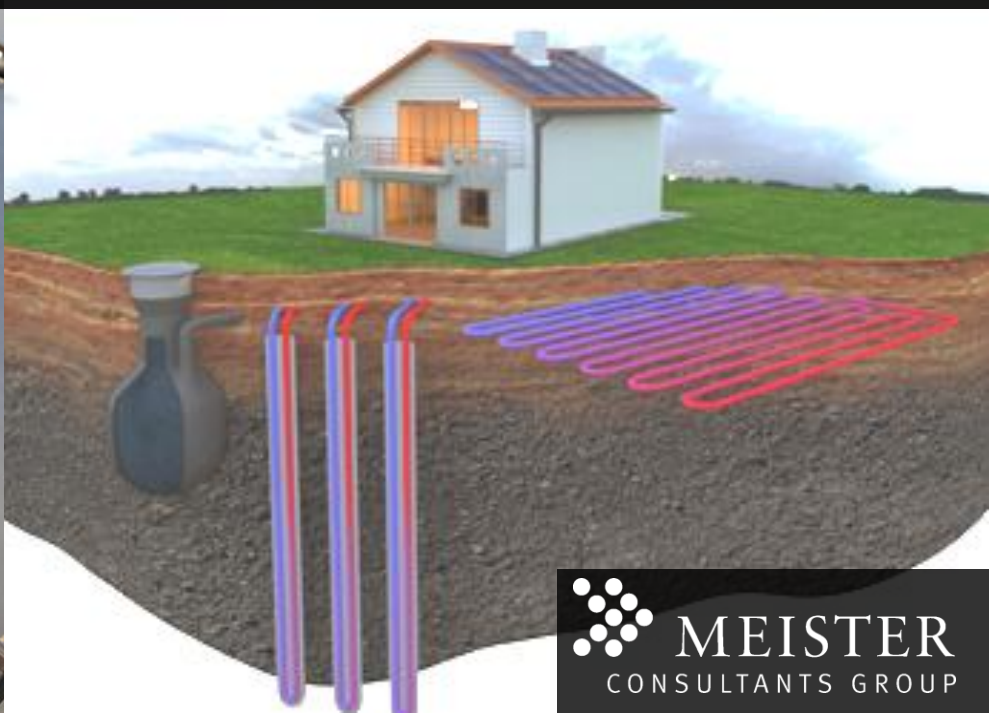
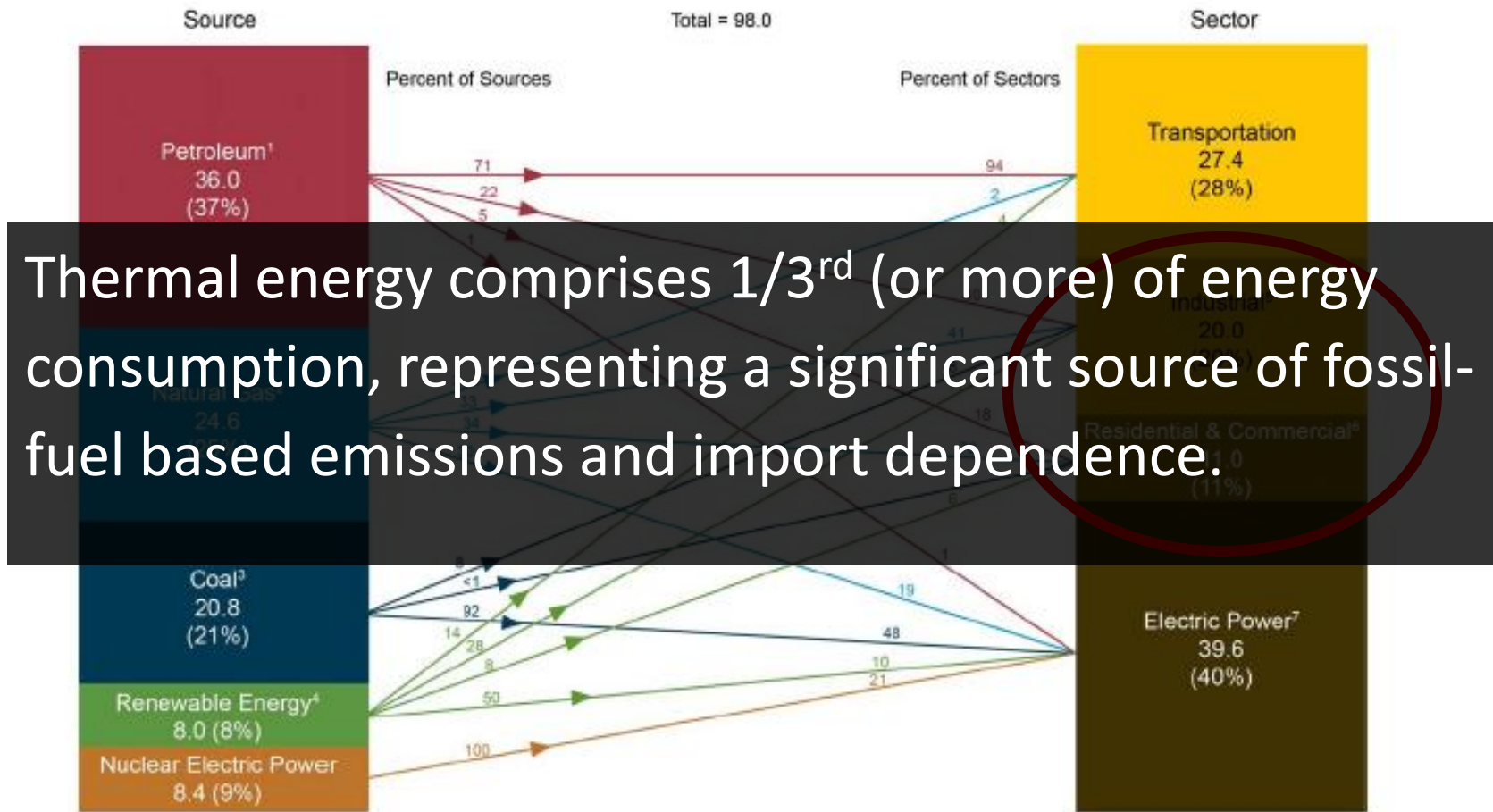




# Renewable Thermal: Pursuing the Policy Pipeline in New England



# THERMAL ENERGY: CHALLENGE & OPPORTUNITY

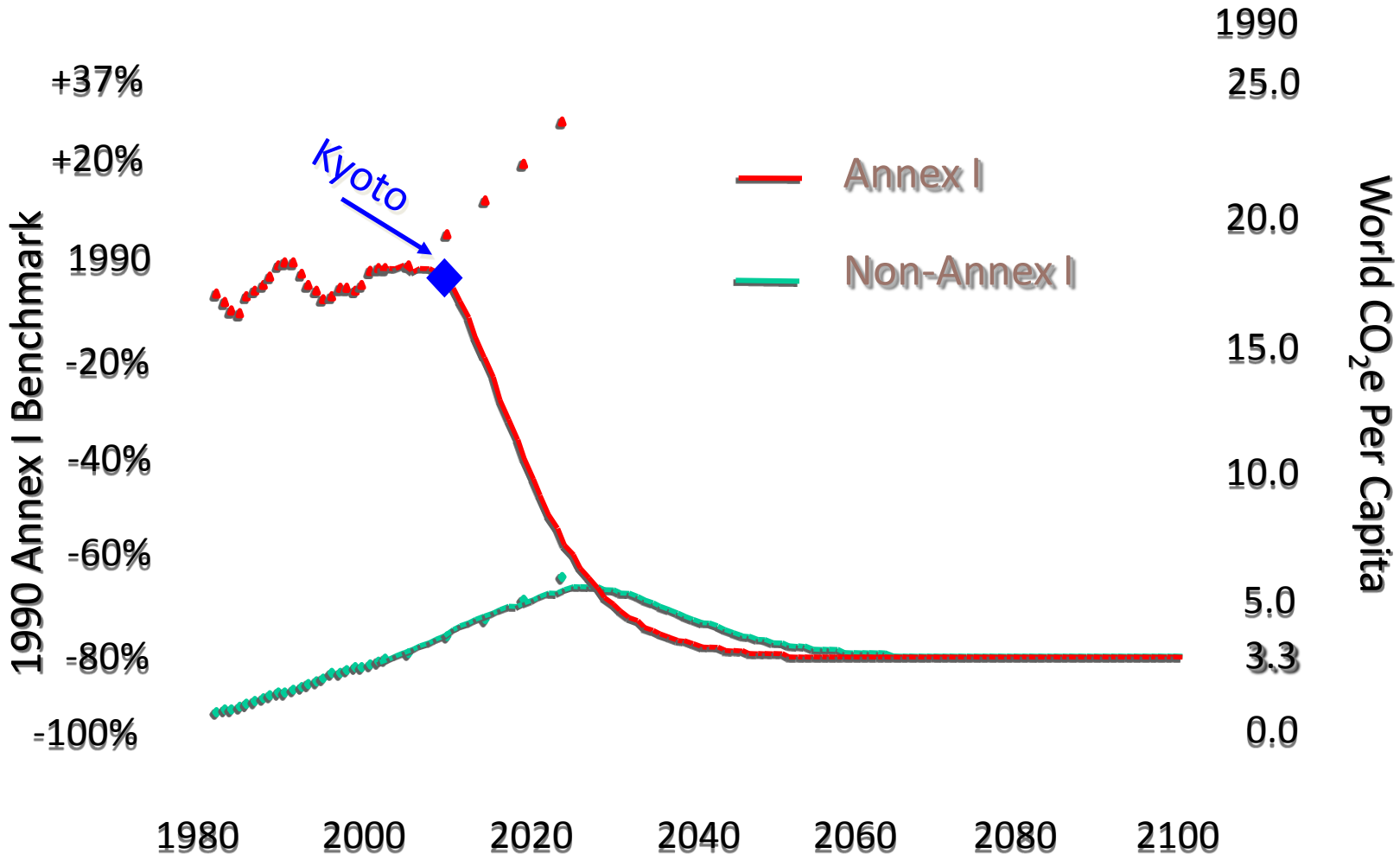


Thermal energy comprises 1/3<sup>rd</sup> (or more) of energy consumption, representing a significant source of fossil-fuel based emissions and import dependence.

<sup>1</sup> Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."  
<sup>2</sup> Excludes supplemental gaseous fuels.  
<sup>3</sup> Includes less than 0.1 quadrillion Btu of coal coke net exports.  
<sup>4</sup> Conventional hydroelectric power, geothermal, solar/PV, wind, and biomass.  
<sup>5</sup> Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.  
<sup>6</sup> Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.

<sup>7</sup> Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.1 quadrillion Btu of electricity net imports not shown under "Source."  
 Notes: Primary energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). • Sum of components may not equal total due to independent rounding.  
 Sources: U.S. Energy Information Administration, *Annual Energy Review 2010*, Tables 1.3, 2.1b-2.1f, 10.3, and 10.4.

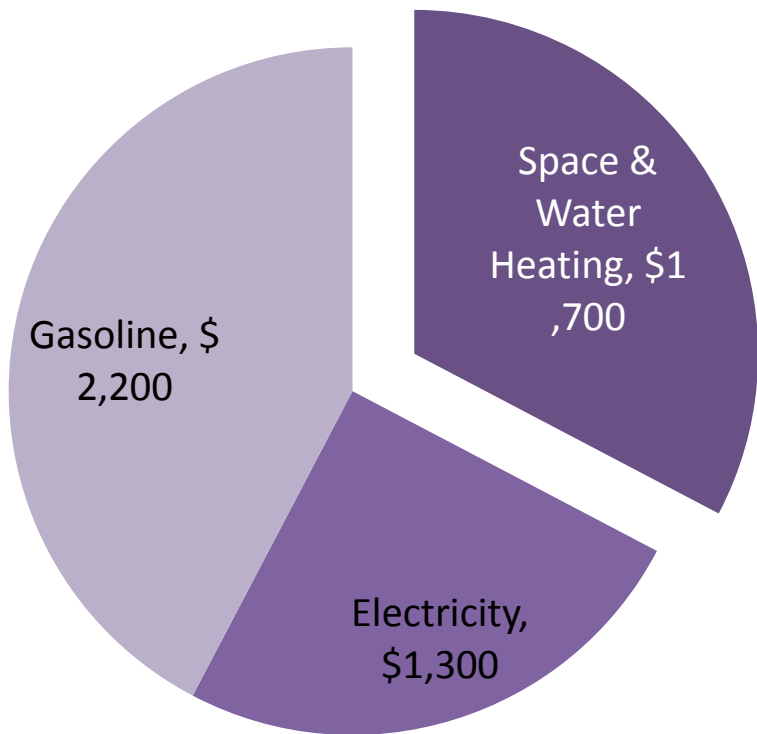
# CLIMATE PLANNING: WORLD GHG EMISSIONS REDUCTION SCENARIO





# ECONOMIC IMPACTS: TYPICAL HEATING EXPENDITURES

In 2008, an average household spent about:



Source: Massachusetts Clean Energy & Climate Plan for 2020





# ECONOMIC GROWTH & JOB CREATION

“Renewable heating technologies...are amongst the *lowest cost options* for both reducing CO2 emissions and fossil fuel dependency.”

- International Energy Agency



# RENEWABLE THERMAL: SOLAR HOT WATER



**Collectors capture heat from sun and transfer it to hot water storage tanks and building distribution system**

## **Applications:**

- Hot water and space heating
- Space cooling
- Pool heating
- Process heating
- District energy

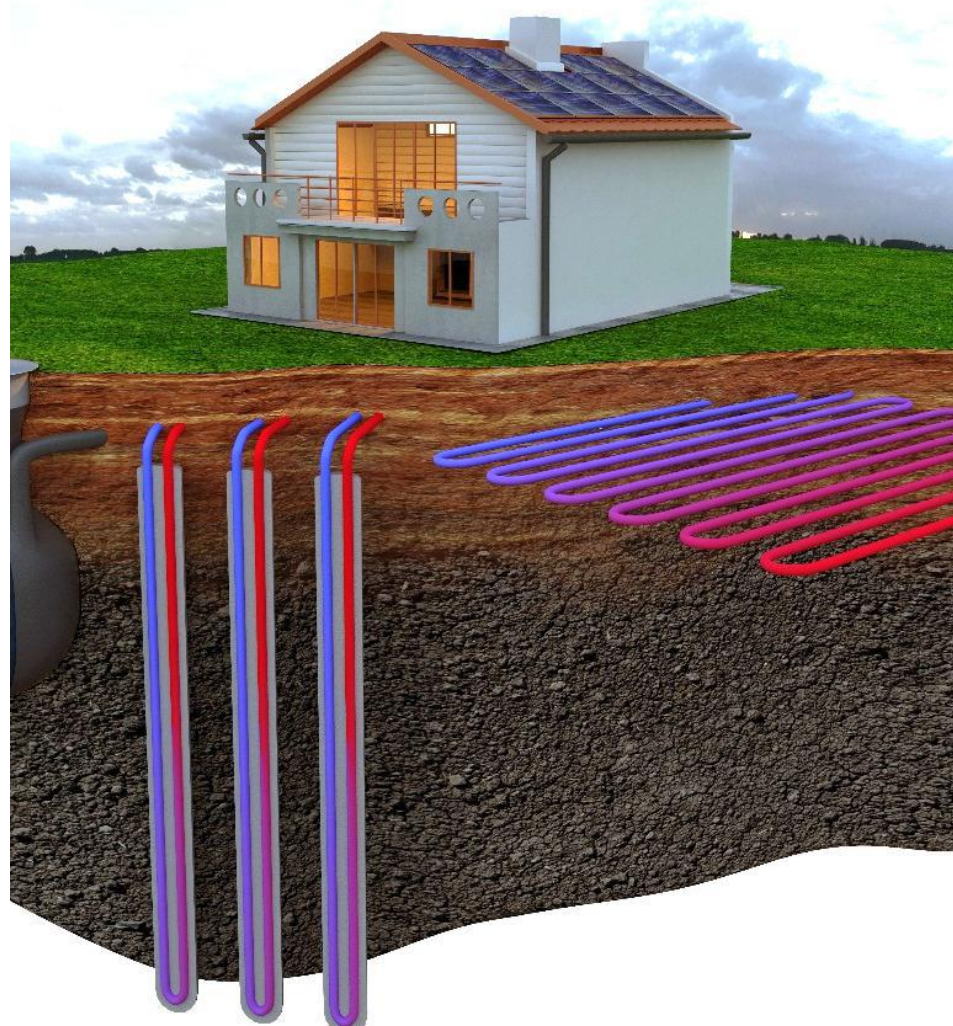


# RENEWABLE THERMAL: GROUND-SOURCE HEAT PUMPS

Collectors loop captures ground heat and compresses and transfers it to building distribution system

## Applications:

- Hot water and space heating
- Space cooling
- District energy





# RENEWABLE THERMAL: HIGH EFFICIENCY BIOMASS

## THERMAL

**Biomass chips and pellets burned in high efficiency boiler or furnace to create heat for building**

### **Applications:**

- Hot water and space heating
- Process heating
- District energy







# RENEWABLE THERMAL: COLD CLIMATE AIR SOURCE HEAT PUMP

Uses a refrigerant system involving a compressor and condenser to absorb heat from air in one place and release it in another

## Applications:

- Hot water and space heating
- Space cooling





# RENEWABLE THERMAL: BIOGAS AND BIODIESEL

Other technologies include renewable fuels like biogas or biodiesel

## Applications:

- Hot water and space heating





# Thank you!

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