Carbon Reduction in the Building Sector from Pursuing All New England's Economically Achievable Electric End-Use Efficiency Potential

Building Energy 2007

Northeast Sustainable Energy Association

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Green Energy Economics Group

Overview

- Socolow and Pacala Stabilization Wedges
  - Global scale; long-term time frame
- Northeast Energy Efficiency Partnerships, Inc. (NEEP) report on economically achievable energy efficiency in New England
  - Regional; 10 yr time frame
- How much does econoimcally achievable electric efficiency resources in New England contribute to the Building Efficiency stabilization wedge?

Stabilization Wedges

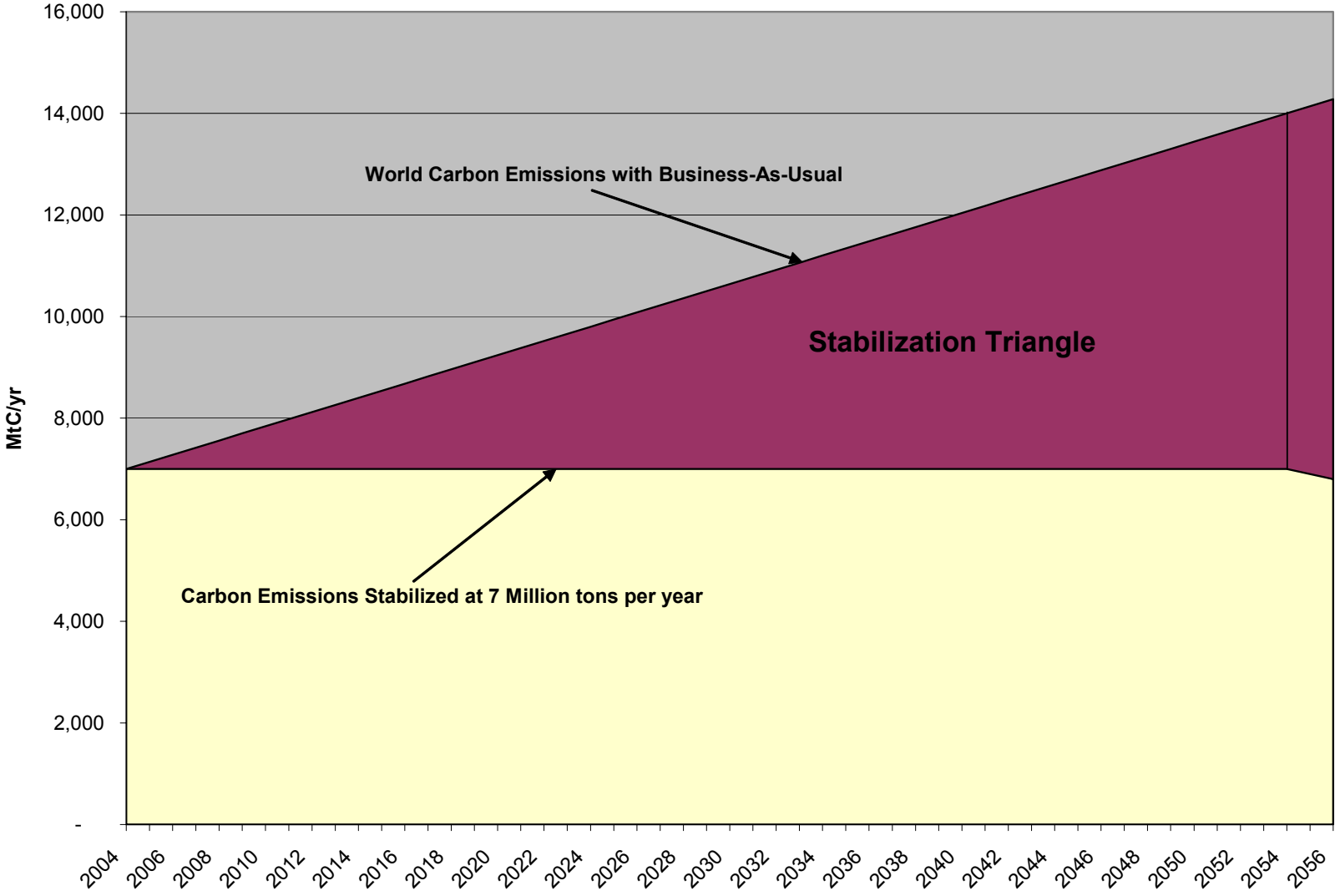
- Concept introduced by Stephen Pacala and Robert Socolow in: "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," Science magazine, August 2004.

Pacala and Socolow Stabilization Wedges

- Limit CO_2 concentrations to 500 ppm (almost double preindustrial)
- 2004 world emissions of 7 billion metric tons Carbon per year (GtC/yr)
- Business-As-Usual (BAU) trajectory would increase 2054 emissions to 14 GtC/yr

Pacala and Socolow Stabilization Wedges

- Need to first stabilize carbon emissions, then reduce
- Stabilization triangle: Area between BAU and stabilized emissions


16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-
MtC/yr
World Carbon Emissions with Business-As-Usual
Stabilization Triangle
Carbon Emissions Stabilized at 7 Million tons per year
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
2046
2048
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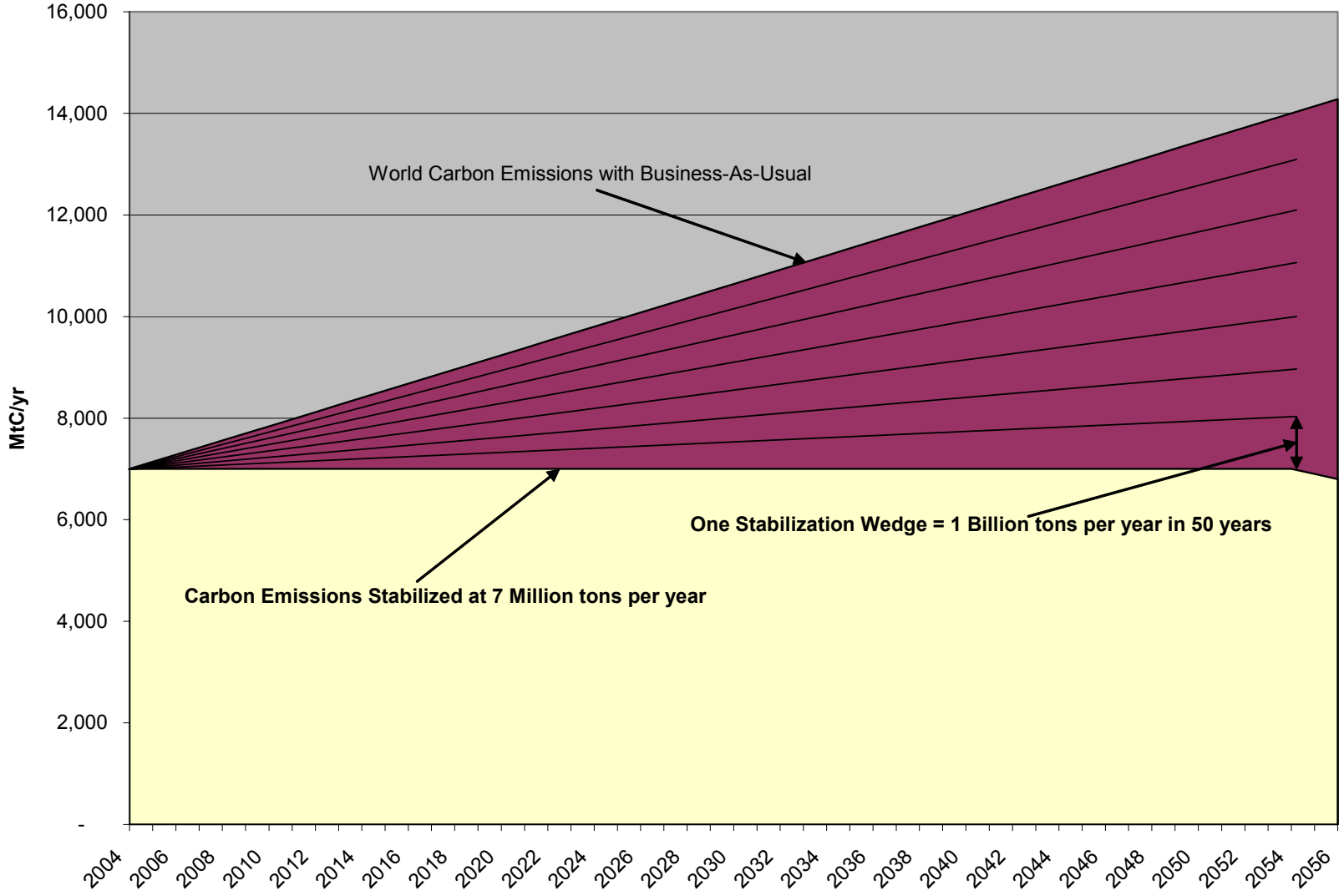
2052
2054
2056

Pacala and Socolow Stabilization Wedges

- Stabilization triangle can be divided into wedges
- One wedge = 1 GtC/yr reduction by 2054


16,000
14,000
12,000
10,000
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MtC/yr
World Carbon Emissions with Business-As-Usual
One Stabilization Wedge = 1 Billion tons per year in 50 years
Carbon Emissions Stabilized at 7 Million tons per year
2004
2006
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Pacala and Socolow Stabilization Wedges

- 6 basic strategies available to reduce carbon emissions with current technologies:
  - Energy Efficiency & Conservation
  - Renewable Electricity & Fuels
  - Fuel Switch
  - Nuclear Fission
  - CO_2 Capture and Storage
  - Forest & Soils

New England Electricity Efficiency Potential

- Northeast Energy Efficiency Partnerships, Inc. (NEEP) 2004 report on economically achievable energy efficiency in New England

What is Economically Achievable Energy Efficiency Potential?

The potential for maximum market penetration of energy efficient measures that are cost-effective based on the Total Resource Cost test, that could be adopted through a concerted, sustained campaign involving proven programs and market interventions, and not bound by any budget constraints.

Achievable EE Potential Underlying Assumptions

- Savings based on % savings by residential, nonresidential sector from existing EE potential studies for MA, ME, CT, VT (extrapolated for NH and RI).

- Avoided double counting by assuming some overlap of codes (12.5%) and standards (25%) savings with savings from potential studies.

Key Sources Used in Analysis

- 2004 Connecticut ECMB Final Report
- (GDS Associates/Quantum Consulting)

- 2003 Vermont Dept. Public Service Study
- (Optimal Energy/Vermont Energy Investment Corp.)

- 2002 Maine Public Advocate Study
- (Optimal Energy/Exeter/Vermont Investment Corp)

- 2001 Massachusetts Utilities and DOER Study
- (RLW Analytics and Shel Feldman Associates)

- 2001 NEEP Codes & Standards Analysis (NEEP/ACEEE)

- 2004 ACEEE Standards Analysis

- 2003 NYSERDA Energy Efficiency and Renewable Resource Development Potential in New York State
  (Optimal Energy/American Council for an Energy Efficiency Economy/Vermont Energy Investment Corporation/Christine T. Donovan Associates)

What is Economically Achievable EE Potential in New England?

- 10-year analysis timeframe: 2004 to 2013
- Results:
  - By 2008: Savings of 17,103 GWH and 4,317 MW

  (Equivalent to annual electricity needs of 2.4m households, and 14 combined cycle gas units @ 300 MW)
  - By 2013: Savings of 34,375 GWH and 8,383 MW

  (Equivalent to annual electricity needs of CT and NH households combined, and 28 combined cycle gas units @ 300 MW)

Achievable Potential Savings				
Cumulative Annual Electricity Savings (at generation)	**2008**		**2013**	
	GWh	Summer MW	GWh	Summer MW
EE programs (Existing and New)	16,878	4,248	33,668	8,172
Building Energy Codes	509	230	1,090	481
Appliance Standards	643	158	2,284	601
Combined (Not additive)	**17,103**	**4,317**	**34,375**	**8,383**

How much would realizing economically achievable New England electric efficiency potential reduce CO2 emissions?

- 17 MtC/yr in 2013 (Million metric tons per year)
- 27 MtC/yr in 2054 if savings after 2013 off-set all energy load growth

What percentage of projected world carbon emissions in 2013 & 2054 would New England efficiency savings represent?

- 0.2% in 2013
- 0.4% in 2054
- 5% of a worldwide stabilization wedge

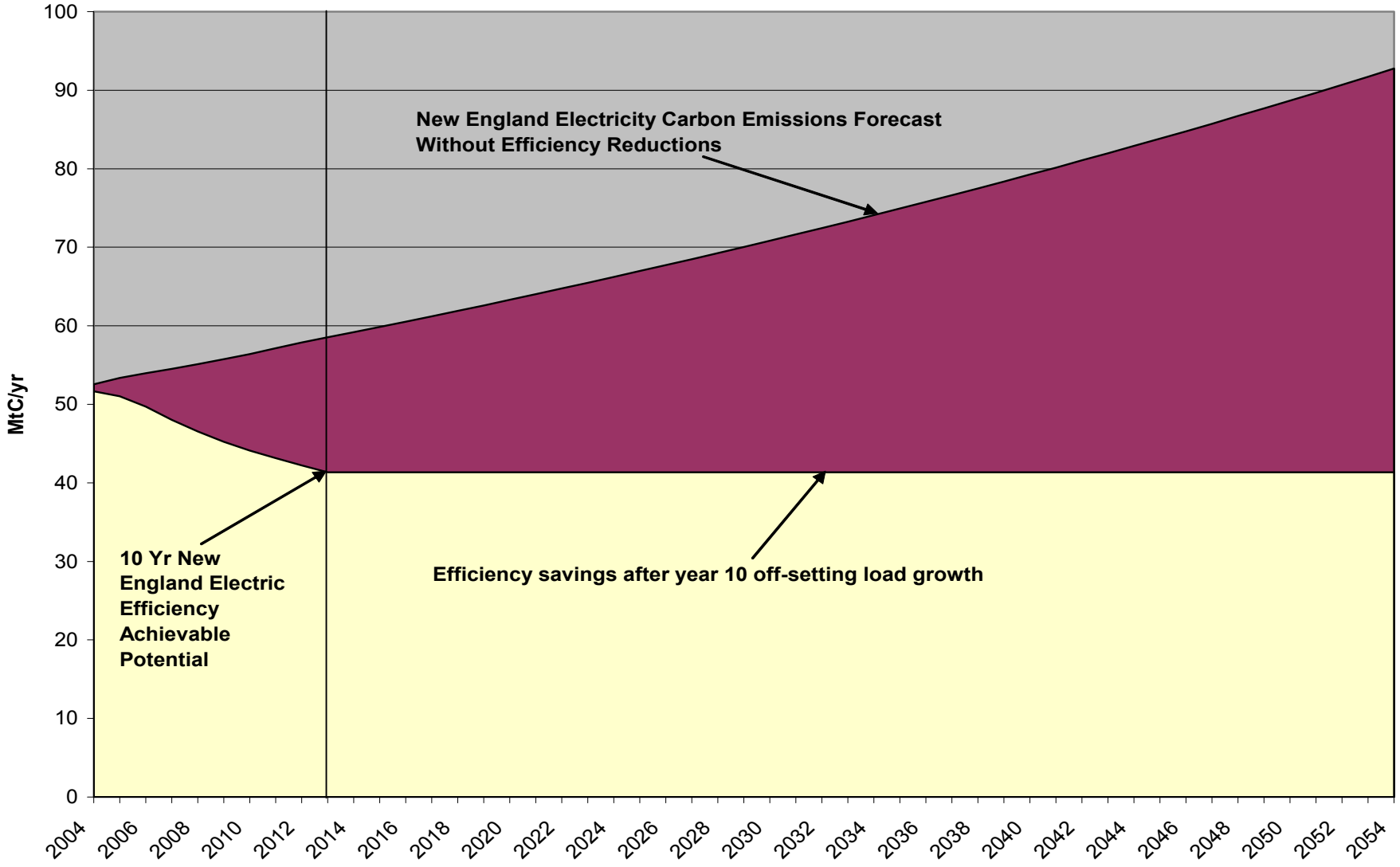
How much does New England electricity consumption contribute to world carbon emissions?

- 0.7%

How much of New England's projected building electricity carbon emissions could be reduced by realizing economically achievable efficiency?

- 29% by 2013
- 55% by 2054

New England Electricity Carbon Emissions



Conclusions

- A sustained effort to realize all New England's economically achievable efficiency potential offers significant carbon emission reductions at negative cost.
- Since avoided costs of electric supply exceed the total resource costs of economically achievable efficiency savings, cost-effective efficiency provides negative-cost carbon emission reductions

Conclusions

- Sustained investment to realize all New England's economically achievable efficiency savings would
  - reduce forecast 2054 building electricity carbon emissions by 55%, assuming continued efficiency investment after 2013 could equal annual load growth cost-effectively.
  - produce 1/20th of a worldwide carbon stabilization wedge.
  - generate significant economic benefits to the region by lowering the costs of living and doing business in New England.

Conclusions

- Since avoided costs of electric supply exceed the total resource costs of economically achievable efficiency savings, cost-effective efficiency provides negative-cost carbon emission reductions