Substantial Resilient Infrastructure Financing Market

Almost all U.S. cities have completed planning studies to become resilient to accelerating, more intense precipitation, storms, and droughts, higher peak floods, sea level rise flooding, resultant higher storm surges, and many other impacts.

For example, Special Reports document Massachusetts and Pennsylvania *existing* sea level rise flooding costs are $328 billion: https://perkinswill.com/news/us-green-building-council-adopts-resilient-building-and-design-standard-reli (under economic benefits)

Through enacted October 2017 legislation, the military set aside funds including for resilient sea level rise flooding for coastal bases, but is holding off spending with possible base relocation if localities do not finance supporting resilient infrastructure.

Recent scientific actual data (not models) show that the last time we were in a period of rapid glacial melt like today, sea level rise came in huge bursts with about six feet of rise in 10 - 20 years. "Fossil coral reefs show sea level rose in bursts during last warming" (Ruth & Boyd, Rice U. (Oct. 19, 2017) http://news.rice.edu/2017/10/19/fossil-coral-reefs-show-sea-level-rose-in-bursts-during-last-warming/

Cities are exploring resilient financing, are under the gun to maintain commerce and security, avoid destructive ongoing S&P and Moody's climate credit rating downgrades, and many are suing big oil to recover the unprecedented costs.

Localities are throwing money away if infrastructure bonds aren't labeled green like with LEED + RELi national consensus underwriting standards, since green + resilient bonds are selling out 3x+ due to substantial investor demand. For example, DC Water's $300 million combined sewer overflow green bond received orders for over $1.1 billion, and was finally priced at $350 million providing DC Water with cheaper capital, $50 million in more bond proceeds, a more valuable and less risky bond, a diversified investor base, improved market access, and reduced reputational risk. DC Water CFO Mark Kim email to MTS / CMP (Nov. 2, 2016) & presentation, Ballard Spahr Infrastructure Conference (Oct. 13, 2016), & peer-reviewed *Green Bond Business Case* released at NYSE by JPMorgan & Sierra Club & updated by leading economists.

In addition to preventing climate credit rating downgrades, S&P will consider higher credit ratings for cities adopting RELi. June 23, 2015 S&P headquarters meeting on resilience standards / downgrades & prior S&P communications. RELi is also an underwriting standard identifying resilience attributes increasing economic value, similar to the underwriting standard achieving higher credit ratings for Morgan Stanley Green Home Bonds.

RELi's national consensus resilient infrastructure standard requires SMaRT certified sustainable products and incorporates Envision sustainable infrastructure. See RELi background:

http://www.gbci.org/reli http://c3livingdesign.org/?page_id=5110

LEED + RELi 2.0 with SMaRT is being released in June, national in-person education has been funded, and NYC in September is tentatively the first Event with opportunities for RELi Partners.

2.15 Partial Pennsylvania Resilience Costs

where data are available from just 8 out of hundreds of categories of damages

Damages	Basis of Calculation	Cost to the Commonwealth
State Agency & City Resilience Report Costs, Expenditures	Estimated total costs expended	$200 million
Sea Walls or Comparable Barriers to Rising Seas in Populated Areas	$44 million per linear mile & 177 miles of populated shoreline	$1.8 billion
Hurricane & Winter Storm Damages	One winter and one summer storm every ten years for 100 years intensified 60% from warming	$442 billion
Infrastructure & Built Environment Costs for *Existing* ~ 6% Higher Peak Floods & 71% More Intense Precipitation	Pa. built environment is valued at $39 trillion based on Commonwealth data. Extensive upgrades to deal with accelerating, more intense precipitation and higher peak floods over time will cost about 10% of this value.	$3.92 trillion
50% Increased Lyme Disease From Warming	Average cost of treatment is $9,528 and number of cases is 38,457	$366 million
Total Ski & Snowmobile Industry Revenue Losses from Warming	$403 million in losses over 100 yrs. from a mean 30% reduction in annual revenue	$40 billion
Total Black Cherry Revenue Loss From Warming	$200 million / yr. loss over 40 yrs. with documentation of all production stopping in about 80 yrs. due to warming	$8 billion
Total Dairy Production Revenue Loss from Warming	Documented 22% annual decline from warming of $280 million, taken over 100 years based on expected continued warming	$28 billion
Total		**$4.44 trillion**

2.16 Partial Massachusetts Resilience Costs

where data are available from just 11 out of hundreds of categories of damages

Damages	Basis of Calculation	Cost to the Commonwealth
Mass. Resilient Grant & Bond Programs	Total grants awarded & bonds issued	$209 million
State Agency & City Resilience Report Costs & Expenditures	Estimated total costs expended	$100 million
Sea Walls or Comparable Barriers to Rising Seas in Populated Areas	$44 million per linear mile & 760 miles of populated coast	$33 billion
Relocation of Coastal Homes in Less Populated Areas Where Sea Walls are not Cost Effective & Resilience is Technically Infeasible	488,676 coastal homes at $600,000 per home	$293 billion
Hurricane & Winter Storm Damages	One winter and one summer storm every ten years for 100 years intensified 60% from warming	$442 billion
Infrastructure & Built Environment Costs for *Existing* ~ 9% Higher Peak Floods & 71% More Intense Precipitation	Mass. built environment is valued at $11.6 trillion from Commonwealth data. Extensive upgrades to deal with accelerating, more intense precipitation & higher peak floods over time will cost about 10% of this value.	$1.63 trillion
50% Increased Lyme Disease From Warming	Average cost of treatment is $9,528 and number of cases is 16,348	$156 million
Total Ski Industry Revenue Losses from Warming	$91.2 million / yr. in losses over 100 yrs. from a mean 28% reduction in annual revenue	$9 billion
Total Revenue Loss From Collapse of the Cod Fishery from Warming	2011 revenue of $27.6 million over 100 years from well-documented collapse of cod fishery over recent time from rising sea temperatures	$27.6 billion
Total Maple Syrup Revenue Loss From Warming	Mean 28% reduction from well-documented warming causes $1.1 million in damages over a 100 year period	$110 million
Total Dairy Milk Production Revenue Loss from Warming	Documented 20% annual decline from warming of $9.4 million, taken over 100 years based on expected continued warming	$940 million
Total		**$2.46 trillion**