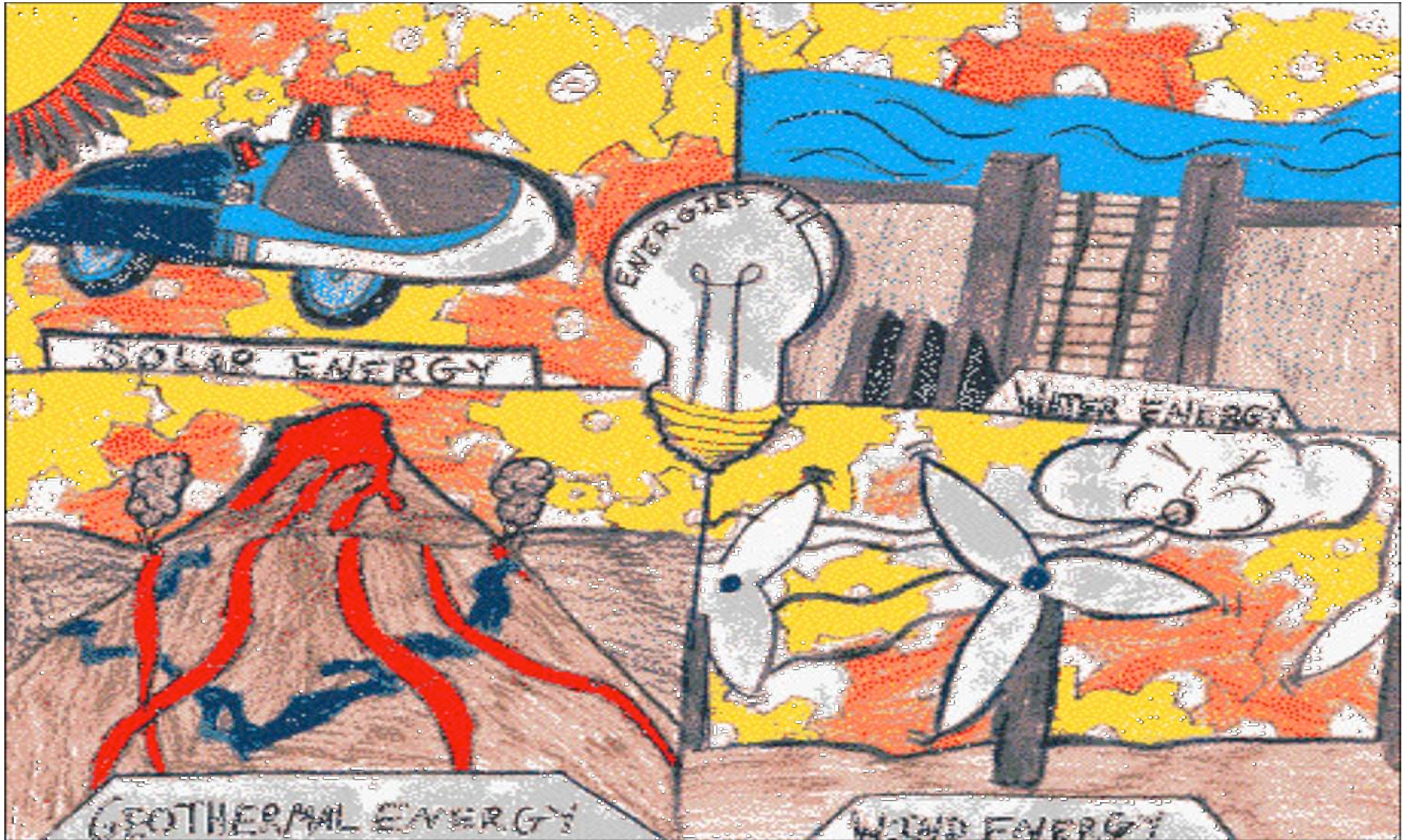


California's Energy Future



Artist: **Jon Wingo**, Fourth grader at Preston School, Rialto, California

Origins

- America's Energy Future study by NAS
- CCST history of doing California versions of NAS reports (eg Gathering Storm)
- Implementation of AB32 and the Governor's Executive Order creates special needs for analysis of energy Technology, Opportunities, Risks, Tradeoffs, and policy implications

California's Energy Future (CEF)

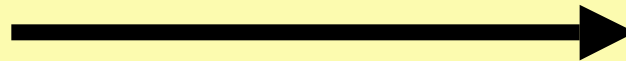
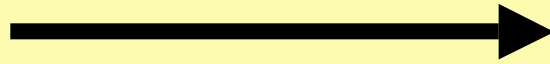
America's Energy Future:

- Technology
- Opportunities,
- Risks, and
- Tradeoffs

+

- Other California energy issues
- Policy implications

Meaning for CA?



California's Energy Future

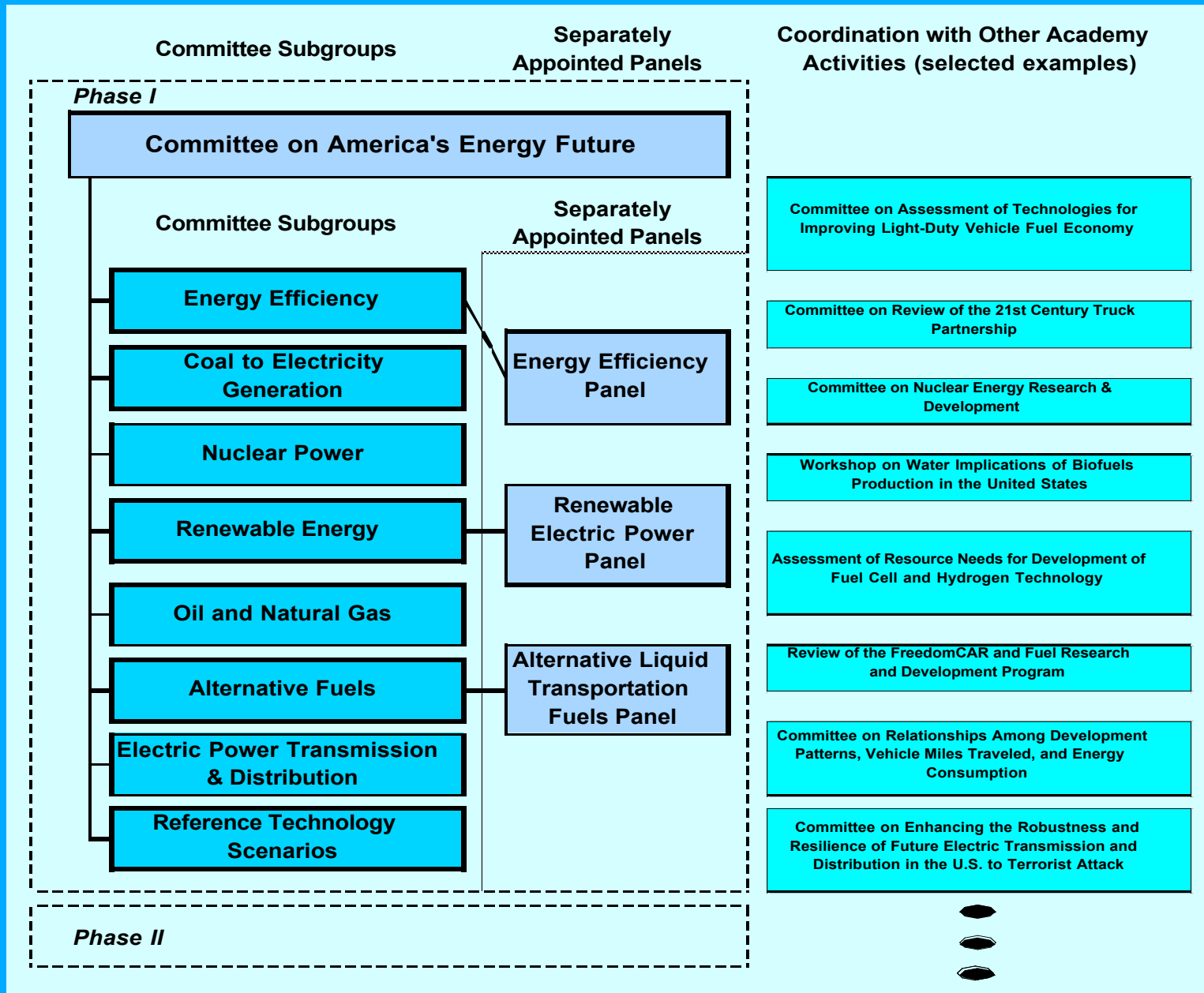
Current Energy Policy Context for AEF: Several Continuing Debates

- Near-term prospects of alternative fuels: grain-based ethanol, lignocellulose-based ethanol, liquid fuels from coal, butanol, and others
- Fuel economy standards for automobiles and light trucks. Litigation on state-specific fuel economy regulation
- Options for reducing greenhouse gas emissions from U.S. energy consumption; Supreme Court decision on regulating CO₂ as a pollutant
- Prospects for restoration of construction of new nuclear power plants in the U.S.
- Maturity of renewable technology to support renewable portfolio standards for electric power generation

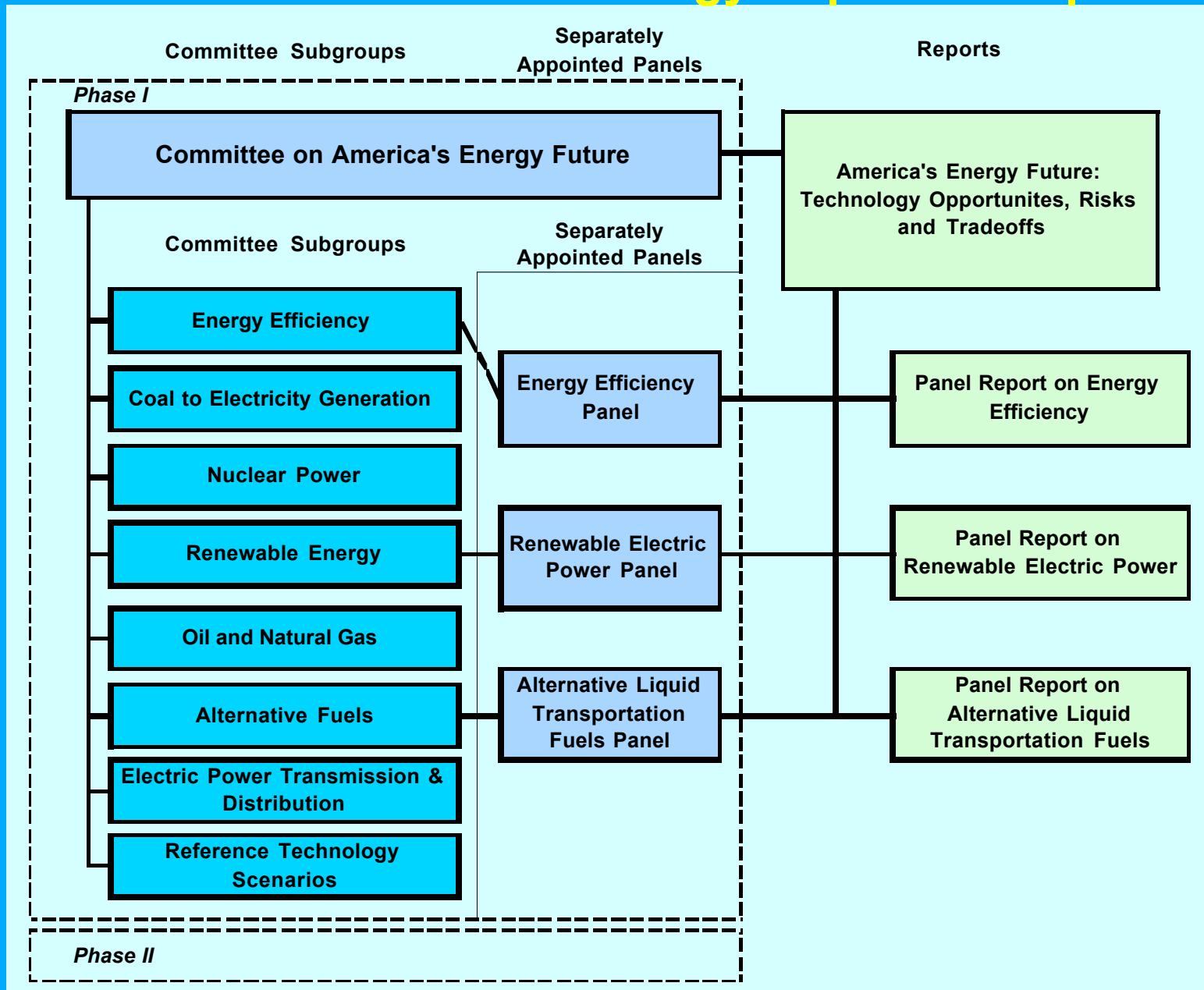
Status of AEF “portfolio” of projects:

- Phase I: Foundational study on energy technology cost, performance, and impact underway
- Phase II: Studies on policy, R&D, impacts, international implications, and others being planned
- The project is sponsored by the National Academy of Engineering, National Research Council, Dow Chemical, Kavli Foundation, Intel Corporation, and the Department of Energy. The completion date for the project is late fall 2008.

Provisional America's Energy Future Project Structure



Provisional America's Energy Expected Reports



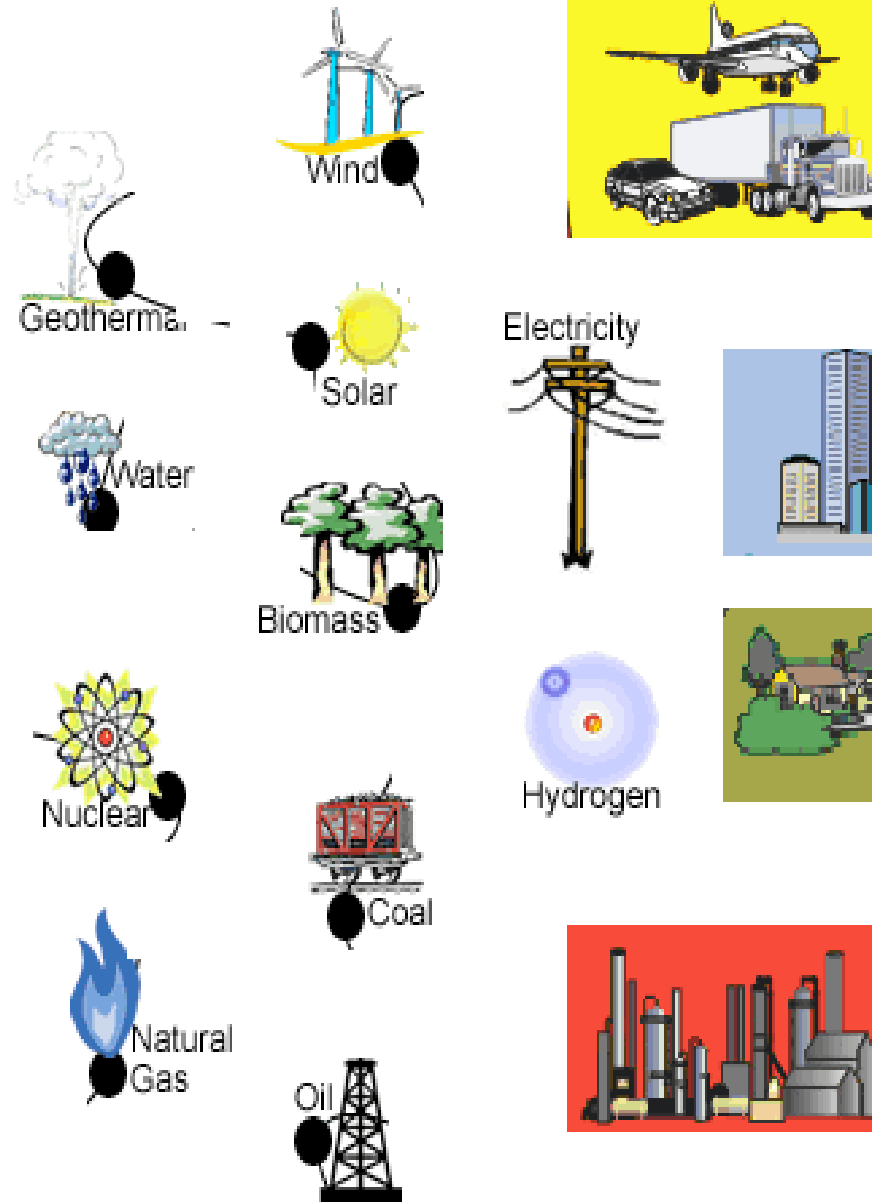
Products of AEF

- For current technologies and technologies (initial deployment within the next decade):
 - estimates of costs,
 - performance, and
 - impacts.
- For technologies with deployment between 10 and 25 years:
 - key factors that enhance or impede adoption,
 - implications for costs
 - R&D challenges.

Expected Principal AEF Report

Providing estimates of:

- current use and future potential of existing energy supply and demand technologies,
- environmental or other impacts,
- projected costs and potential for new technologies deployable within the next decade.



Expected Principal Contribution

Foundation (**Phase 1**) for a portfolio of subsequent Academy studies (**Phase 2**) and those of others related to areas such as:

- **prospects for alternative fuels**
- **strategies for greenhouse gas emissions reduction**
- **energy transportation policy**
- **energy research and development priorities**
- **strategic energy technology development**
- **policy analysis**

California Context

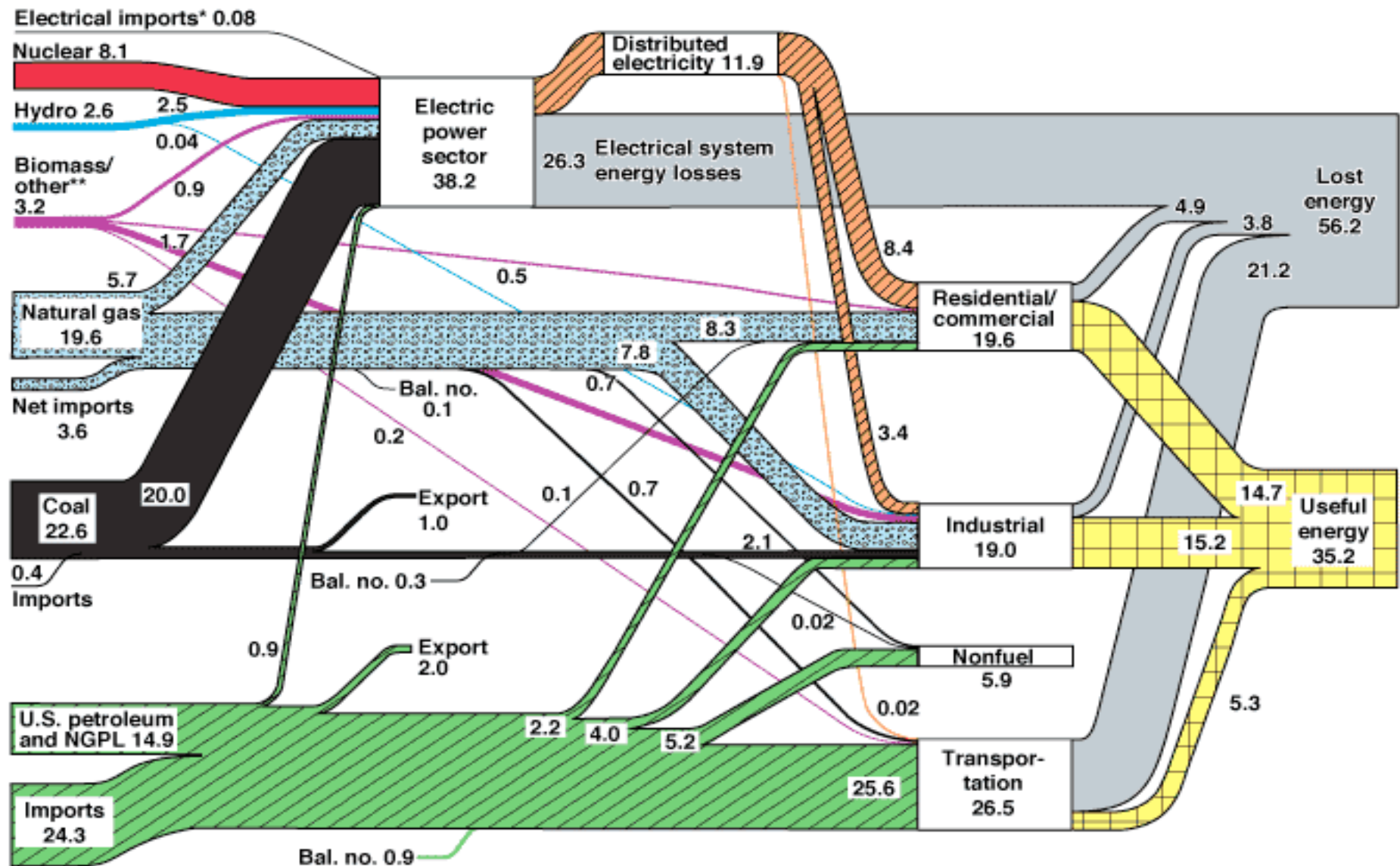
- California leading the nation in response to climate change.
- AB 32 Requires reducing GHG emissions to 1990 levels by 2020 - a reduction of about 25 percent,
- Governor's executive order (2005) requires an 80 percent reduction below 1990 levels by 2050.

Major Risks

- **Timing**
- **Technology limits**
- **Costs**
- **Implementation barriers**
- **Unexpected impacts**
- **Not meeting the targets – electric car redux**

U.S. Energy Flow Trends – 2002

Net Primary Resource Consumption ~97 Quads



Source: Production and end-use data from Energy Information Administration, *Annual Energy Review 2002*.

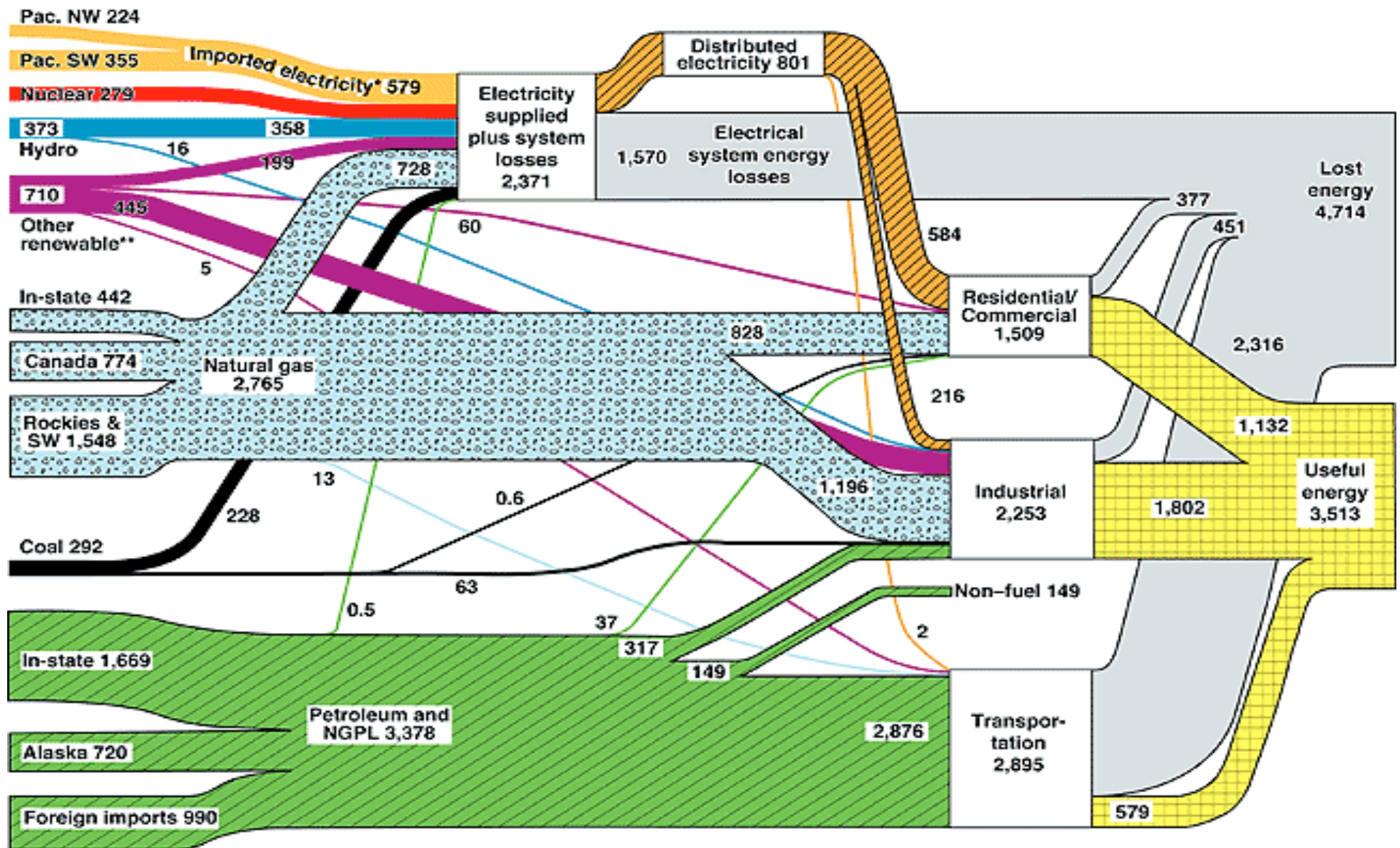
*Net fossil-fuel electrical imports.

**Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

June 2004
Lawrence Livermore
National Laboratory
<http://eed.llnl.gov/flow>

California Energy Flow Trends– 1999

Net Primary Resource Consumption ~8375 Trillion Btu (8.375 Quads)



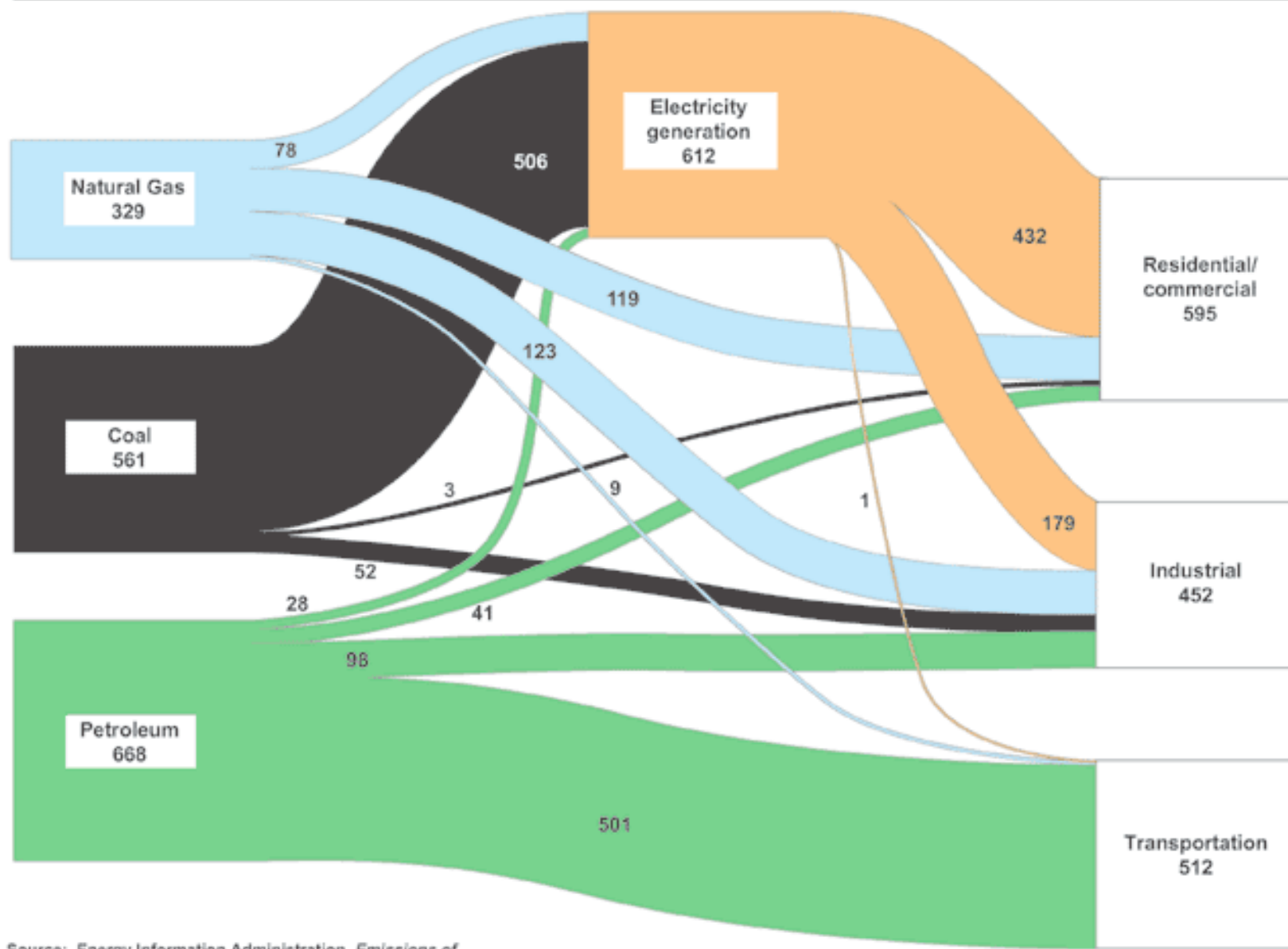
Sources: U.S. Department of Energy's Energy Information Administration and California Energy Commission.

*Electricity flowing into the California control areas: CAISO, LADWP, and IID.

**Other renewable includes geothermal, wood and waste, solar, and wind.

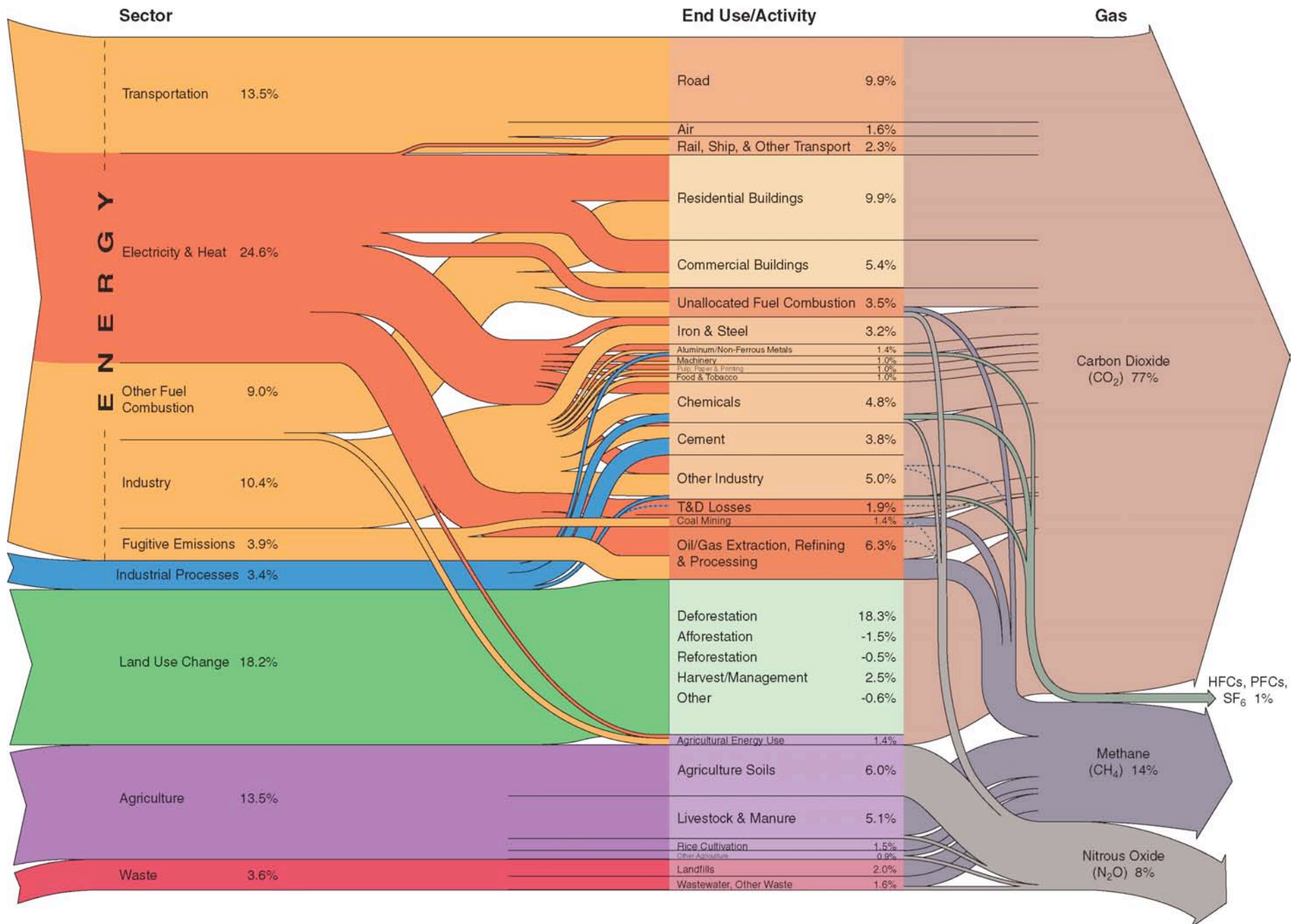
May 2003
Lawrence Livermore
National Laboratory
<http://en-env.llnl.gov/flow>

U.S. 2001 Carbon Emissions from Energy Consumption – 1547* MtC

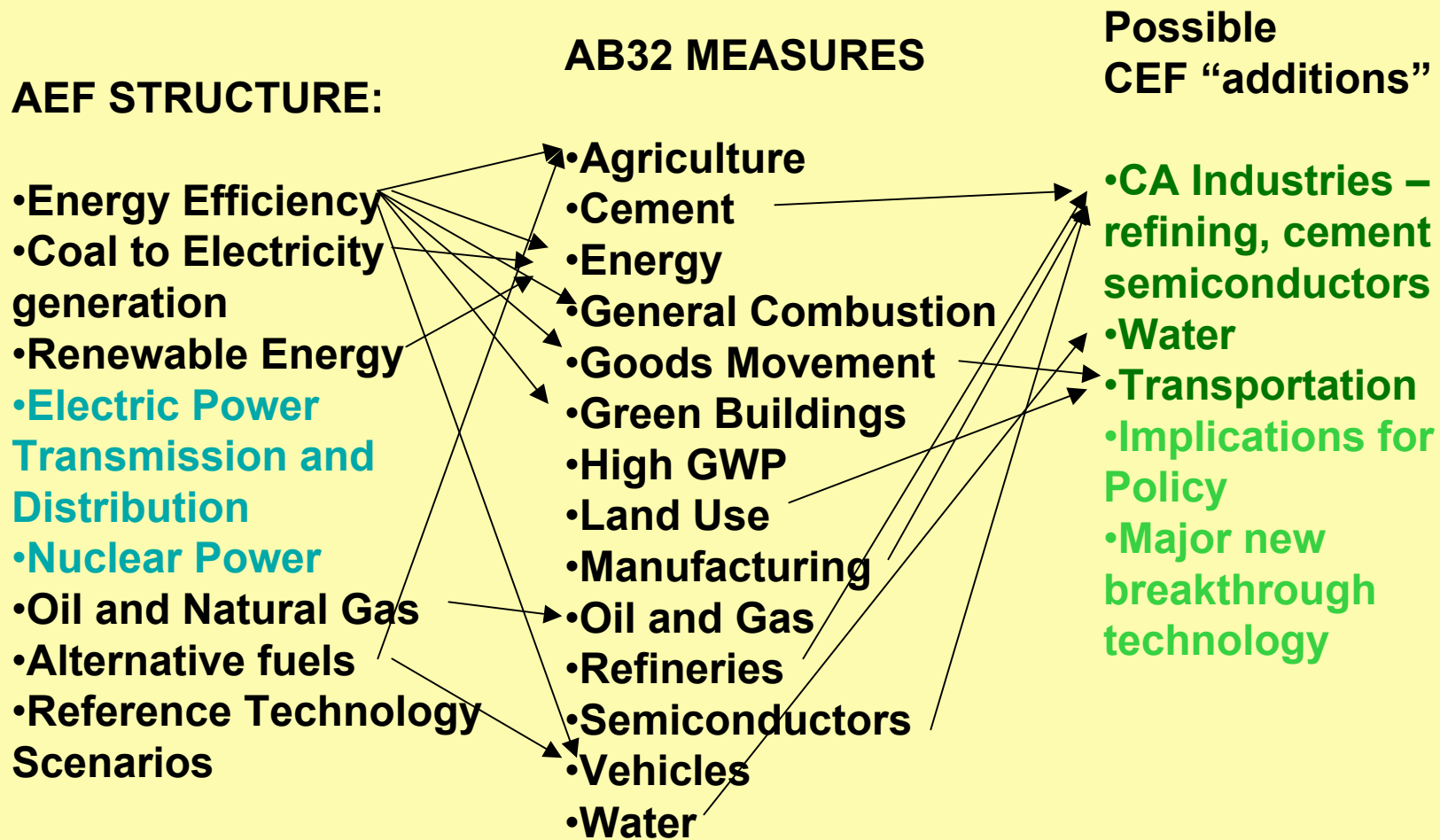


Source: Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2001*
 *Includes adjustments of 14.8 million metric tons of carbon (MtC) from U.S. territories, less 26.4 MtC from bunker fuels
 Note: Numbers may not equal sum of components because of independent rounding

GHG Flow Diagram: Global Greenhouse Gas Emissions



Mapping AEF to CA to CEF



AEF cannot be mapped to California in a vacuum, for example

- **CEC Integrated Energy Policy Reports and supplemental reports**
- **CEC-CPUC Energy Action Plan**
- **CEC-CPUC California Solar Initiative**
- **Governor's Bioenergy Action Plan and associated Executive Order**
- **joint CEC-ARB State Alternative Fuels Plan**
- **Governor's Climate Action Plan and related Executive Orders**
- **Western Governors Association Clean and Diversified Energy Initiative and the Transportation Fuels for the Future**
- **Economic Advancement Advisory Committee Report**
- **etc**

Projected Costs

- AEF is a \$3,000,000 effort
- CEF is currently estimated to cost \$400K
- Fundraising effort underway
- Goal is no more than 50% funding from industry

Steering committee:

- Co chairs: Mim John, Jane Long
- Larry Pappay
- Maxine Savitz
- Jim Sweeney
- Charlie Kennel
- Susan Hackwood

California members of the AEF committee.

- **AEF Technology Opportunities, Risks and Tradeoffs Committee**

- Steven Chu (A, T)
- Lynn Orr (F, R)
- Larry Papay (R, T)
- Aristides Patrinos (A, R)
- Maxine Savitz (E, R)
- Jim Sweeney (S, A)

- **Alternative Transportation Fuels**

- Jim Sweeney

- **Reference Technology Scenarios**

- Nari Hingorani

- **Renewable Electric Power**

- Charles Gay
- Sossina Haile
- Nathan Lewis
- Carl Weinberg
- Kurt Yeager

- **Energy Efficiency**

- Linda Cohen
- Magnus Craford
- David Goldstein
- Daniel Sperling
- Maxine Savitz
- Art Rosenfeld

(F-=Fossil, N=Nuclear, R=Renewables, E=Energy Efficiency, A=Alternate Fuels, T-T&D, and S=Scenarios).

CEF possible subcommittees:

- Energy Efficiency and conservations
- Coal to Electricity Generation
- Nuclear Power
- Renewable Energy (incl electricity)
- Oil and Natural Gas
- Alternative Fuels
- Electric Power Transmission and Distribution
- Reference Technology Scenarios
- CA Industries – refining, cement semiconductors
- Water
- Transportation
- Implications for Policy
- Major new breakthrough technology

Schedule (draft)

June 2, 2008	Initial meeting of California based AEF participants. Scope, committee structure and overall work plan proposed.
July 2008	Meet with California Stakeholders: Review work plan and proposed project. Modify these with stakeholder input.
Aug 2008	Subcommittees formed and chairs appointed
Nov 2008.	First draft ready for review
Dec 2008	Subcommittee drafts completed
Feb 2009	Final report
March 2009	Energy summit: present results

