

Fossil fuels remain the mainsource of energy and hence the cost of carbon will be \$15t/CO<sub>2</sub> e limited to EU ETS.

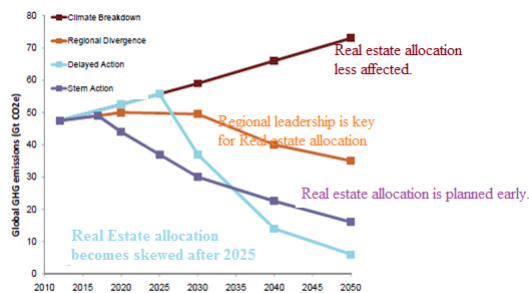
#### Relevance to Real estate:

Minimum impact on property owners to take action. The concept of Green building environment will be on a back runner.

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## Scenarios on emission compared: Carbon emissions



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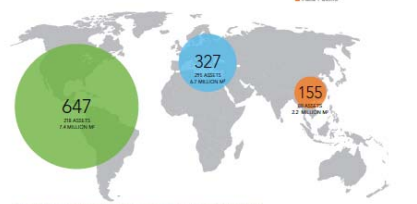
## Sensitivity to climate change & Global emissions

### Real estate sensitivity to climate change

Climate Change Risk Factors	Real estate Core Unlisted
Technology	High
Impacts	Low to Moderate
Policy	High
Overall climate change sensitivity	High

### GREENHOUSE GAS EMISSIONS

#### Emissions by Global Region



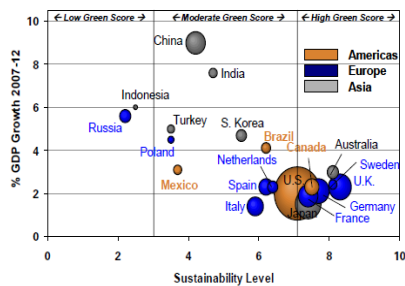
Source: Greenprint Carbon index, Green print foundation

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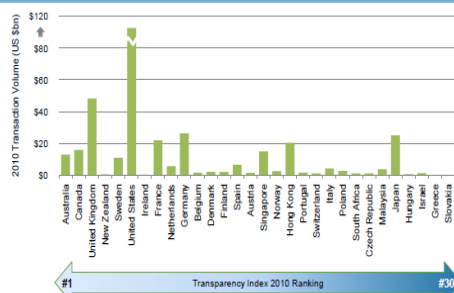


## Real estate investment markets

### Leading Real Estate Investment Markets Scaled by Value of Investible Stock - 2007



### Transparency Leads to Transaction Volume



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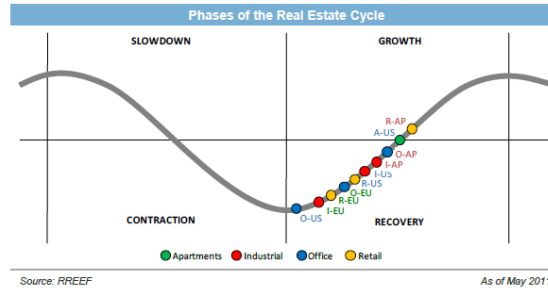
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## Conclusion



- Most of the growing economies has crossed the contraction stage
- Tenants are increasingly demanding greener facilities and many new firms are fully integrating their tenancy decisions into their sustainability reporting

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## Risk quantification

$$R_{i,t} - RFR_t = \beta_1 + \sum \beta_{1,j} \times F_{j,t} + \epsilon_{i,t}$$

$R_{i,t}$  = the return for asset  $i$  at time  $t$  (synchronised for private equity / real estate)

$RFR_t$  = the risk free rate (nominal 3 month treasury-bills)

$F_{j,t}$  = the return for factor  $j$  at time  $t$

$\beta_1$  = the asset class unique premium (roll yield, alpha or illiquidity). A full multivariate model splits  $\beta_1$  into a set of different betas

$\beta_2$  = sensitivity to unexpected inflation premium ("real asset" premium)

$\beta_3$  = sensitivity to equity premium (S&P 500 – 3 month t-bills)

$\beta_4$  = sensitivity to small cap premium (Russell 2000 – S&P 500)

$\beta_5$  = sensitivity to term premium (Barclays Government bond index – 3 month t-bills)

$\beta_6$  = sensitivity to credit spread premium (Barclays high yield - Government)

$\epsilon_{i,t}$  = the unexplained portion (error term, or residual)

Formula for risk quantification :

Source: Mercer et al 2011

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