



**V**ermont

*Governor's Commission on Climate Change*



# Energy Supply and Demand Technical Work Group Teleconference Meeting #1

October 30, 2006



**VERMONT**  
ENVIRONMENTAL CONSERVATION



CENTER FOR CLIMATE STRATEGIES

# Introductions

- Technical Work Group (TWG) members
- VT DEC
- CCS TWG leaders
- Public

# Today's Agenda

- Introductions
- Purpose and goals
- Review of the GCCC-PG and TWG process
- Brief review and discussion of the Vermont emissions inventory & forecast
- Review and discussion of the Catalog of State Actions
- Next Steps for TWGs
- Agenda, time, and date for next meeting
- Public input and announcements

# Part 1

- GCCC-PG and TWG Process

# Purpose & Goals

- December 5, 2005 Letter from Vermont Governor Jim Douglas
  - Governor's Commission on Climate Change
  - Climate Action Plan by September 1, 2007
    - Vermont greenhouse gas emissions inventory and forecast
    - Policy recommendations

# Roles & Responsibilities

- Process convened by Governor Jim Douglas
- VT DEC provides coordination and organization
- State agencies act as advisors
- GCCC to make ultimate recommendations to Governor
- GCCC created Plenary Group (GCCC-PG) to provide broader stakeholder input across Vermont sectors and life
- TWGs advise Plenary Group
- Public input and review
- CCS provides evaluative facilitation, final report

# Timing

- GCCC Plenary Group meetings
  - September, November, January, March, May, July
- TWG calls
  - Regularly scheduled
  - Two to three 90-minute calls between each Plenary Group meeting
- Work Products
  - GHG inventory & forecast
  - GCCC report to the Governor: September 2007

# Ten Step Work Plan

1. Develop initial GHG inventories and forecasts
2. Identify possible GHG mitigation options
3. Identify initial priorities for evaluation
4. Evaluate supply potential, cost effectiveness; additional and feasibility issues as needed
5. Identify barriers, alternative policy design needs
6. Modify, add or subtract options as needed
7. Evaluate cumulative results of options
8. Iterate to consensus, with votes as needed
9. Aggregate options into implementation scenarios
10. Finalize recommendations and report language

# TWG Next Steps

- Review and revision of Vermont greenhouse gas (GHG) inventory and forecast
- Identify “priorities for analysis” from catalog of states’ actions
  - Add existing and new VT options as needed
  - Rank and screen options
  - Suggest initial “priorities for analysis” to the GCCC-PG

# Sample Potential Options - Agriculture

Option No.	Climate Mitigation Option	Priority for Analysis	Potential GHG Emissions Reduction	Potential Cost or Cost Savings	Ancillary Impacts, Feasibility Considerations	Notes
<b>AFW-1</b>	<b>AGRICULTURE – PRODUCTION OF FUELS AND ELECTRICITY</b>					
1.1	Manure Digesters/Other Waste Energy Utilization**					
1.2	Biodiesel Production (incentives for feedstocks and production plants)					
1.3	Biomass Feedstocks for Electricity or Steam Production**					
1.4	Ethanol Production					

# Decision Criteria

- GHG reduction potential (CO<sub>2</sub>e)
- Cost per ton GHG removed
- Additional issues
- Feasibility issues

# Policy Template



**Policy Description:**

**Policy Design:**

- Goals:
- Timing:
- Coverage of Parties:

**Implementation Methods:**

**Related Policies/Programs in Place:**

**Estimated GHG Savings and Costs per tCO<sub>2</sub>e:**

- Data Sources:
- Quantification Methods:
- Key Assumptions:

**Key Uncertainties:**

**Additional Benefits and Costs:**

**Feasibility Issues:**

**Status of Group Approval:**

**Level of Group Support:**

**Barriers to Consensus:**

# End Product/Final Report

- Executive Summary
- Background, Purpose and Goals
- Policy Recommendations and Results
  - Agriculture, Forestry & Waste Management
  - Energy Supply
  - Residential, Commercial, Industrial
  - Transportation & Land Use
  - Cross-Cutting Issues
- Appendices

# Part 2

- VT Greenhouse Gas Inventory and Forecast review

# Vermont GHG Emissions

- Inventory and Reference Case Projections
- Initial analysis by CCS for further discussion and final revision
  - Inventory of historical emissions from 1990 to most recent data year (2000-2004, depending on sector)
  - Projection of emissions to 2020

# Coverage

- Six gases per USEPA and UNFCCC guidelines
  - Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous Oxide (N<sub>2</sub>O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur Hexafluoride (SF<sub>6</sub>)
  - Black Carbon considered separately
- All major emitting sectors
  - Electricity
  - Residential, Commercial, Industrial Fuel Use
  - Transportation
  - Agriculture and Forestry
  - Waste Management
  - Industrial Processes and Other Sources

# Inventory Approach

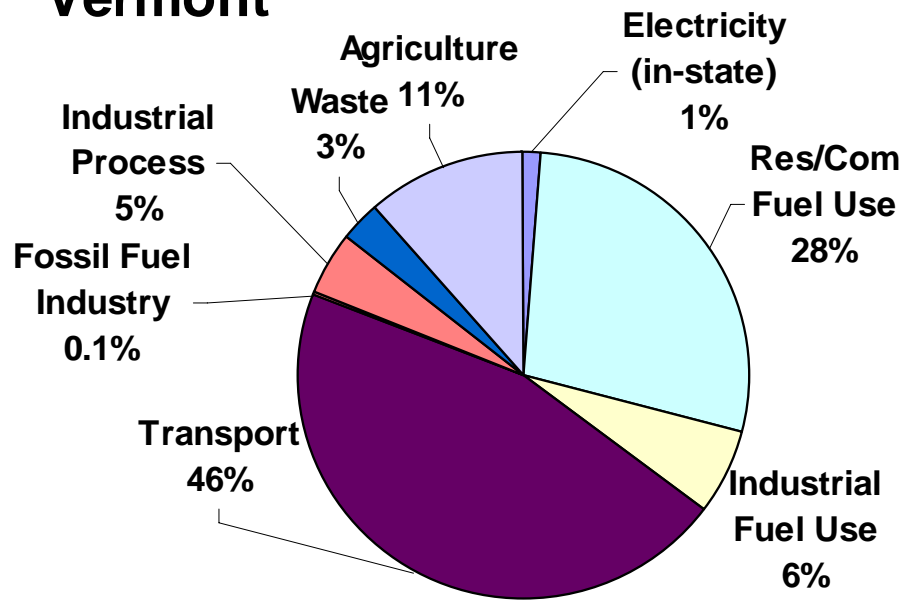
- Standard US EPA and UN methodologies, guidelines, and tools
- Emphasis on transparency, consistency, and significance
- Preference for Vermont or regional data, where available
- Consumption and production-basis emissions from electricity generation
  - Very simplified approach used for initial analysis

# Projection Approach

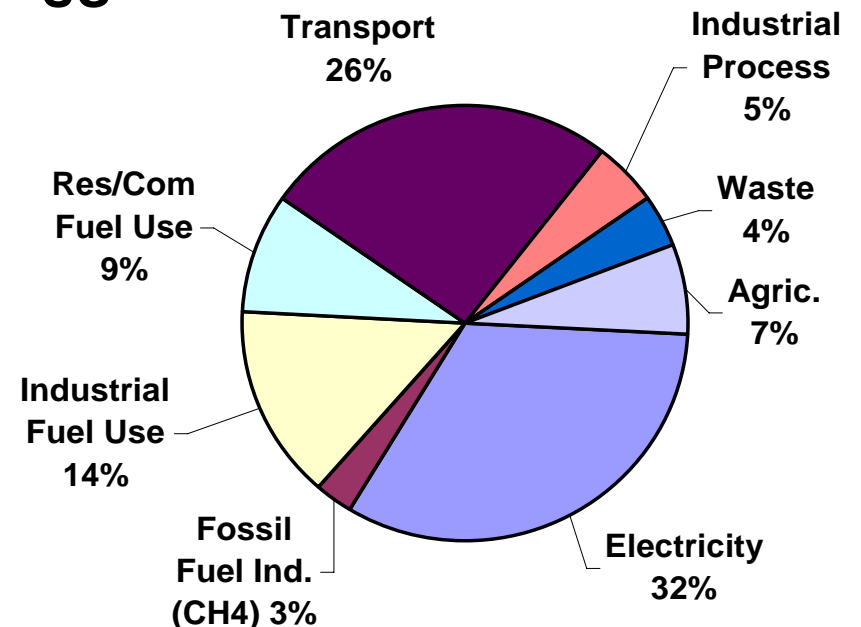
- Reference case assumes no major changes from business-as-usual
  - Includes approved policies and actions to the extent possible (e.g. Environmental Portfolio Standard)
- Growth assumptions from existing sources
  - US Census and Bureau of Labor & Statistics
  - US Energy Information Administration
  - Regional Planning Organizations (e.g. Mid-Atlantic – Northeast Visibility Union or MANE-VU)

# Vermont & US Emissions By Sector, Year 2000

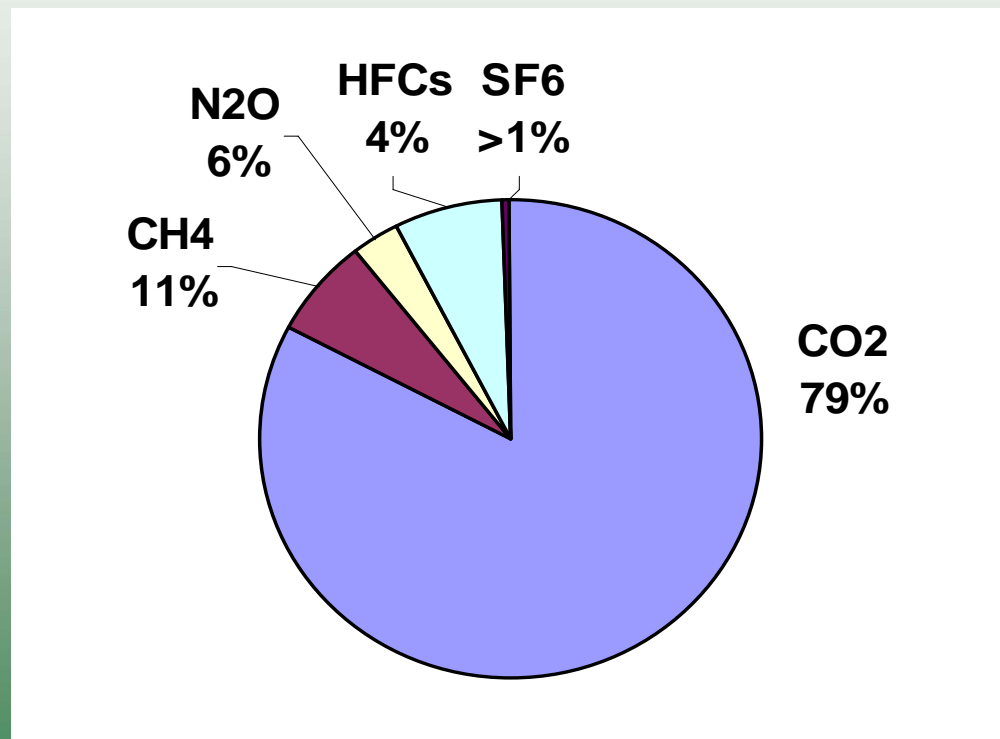
## Vermont



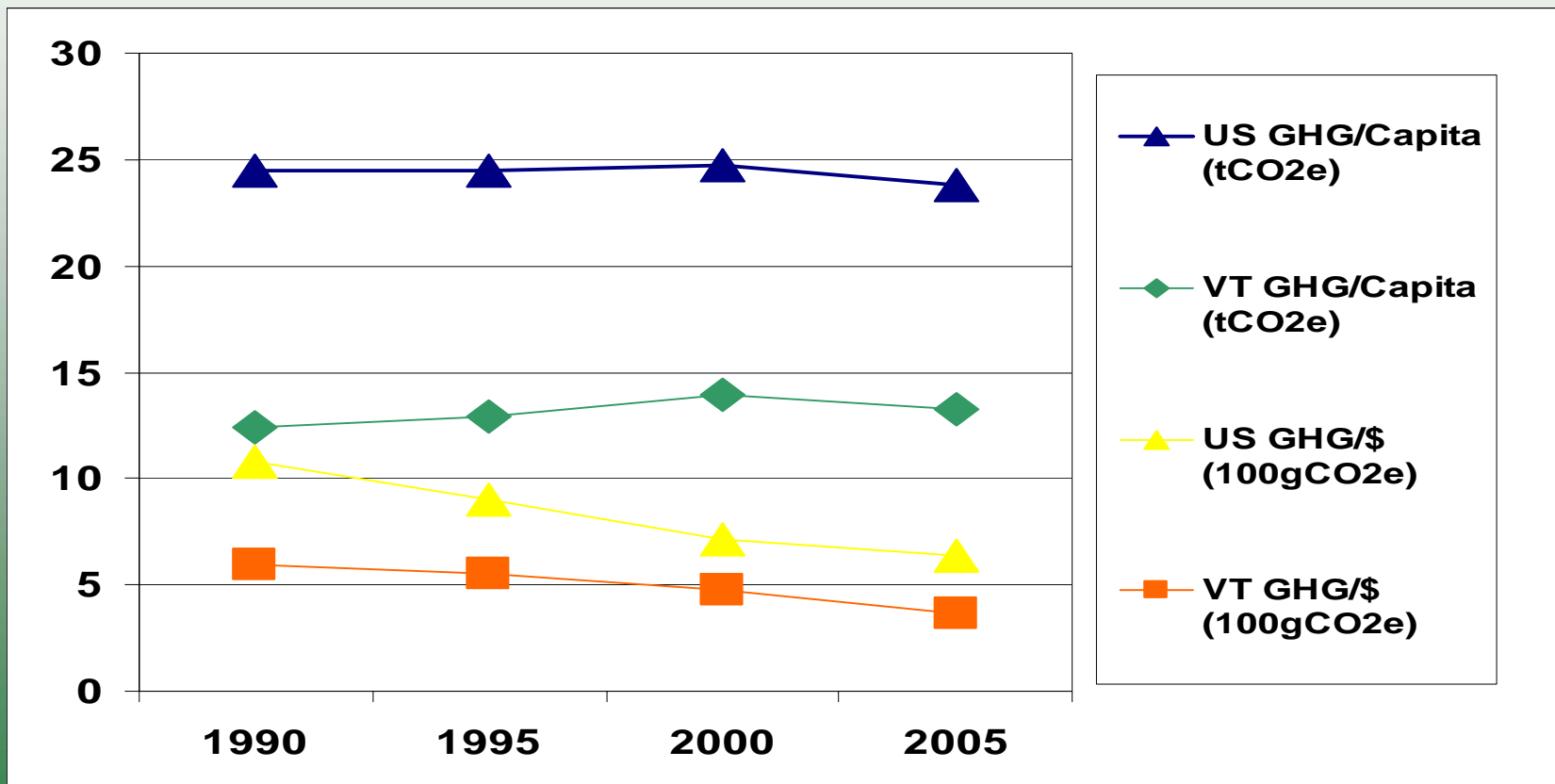
## US



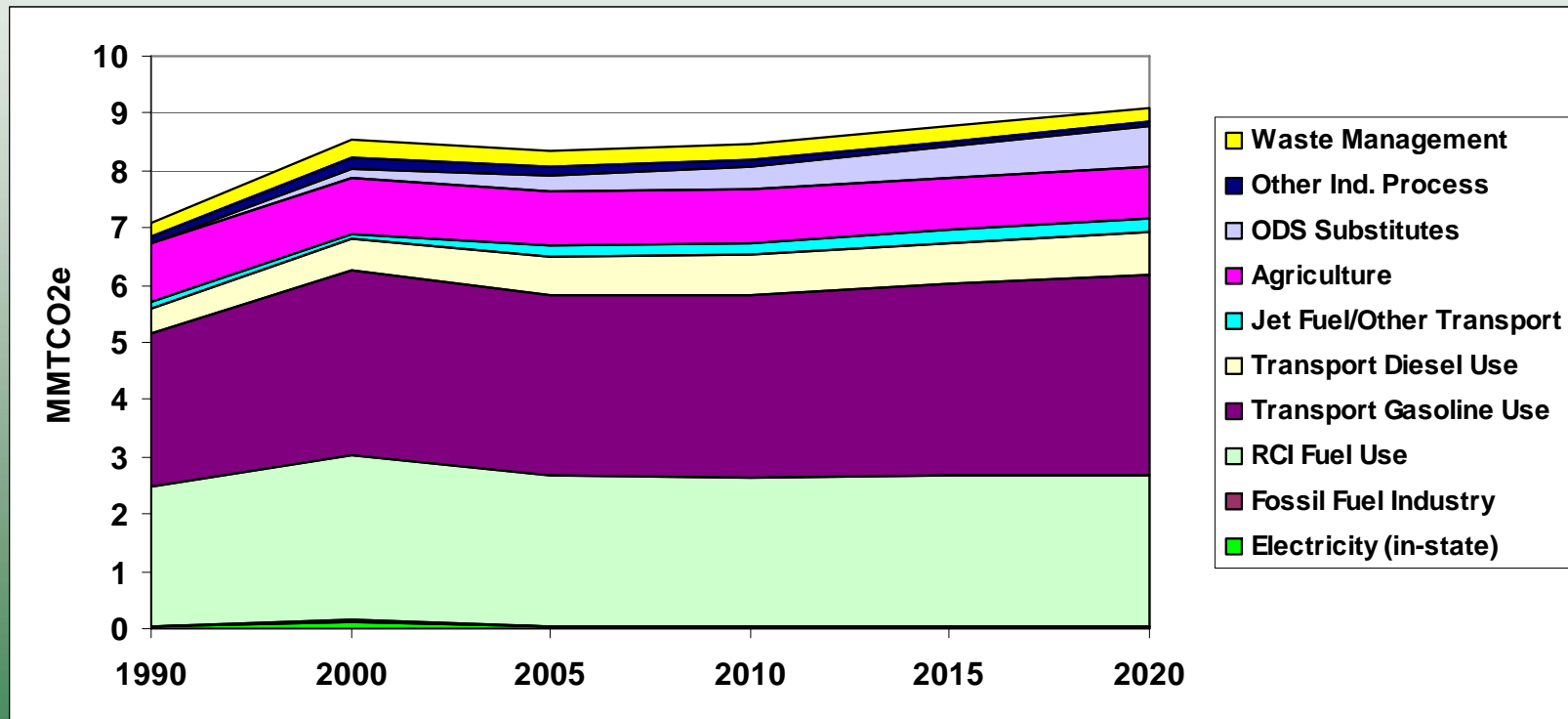
# Vermont Emissions By GHG, Year 2000



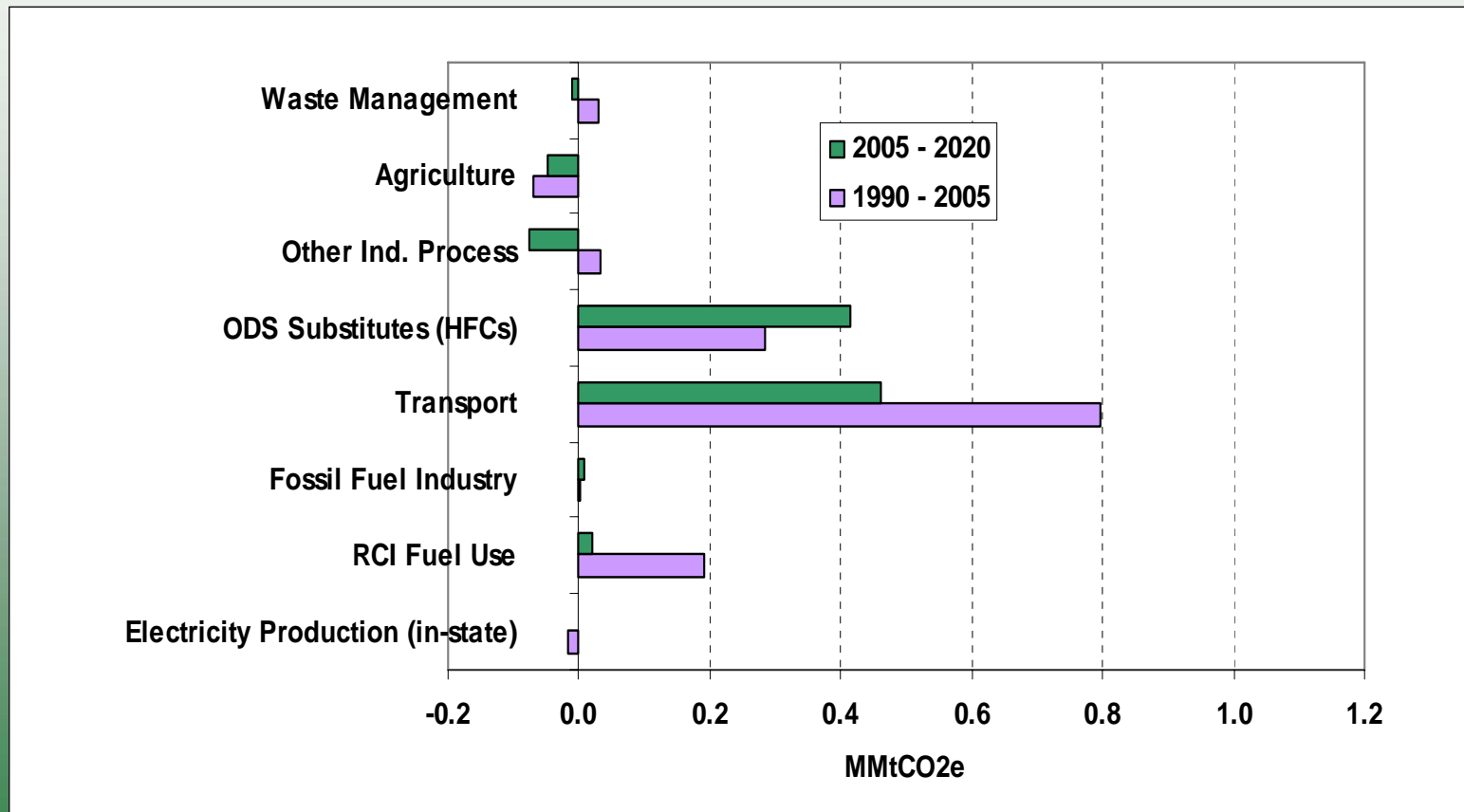
# Per Capita and GSP/GDP GHG Emissions, 1990-2002



# Gross Vermont GHG Emissions By Sector, 1990-2020



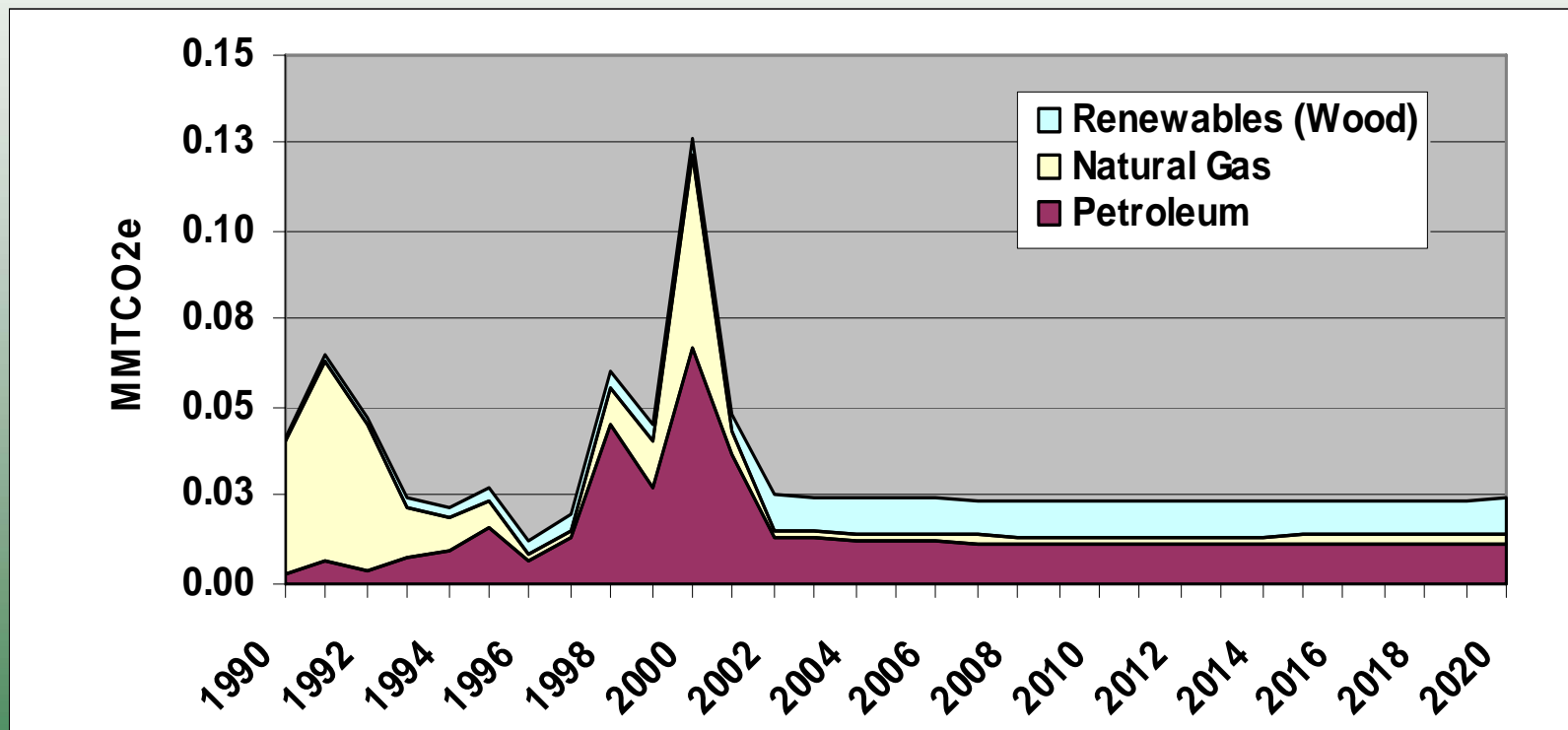
# Vermont Emissions Growth



# Key Points

- Preliminary draft for TWG review and revision, as needed
- Helpful for diagnosis of GHG emissions, but not a compliance baseline
- Consumption v. production methods
- Role of carbon storage

# Electricity



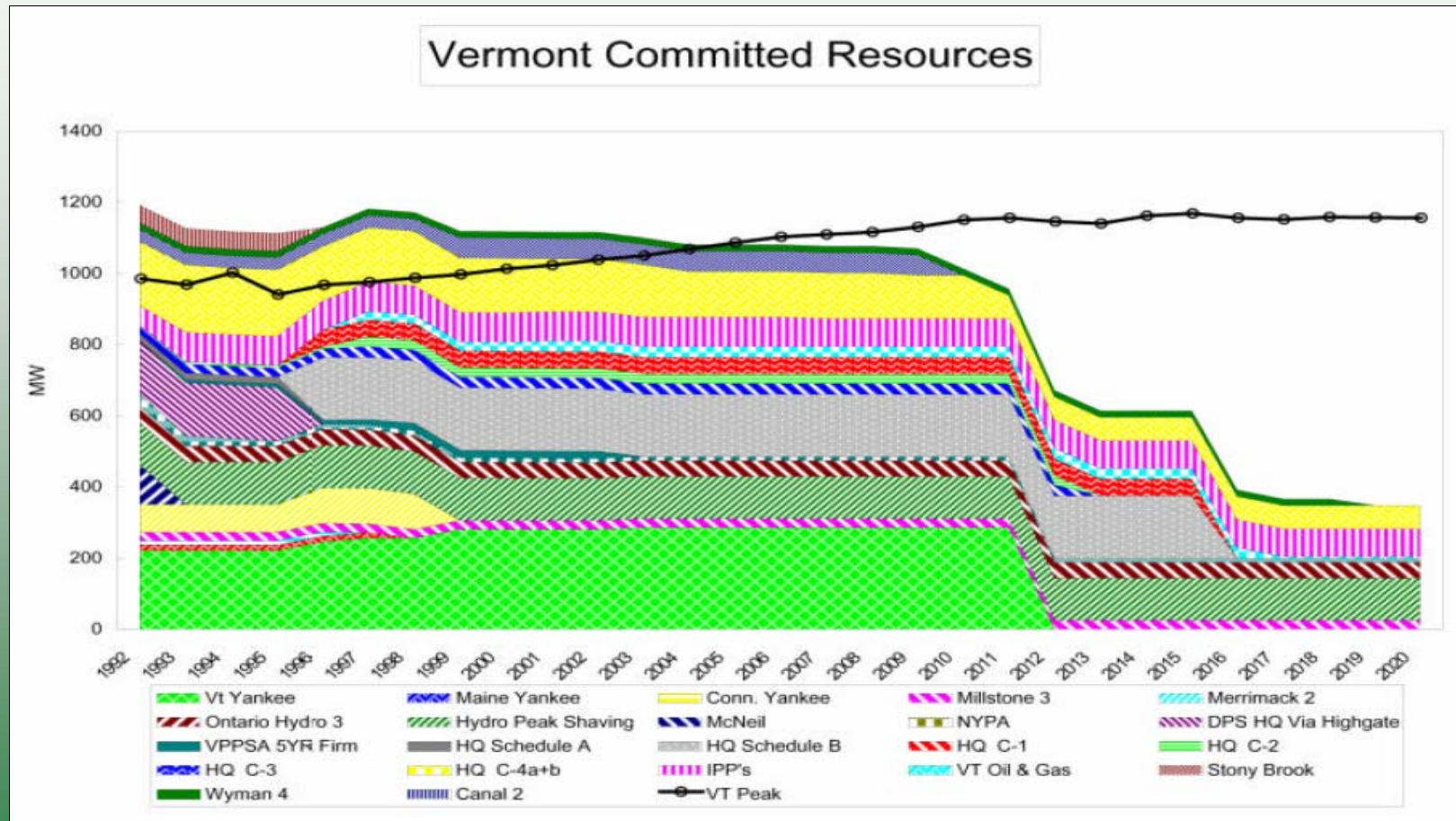
# Electricity

- Data Sources
  - EIA State Energy Data (SED)
    - Historic energy consumption for natural gas (NG), oil, wood
  - EIA Annual Energy Outlook 2006 (AEO2006)
    - Projected regional consumption, amount and type, for the New England states
  - Vermont Electric Plan 2005
- Methods
  - Historic – use energy consumption and emission factors
  - Projections for energy based on growth and mix of new generation, emissions based on energy X emission factors

# Electricity

- Key Assumptions
  - BAU
    - VT Yankee (nuclear) license renewed
    - AEO2006 regional forecasts for NG, oil, & wood are reasonable
- Key Uncertainties
  - Growth rate & mix of replacement / new generation
  - Consumption-based estimates for imports not yet estimated

# Electricity



Source: Vermont Energy Plan, 2005

# Electricity

- Contributors to Looming Supply Gap
  - VT Yankee –
    - 34% of total generating capacity in 2002
    - License expires March 2012
  - Hydro-Quebec
    - 32% of total generating capacity in 2002
    - Ramp-down from 2012 to 2018  
(~98% of HQ capacity coming off-contract)

# Electricity

## Electricity Generation Resource Mix Options from VT Electric Plan, 2005

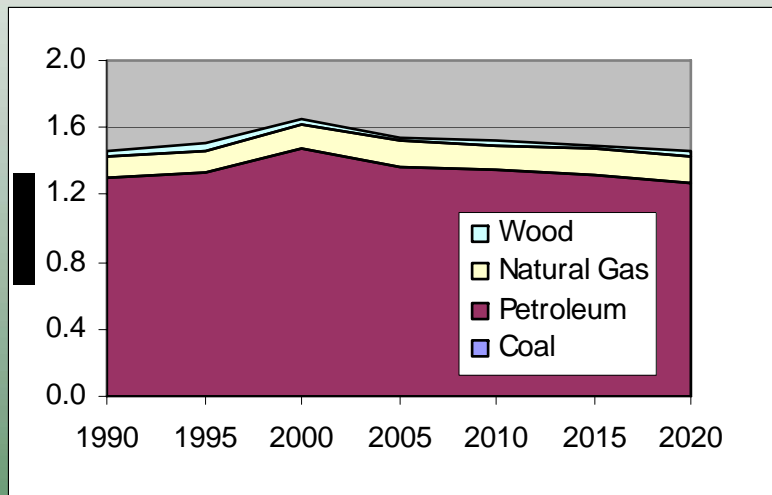
Resource	2002	2015	2025
Nuclear	34.0%	---	---
Hydro-Quebec	32.0%	---	---
Market Purchases	13.5%	40.0%	35.0%
In-state Resources	13.5%	35.0%	35.0%
Demand Side Management	6.5%	15.0%	20.0%
Connecticut River Hydro	---	7.0%	5.0%
On-site Generation	---	3.0%	3.0%
Solar	---	---	2.0%

# Electricity

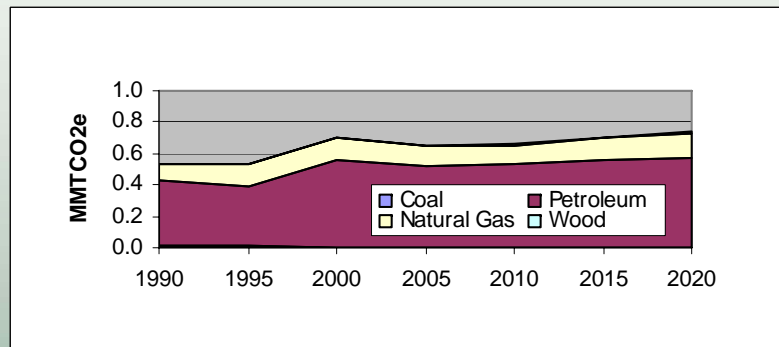
- Electricity Generation Resource Mix Assumptions
  - 2002:
    - Market purchases assumed to be non-GHG emitting
    - In-state resource fuel mix:
      - 6.4% hydro (in-state)
      - 4.6% other renewable (wind, biomass)
      - 1.5% oil
      - 1% gas
  - 2015-2025:
    - Fuel mix not defined for market purchases, in-state resources, and on-site generation

# RCI

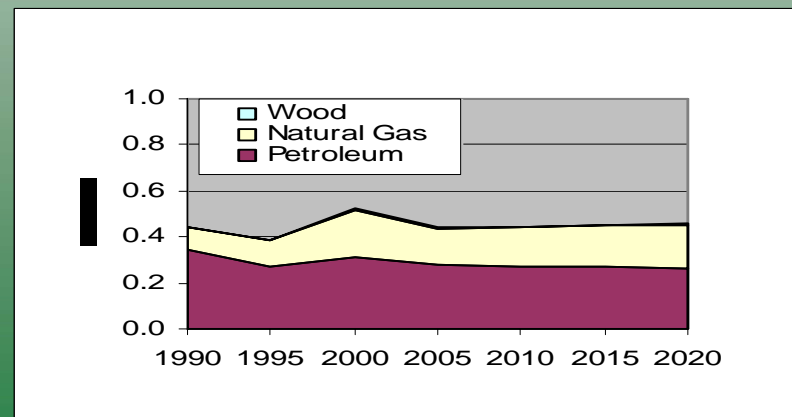
## Residential Sector



## Commercial Sector



## Industrial Sector



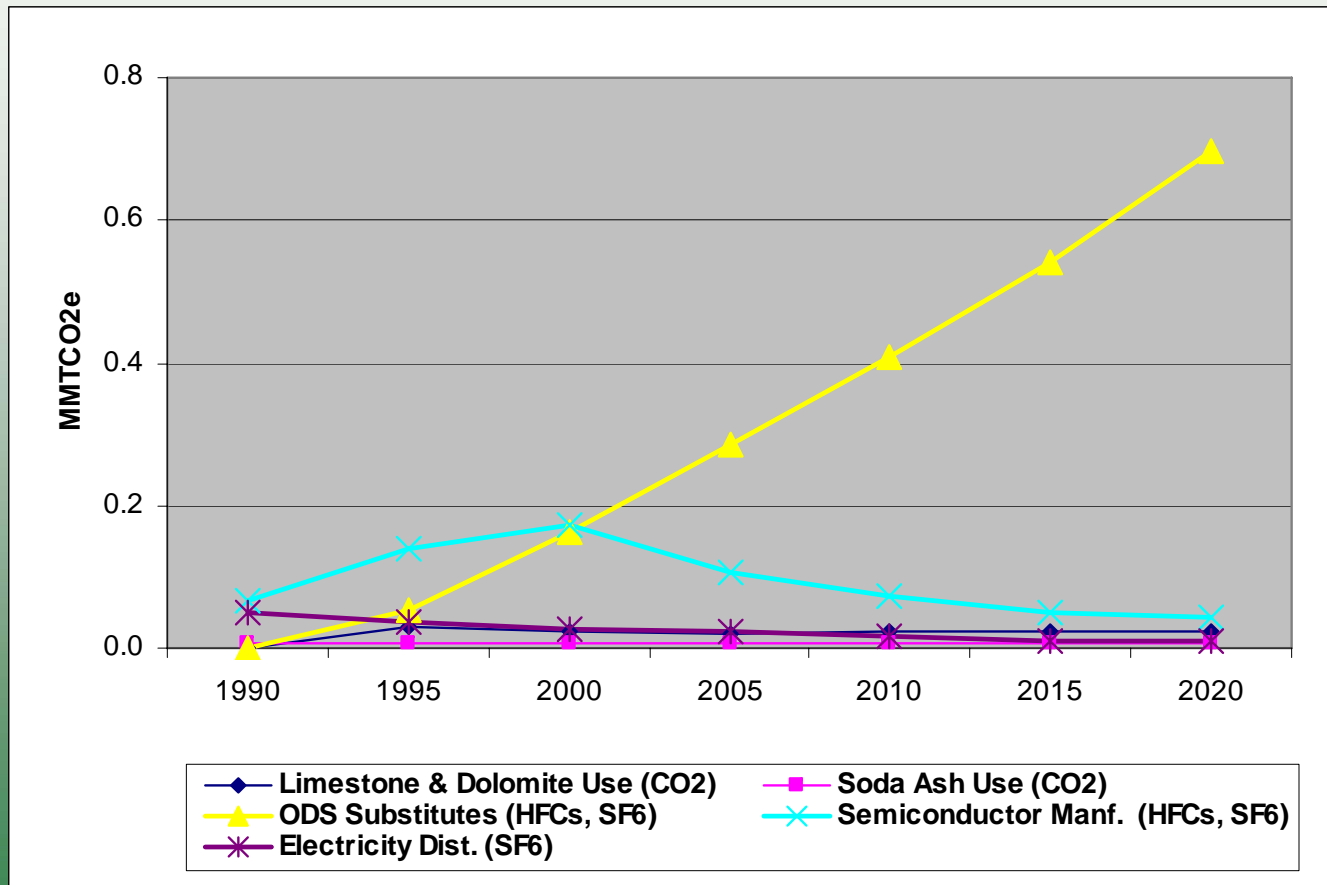
# RCI

- Data Sources
  - EIA State Energy Data (SED)
    - Historic energy consumption for NG, oil, wood, coal
  - EIA Annual Energy Outlook 2006 (AEO2006)
    - Projected consumption, amount and type
- Methods
  - Energy consumption multiplied by emission factors
  - Estimates for energy consumed by natural gas transmission and distribution reported under Fossil Fuel Production sector

# RCI

- Key Assumptions
  - Projections based on regional projections scaled for VT population and economic growth projections
- Key Uncertainties
  - RCI wood consumption projections
  - Industrial sector growth and mix

# Industrial Process



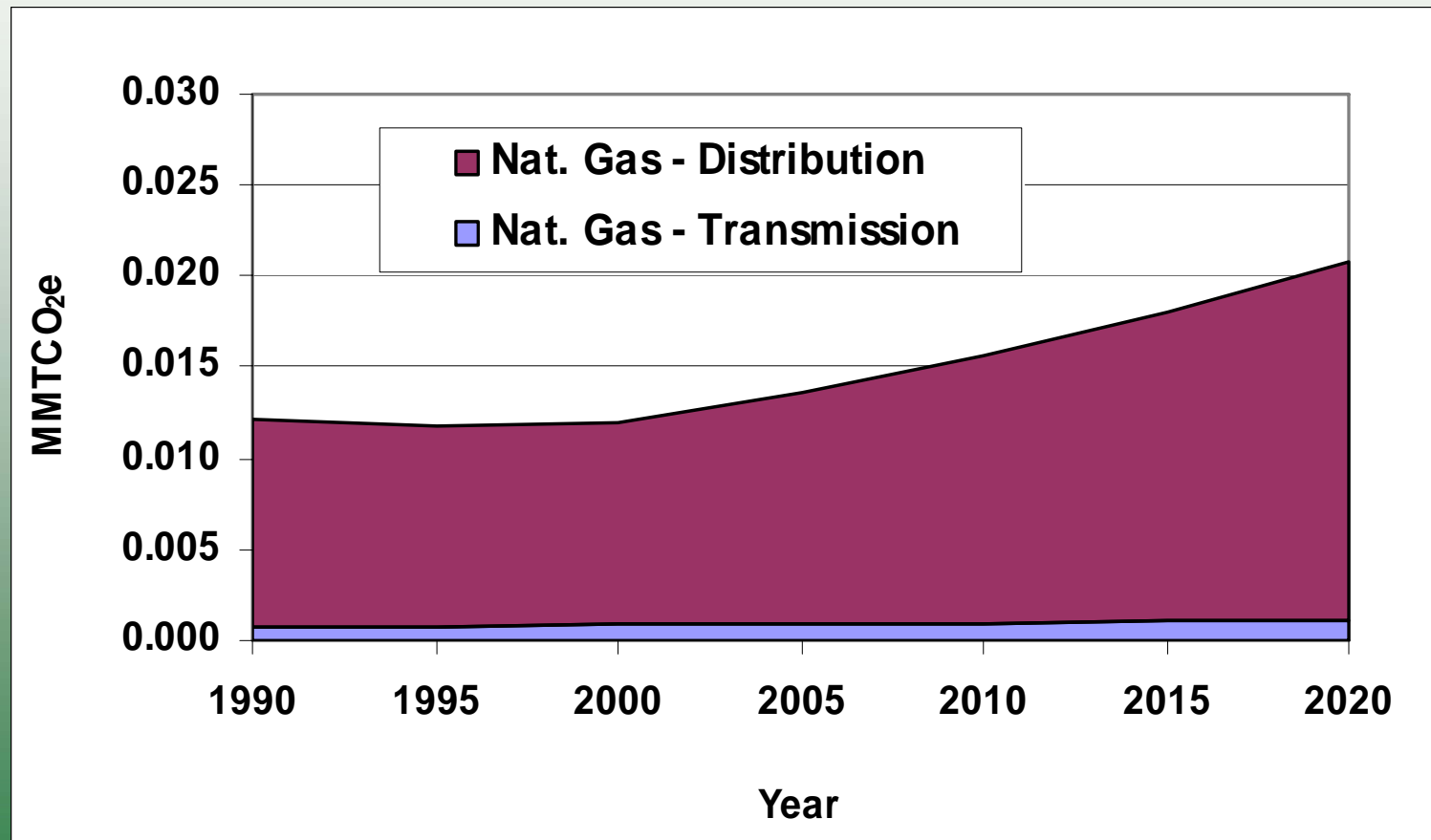
# Industrial Process

- Data sources
  - US EPA National GHG Inventory for national emissions from ODS substitutes, electric distribution, and semiconductor manufacturing
  - USGS data
    - Soda ash production use
    - Limestone and dolomite use
- Methods
  - Based on US State GHG Inventory Tool
  - Scale national to state (ODS subs, Electricity Tans./Dist.)
  - Activity X emission factors (all other)

# Industrial Process

- Key Assumptions
  - Growth Rates
    - ODS subs and Elec. Dist. –
      - National growth rate (US State Dept and US EPA)
    - Limestone/dolomite use –
      - Grown with VT manufacturing employment (0.1% per year)
- Key Uncertainties
  - Industry activities to reduce GHG emissions

# Fossil Fuel Production



# Fossil Fuel Production

- Data sources
  - Natural Gas –
    - US Office of Pipeline Safety
      - Miles of transmission and distribution pipeline
    - No oil or gas production in VT
- Methods
  - Based on US State GHG Inventory Tool

# Fossil Fuel Production

- Key Assumptions
  - Growth Rates
    - Distribution pipelines – 3% annual (VT DPS)
    - Transmission pipelines – 1% annual (based on 1990-2005 growth rate)
- Key Uncertainties
  - Growth rates

# Part 3

- Draft Potential GHG Mitigation Options

# CCS Catalog of State Actions

- Actions undertaken or considered by a wide variety of US states
- Many actions provide GHG reductions coincidentally or as a co-benefit
- Cover all economic sectors
- Cover many implementation mechanisms

# Categories of Electricity Generation Actions

- Expand low emitting and renewable sources
- Reduce fuel extraction and process emissions
- Reduce delivery related emissions
- Capture and store carbon (sequestration)
- Remove particulates (black carbon)

# Categories of Residential, Commercial, Industrial Actions

- Increase energy efficiency and conservation
- Reduce industrial process related emissions
- Expand waste recovery and recycling
- Expand low embedded energy products
- Shift to low emitting product inputs

# Categories of Transportation Actions

- Reduce travel demand for passengers and freight (location efficiency, community design, mode choice)
- Reduce vehicle emissions for cars and trucks
- Expand use of low emitting (renewable) fuels
- Remove fine particulates (black carbon or soot)
- Reduce emissions from service equipment

# Categories of Agriculture Actions

- Protect farmland and existing carbon stocks, biomass supplies
- Expand soil carbon storage and future carbon stocks, biomass supplies
- Expand renewable energy production
- Reduce process/waste emissions
- Increase energy recapture and reuse
- Improve animal feed efficiency
- Reduce food delivery/transportation emissions

# Categories of Forestry Actions

- Protect forestland (existing carbon stocks) from permanent clearing
- Restore and expand forests (expand carbon stocks)
- Improve forest regeneration and stocking (increase carbon stock densities)
- Sustainable thinning and density management of forests
  - Expand wood products carbon storage
  - Expand renewable biomass energy use
- Recycle wood products biomass waste to energy

# Categories of Waste Management Actions

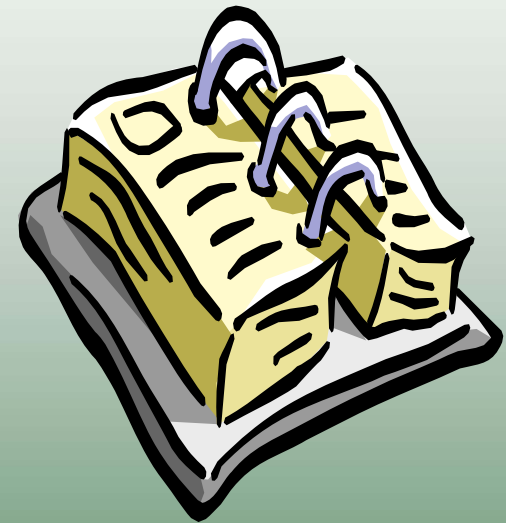
- Expand solid and liquid waste energy recovery
- Expand low emitting waste storage
- Expand source reduction, reuse, recycling
- Expand energy efficient processing of waste

# Categories of Cross-Cutting Actions

- Inventory and Forecasts
- GHG Reporting
- GHG Registry
- Public Education and Outreach
- Adaptation
- Goals/Targets
- State's Own Emissions

# Next TWG Call

- Agenda:
  - Discuss potential priorities for analysis of policy options
  - Review the Vermont emissions inventory and projection
  - Tentative: Tuesday, November 28, 2006 from 1:30 - 3:30 p.m.



# Public Input, Announcements