AIChE ASME AIME IEEE ASCE
Carbon Management

Funded by the United Engineering Foundation

TECHNOLOGIES FOR CARBON MANAGEMENT

A Founder Societies' Project Initiative

VERONIKA RABL

IEEE LEAD TECHNICAL MEMBER

JULY 27, 2010

IEEE-USA

IEEE Advancing Technology for Humanity

IEEE PES Power & Energy Society®

Outline

What is it

Project elements

- Scorecards
- Gaps & Barriers
- Carbon Measurement

New starts

- Metrics & boundaries
- CCS Network
- Carbon Management Conference

Funded by the United Engineering Foundation

Grand Challenge Initiative

Project concept – 2008

- Carbon management – a grand challenge
- Engineering societies are active (e.g. joint meetings, policy statements, congressional briefings)
- Activities reflected engineering society interests
- Limited focus on an integrated systems view

Recognition of need to

- Provide greater technical understanding to inform policy
- Dialogue across our traditional engineering borders
- Enable larger voice through collaboration

Launched April 2009

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

Objective

TO CREATE AND MAINTAIN A FOCAL POINT FOR UNBIASED INTERDISCIPLINARY STATE-OF-THE-ART ENGINEERING EXPERTISE ON GREENHOUSE GAS MANAGEMENT OPTIONS

- Provide a platform to integrate the knowledge, foster cross-society collaboration, and disseminate joint and separate society activities
- Provide a uniform basis for decision support (metrics, boundaries, techniques)
- Develop and maintain a premier bridge between engineering expertise in Carbon Management Technology and government and the public understanding of carbon management technologies

Funded by the United Engineering Foundation

Project Activities

- Principal elements
  - **Scorecards**
  - **Gaps & Barriers**
  - **Carbon Measurement**
- Electric Power and Transportation selected for initial technology focus (about 70% of US CO_2 emissions)
- Website established to share information

  http://www.aiche.org/FSCarbonMgmt/

Funded by the United Engineering Foundation

Scorecards

- To identify options that could generate a *significant reduction* in greenhouse gases in the 2020 and 2050 timeframes
- Simple approach (qualitative)

Funded by the United Engineering Foundation

Electric Power Scorecard

OPTIONS		ATTRIBUTES						
Main Category	**Subcategory**	**GHG Reduction Potential**	**Technology**	**Financial**	**Environmental**	**Risk**	**Social-Political**	**Implementation Timing**
NATURAL GAS	Simple or Combined Cycle w/o CCS							
	With CCS							
COAL with CCS	Existing Plant Retrofit							
	New Plant (e.g., IGCC, other advanced coal)							
COAL w/o CCS	New Plant (e.g., IGCC, other advanced coal)							
WIND	On-shore							
	Off-shore							
SOLAR	Photovoltaics							
	Concentrating Solar Power							
NUCLEAR	Life Extension							
	On-site Expansion							
	New units (Generation IV technology)							
HYDRO								
BIOMASS	Co-firing w/o CCS							
	Co-firing with CCS							
	100% biomass							
GEOTHERMAL								
DISTRIBUTED GENERATION								
Scores								
A = best		Very high	Very high	None to minor	None to minor	None to minor	Very high	Very high by 2020
B		High	High	Low	Low	Low	High	High by 2020; very high by 2050
C		Somewhat	Somewhat	Somewhat	Somewhat	Somewhat	Somewhat	Some by 2020; high by 2050
D		Low	Low	High	High	High	Low	Low by 2020; some by 2050
E = worst		None to minor	None to minor	Very high	Very high	Very high	None to minor	Minor by 2020; low by 2050

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

What Next?

- Use/test with Society members
  - ***PLEASE FILL OUT AND RETURN***
- Apply to other sectors (industrial)

Funded by the United Engineering Foundation

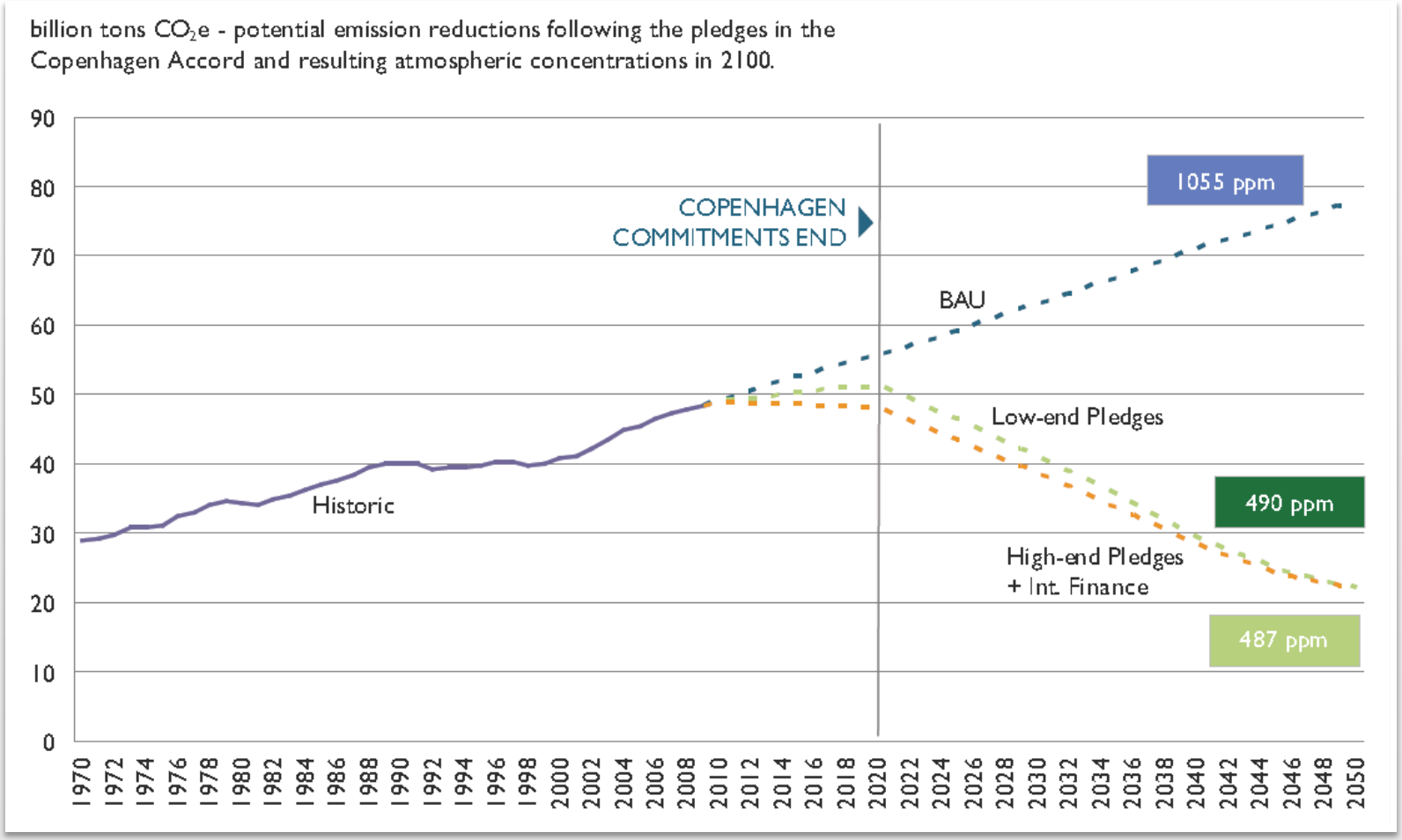
Gaps & Barriers

Workshop Objectives:

- Focus on promising technology options
- Define principal
  - knowledge & technology gaps and
  - implementation barriers
- Develop recommendations to address gaps and barriers
- Define role for Engineering Societies

Funded by the United Engineering Foundation

What's "promising?"



Source: T. Houser, Copenhagen, the Accord, and the Way Forward,*Peter G. Peterson Institute for International Economics, March 2010*

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

Gaps & Barriers

Workshop Objectives:

- Focus on promising technology options
- Define principal
  - knowledge & technology gaps and
  - implementation barriers
- Develop recommendations to address gaps and barriers
- Define role for Engineering Societies

Funded by the United Engineering Foundation

Workshop Process

35 multi-disciplinary participants: engineers, economists, public policy, industry, university

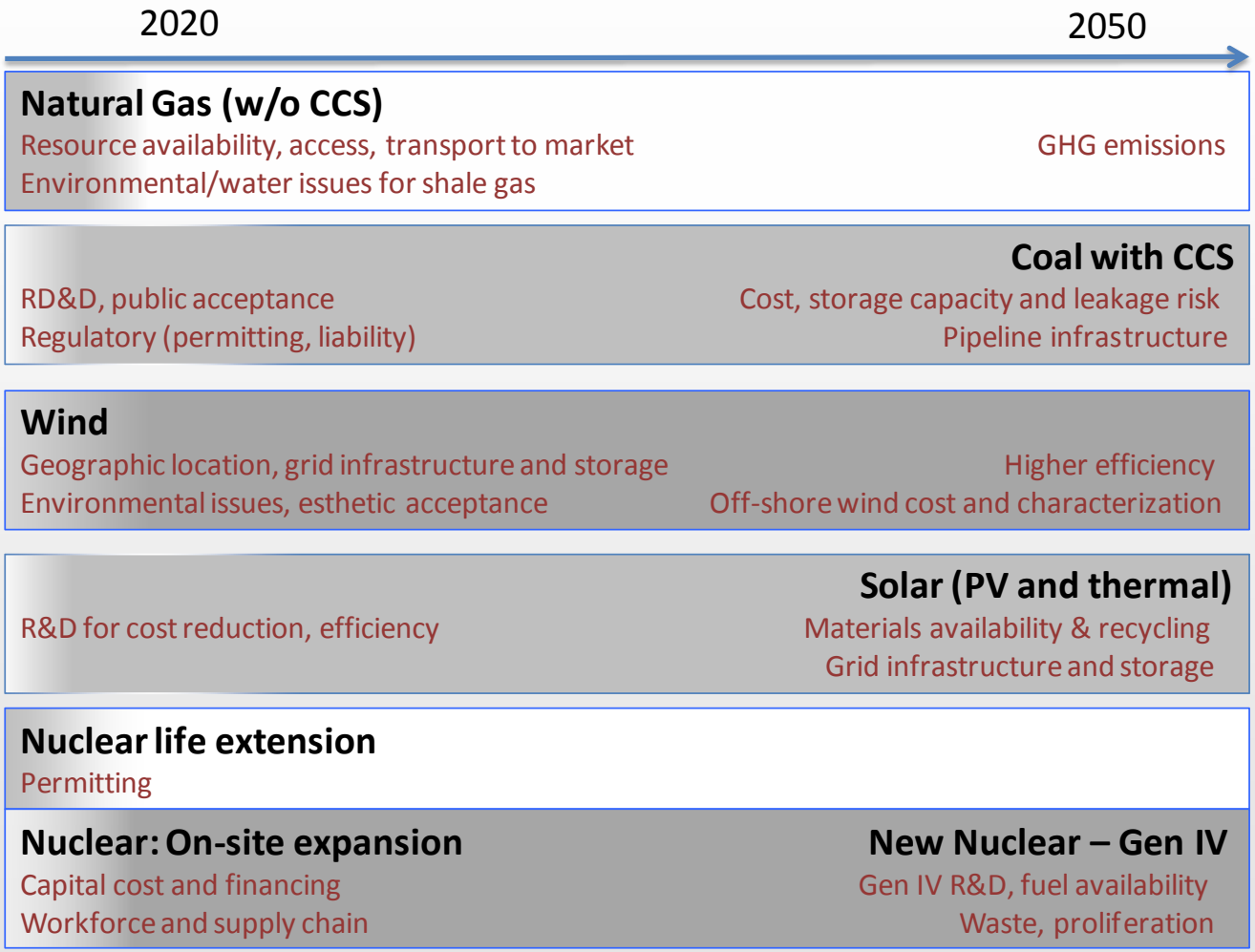
Four breakout groups with topics:

- Gaps and barriers for the most promising electric power options
- Gaps and barriers for the most promising transportation options
- Barriers to implementation at a pace and scale needed to affect overall GHG emissions
- Legal, regulatory and acceptance barriers to implementation

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

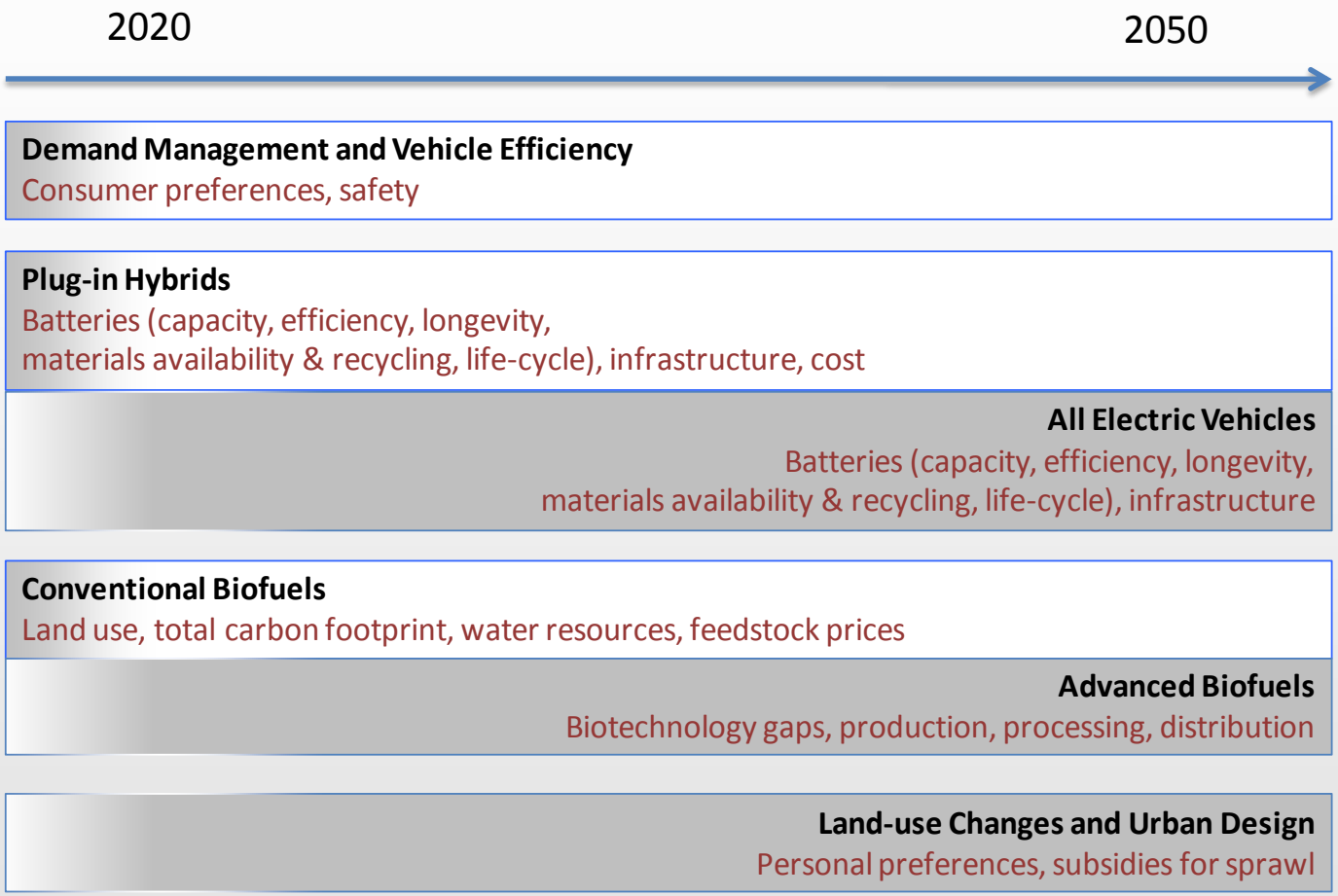
Electric Power



AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

Transportation



AIChE ASME AIME IEEE ASCE
Carbon Management

Funded by the United
Engineering Foundation

Observations

Addressing the gaps and barriers requires solutions spanning technology, regulation, and policy

Public and decision makers' expectations of the pace and scale of technology change are much higher than can realistically be achieved given the current state of technology, regulation and policy

Funded by the United Engineering Foundation

Recommendations

R&D funding must be consistent, sustained, and focused

Close information gaps on resources

- Clarity on resource abundance and accessibility
- Assure the infrastructure for delivery and production of fuels and raw materials.
- Understand and develop environmental and economic extraction/production processes.
- Apply life-cycle analysis to manage resources sustainability

Funded by the United Engineering Foundation

Recommendations

Streamline regulatory and permitting system

- With over 40,000 regulatory jurisdictions in the U.S., GHG mitigation technologies will be impacted by legislation and regulation intended to address a multiplicity of other purposes
- A concerted effort is needed to identify regulation and legislation that would apply to promising new technologies and simplify the process to avoid unnecessary delays

Funded by the United Engineering Foundation

Next Steps…

Form expert groups to assess and address specific types of identified gaps and barriers

- e.g., groups on regulatory streamlining, CCS, adaptation
- Development of metrics for key gaps and barriers to the principal options for carbon management

Funded by the United Engineering Foundation

GHG Measurement

Leadership

Alan Weakly, AIME-SME

Dave Gustashaw, ASME/AIChE

Brajendra Mishra, AIME-TMS

Miriam Heller, WRI (ASCE)

Beth Beloff, Bridges to Sustainability

Andy Miller, EPA

Participants

Tom Baumann, Climate Check

Cal Cooper, Apache Corp

Mary Ann Curran, EPA

Mahesh Iyer, Shell Chemical

Elizabeth Kujan, BD

Andy Miller, EPA

Carol English, Cytec

Chuck Hookham, HDR

Amy Mussen, Bentley

Mary Ellen Turnes, Macafee Tate

25 others are engaged

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

Project task teams

Continuation of Early Adopter Experiences

- Continue to document experiences, gaps and obstacles early adopters see across industry sectors

Direct Measurements

- To identify methods, best practices, and standards to enable an organization (i.e., regulated community) to transparently, accurately, consistently, comparably, completely, and directly measure GHG emissions

GHG Measurement Protocols

- Identify the key GHG measurement provide a comparative assessment of their optimal application and to enable comparative calculations
- Outcomes: Assessment Report, “Web Comparator”

Funded by the United Engineering Foundation

Outline

What is it

Project elements

- Scorecards
- Gaps & Barriers
- Carbon Measurement

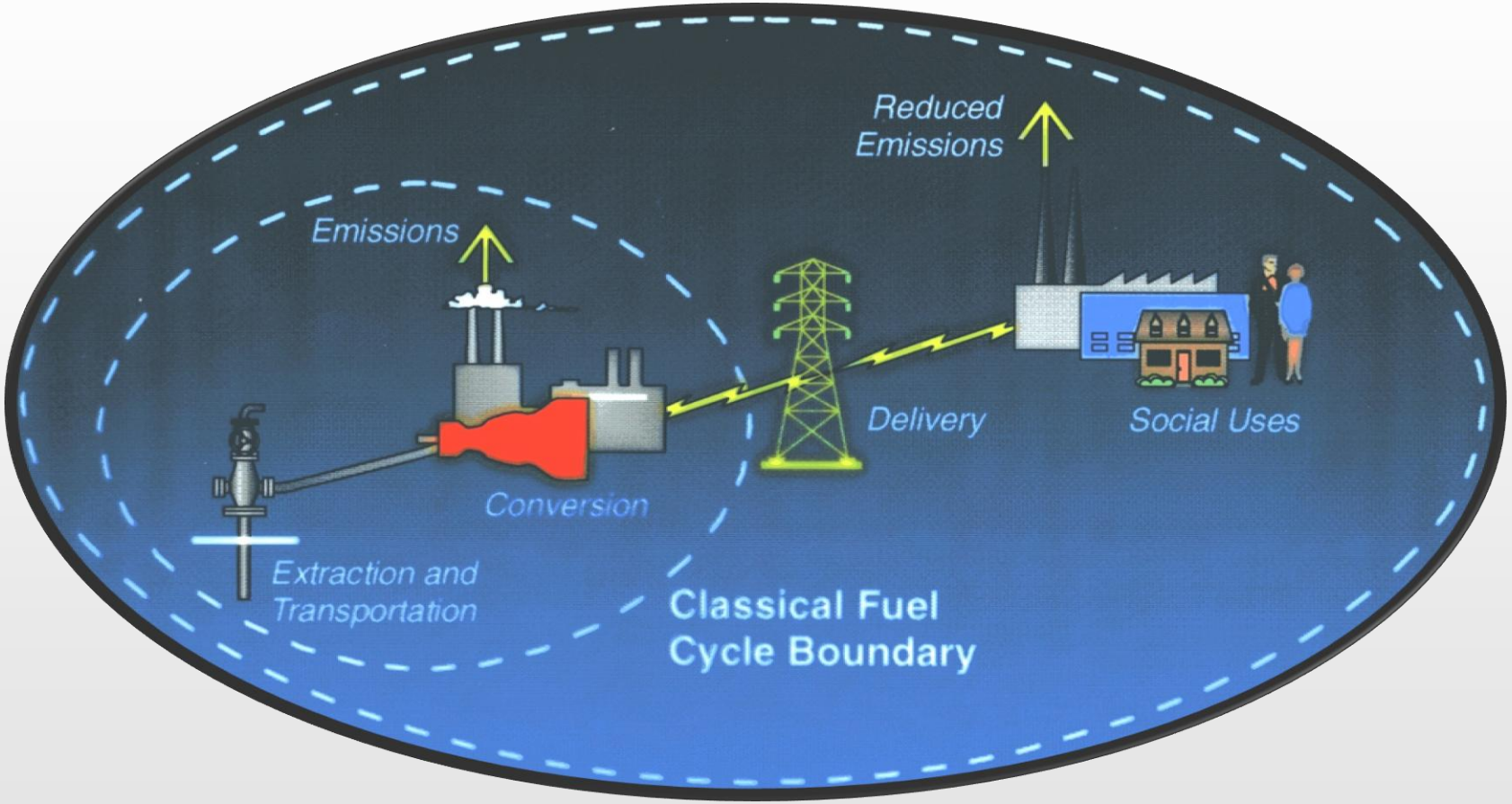
New starts

- Metrics & boundaries
- CCS Network
- Carbon Management Conference

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation

System Boundaries



AIChE ASME AIME IEEE ASCE
Carbon Management

Funded by the United Engineering Foundation

More information? See:

http://www.aiche.org/fscarbonmgmt

Interested in participating? Contact:

carbonmanagement@foundersocieties.org

More questions?

VRabl@Vision-Results.com

AIChE ASME AIME IEEE ASCE Carbon Management

Funded by the United Engineering Foundation