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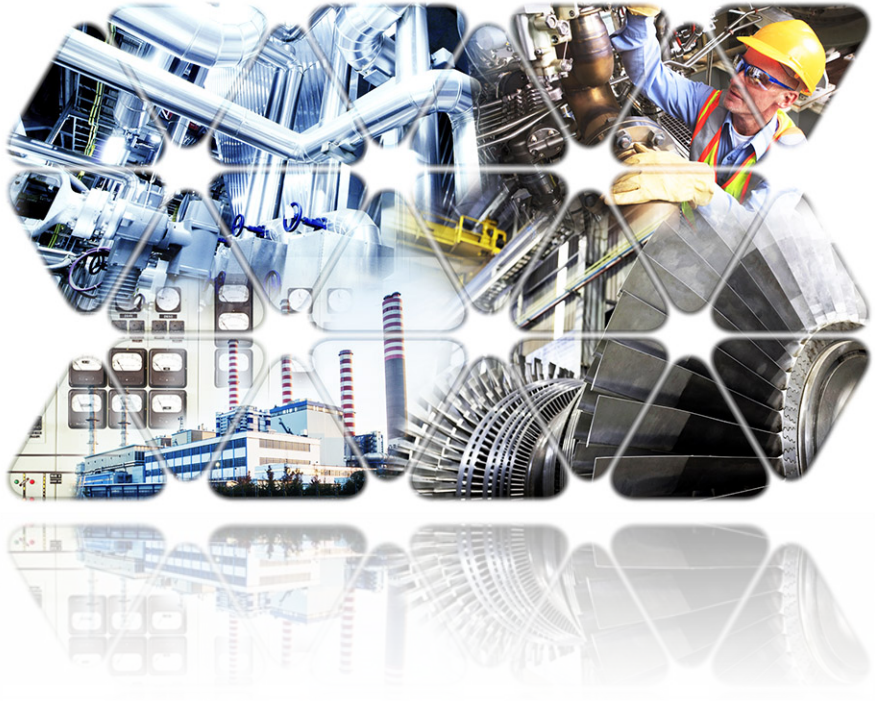
Revitalizing CCS:
Bringing Scale and Speed to CCS Deployment



Dr. Jeffrey N Phillips
Senior Program Manager

DOE CO_2 Capture Conference
June 2015

“Today, deploying CCS technology is costly. Tomorrow, not deploying CCS technology will exert an even greater cost.”

National Coal Council Report “Fossil Forward”

http://www.nationalcoalcouncil.org/page-NCC-Studies.html

>> STUDY REQUEST

Secretary Moniz's Charge to NCC – May 2014

… request the NCC conduct a study that assesses the value of DOE's Carbon Sequestration Program … The assessment should address the question: "What is industry's assessment of the progress made by the DOE and others regarding cost, safety, and technical operation of CCS/CCUS?

… In other words, how does industry see and accept major technical findings from the CCS/CCUS community, and how do those relate to DOE programs and investments?

… an assessment based on technical soundness and results to date would provide a welcome perspective from leading companies with experience in CCS/CCUS technology."

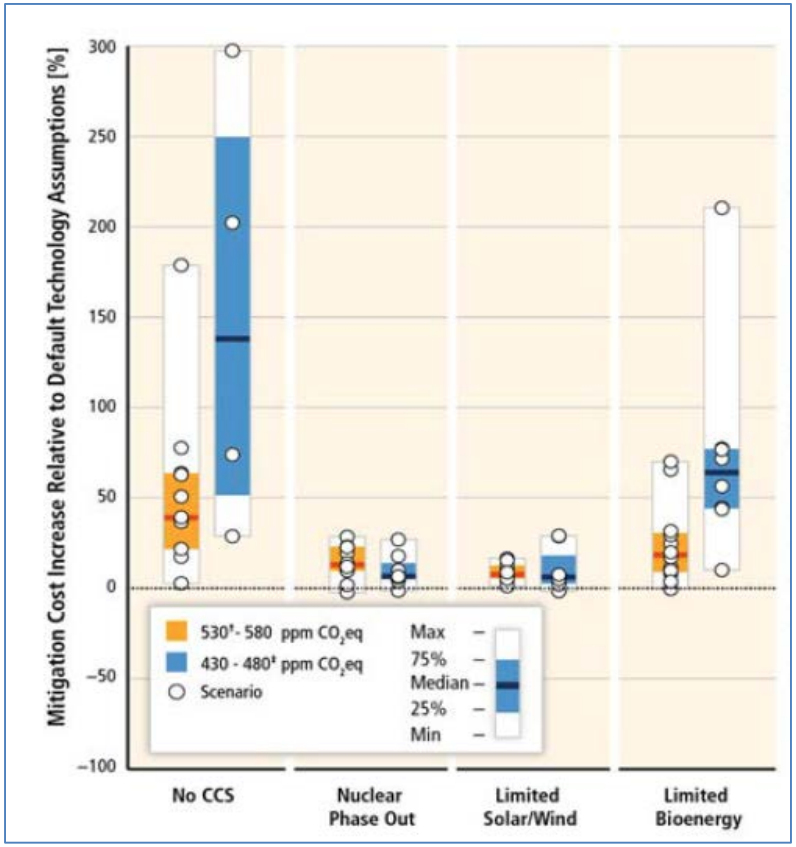
>> Fossil Forward Principal Theme

"While DOE is indisputably a world leader in the development of CCS technology, the DOE CCS/CCUS program has not yet achieved critical mass."

- "Without adequate demonstration there can be no commercialization."
- "There is no point in capturing CO_2 if there is no place to use it or store it."

>> The CCS/CCUS Imperative

Not including CCS as a mitigation technology is projected to increase the overall costs of meeting CO_2 emission goals by 70-138%.



Climate Change Mitigation Costs Without CCS and Other Technologies

>> Key Findings Overview

- ***In order to achieve CCS at commercial scale, policy parity with other low/no carbon technologies is required.***
- ***Technology and funding incentives must be significantly better coordinated to be effective.***
- ***DOE program goals need far greater clarity and alignment with commercial technology and funding approaches used by industry.***
- ***Funding for CCS RD&D is limited and must be enhanced and focused.***
- ***Public acceptance continues to be a major hurdle.***
- ***Greenhouse gas control is an international issue in need of international initiatives.***

>> Key Recommendation

In order to achieve CCS at commercial scale, policy parity with other low/no carbon technologies is required…

<u>The National Coal Council recommends that:</u>

- **DOE take a stronger position on the need for policy parity with respect to funding allocations**

- **DOE take a stronger position on the need for policy parity with respect to incentive mechanisms and subsidies applied to near zero emission energy technology**

>> Key Recommendation

Technology and Funding Incentives must be significantly better coordinated to be effective…

The National Coal Council recommends that:

- **DOE develop a plan to have a total of 5-10 GW of CCS/CCUS demonstration projects in operation in the U.S. by 2025**
- **DOE expand the RCSP program to identify and certify at least one reservoir in each region that is capable of storing a minimum of 100 million tons of CO_2 at a cost of less than $10/ton by 2025**
- **All federal incentives for CCS demonstration projects undergo a coordinated review for their combined adequacy and effectiveness in supporting CCS deployment in time to achieve the installation of storing a minimum of 100 million tons of CO_2 at a cost of less than $10/ton by 2025**
- **Concerted effort be undertaken by DOE to identify and pursue creative mechanisms to finance CCS/CCUS projects**

>> DOE CCPI Program

CCPI does not appear to have a high success rate.
Only a small number of projects have been selected for funding.
Ratio of Federal Grant to Total Project Cost = 5-18%

Status	Number of Projects
Complete	4
Active	4
Withdrawn	7
Discontinued	2
Negotiations Ceased	1
Total	18

	Applications Submitted	Applications Selected
Round 1	36	8
Round 2	13	4
Round 3	36	6

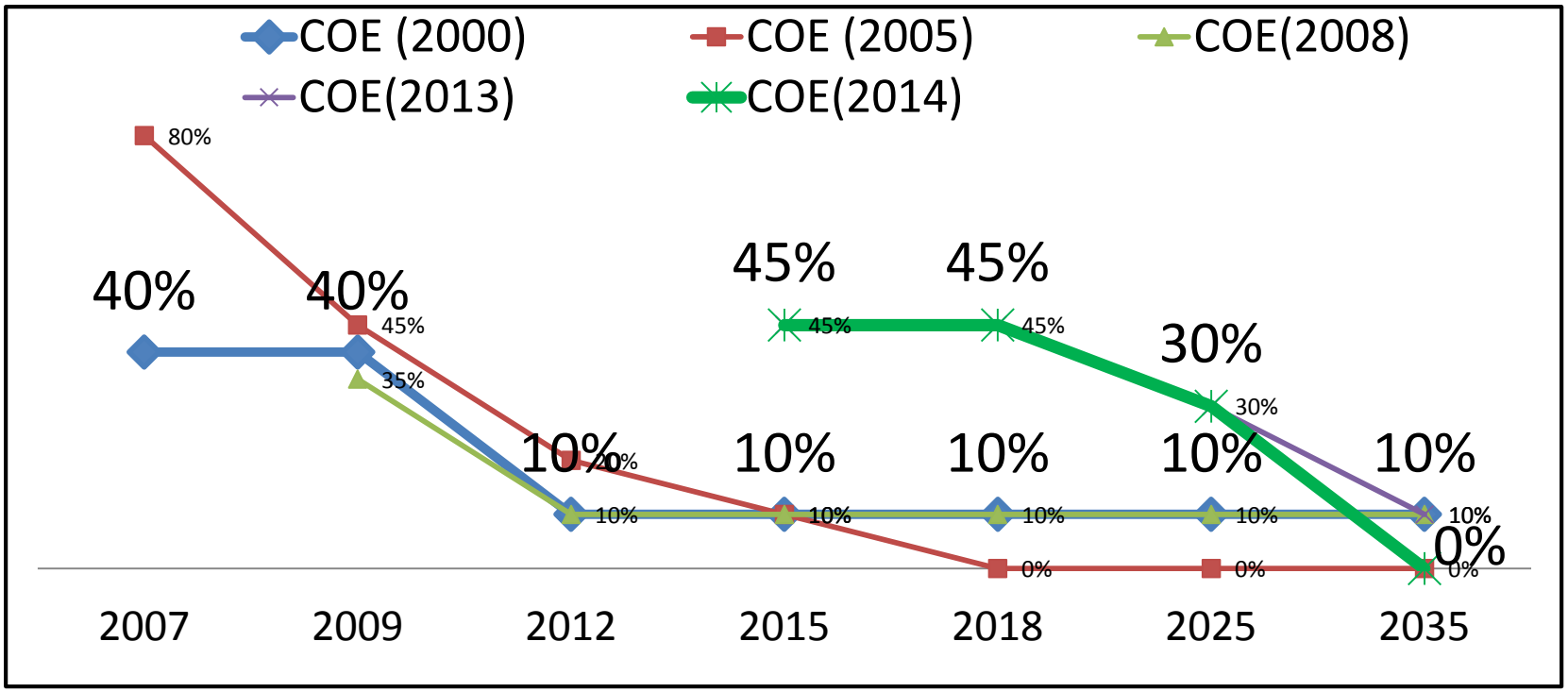
Project	Total Federal Grant	Total Project Cost	Federal Cost Share
Hydrogen Energy California	$408 M	$4 B	10%
Summit Texas Clean Energy	$450 M	$2.5 B	18%
NRG Energy	$167 M	$1 B	17%
Southern Kemper Energy	$293 M	$6.1 B	5%
Totals	$1.752 B	$13.6 B	13%

>> Key Recommendation

DOE Program Goals need far greater clarity and alignment with Commercial Technology and Funding Approaches Used by Industry…

- **DOE and Industry prioritize projects critical to achieving goals consistent with the need to bring CCS technologies up to Technology Readiness Level 9**
- **DOE establish interim goals that are more amenable to testing for scale up of CCS technologies that show promise towards meeting the cost and performance goals**
- **A targeted number of projects or GW's be established with dates of operation that are consistent with overall emission reduction targets**
- **Future QER reports examine CCS infrastructure needs for a comprehensive nationwide CCS/CCUS system**
- **DOE undertake a general equilibrium model study to determine if the goal of CCS cost parity by 2035 is adequate and consistent with the overall CO2 reduction goals**

Overview of Current DOE CCUS Programs - Timeline of Goals



While **cost goals** were **intended to show progressive improvement** over time, eventually leading to cost parity w/conventional technology, lack of funding for large demonstrations has driven **time frames well into the future**

>> Key Recommendation

Funding for CCS RD&D is limited
and must be enhanced and focused…

- **DOE continue fostering a portfolio of technologies for implementing CCS and "prime the pump" with early stage funding for promising concepts. NCC recommends that after technologies reach TRL 4, DOE cull its support to only those technologies which show a clear promise of meeting or exceeding DOE's CCS performance goals**

- **DOE continue to develop a plan for demonstrating second generation and transformational CCS technologies showing cost and performance advantage at a scale of 25-50 MW by 2020 and make subsequent budget request to carry out the plan**

>> Key Recommendation

GHG Control – International Issue in need of International Initiatives

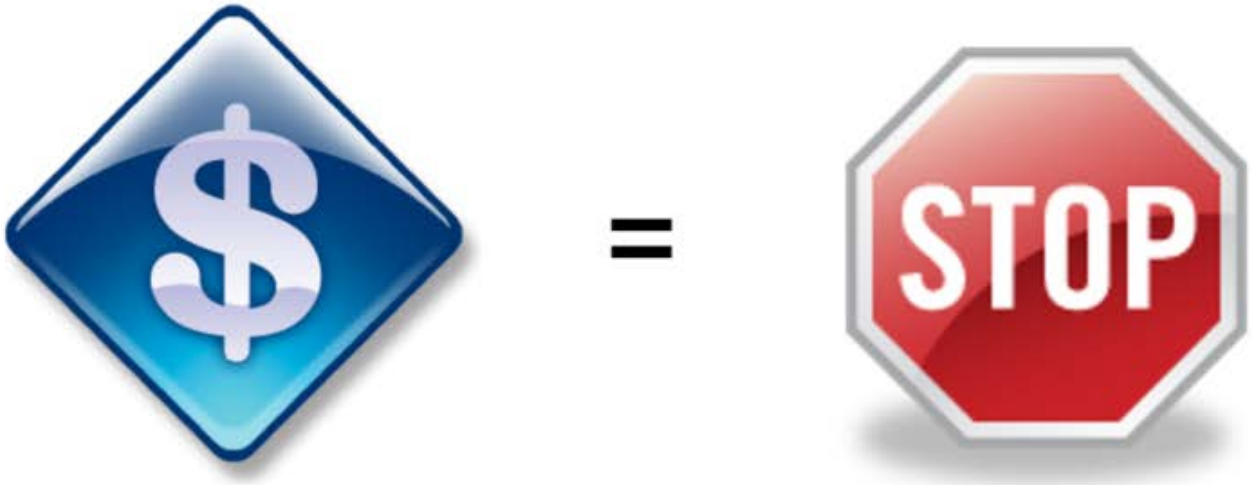
- **DOE maintain its current CCS/CCUS international collaboration efforts including Carbon Sequestration Leadership Forum and US-China Clean Energy Research Center**
- **DOE pursue international partnerships in commerce for CCS/CCUS demonstrations in CO_2 intensive developing nations. Focus to be given to CO_2 utilization and storage projects to increase global knowledge and acceptance of commercial scale CO_2 storage**
- **DOE actively advance the recently announced collaboration with China on a water producing, commercial scale CCUS project**
- **DOE propose an international pool of funds specifically set up for the implementation of CCS demonstration projects at scale**
- **DOE consider programs and policies to promote the purchase of US manufactured CCS equipment for international CCS demonstration projects**

>> Key Recommendation

Public Acceptance continues to be a major hurdle…

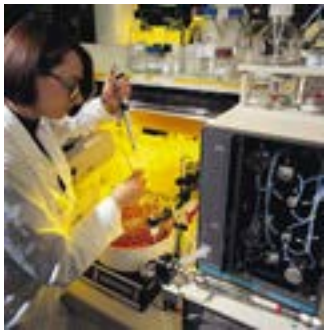
- **DOE increase its existing CCS/CCUS public engagement, education and training activities targeting counties and states with demonstration projects and regions that have potential infrastructure developments**
- **DOE incorporate into its outreach/education program experience from existing projects, including direct discussions with people that operate such projects and those that live near them**
- **DOE create a University Carbon Systems Research Program so as to place engineering students in summer internships focused on CCS/CCUS technologies**

Final Point



(This slide was presented at the Interagency Task Force on Carbon Capture and Storage Public Meeting - May 6, 2010)

Final Point



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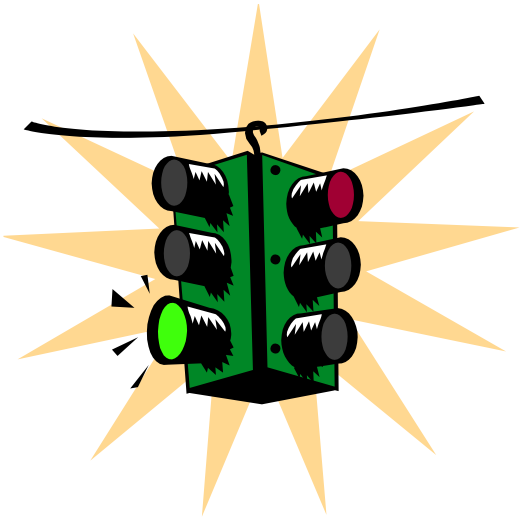

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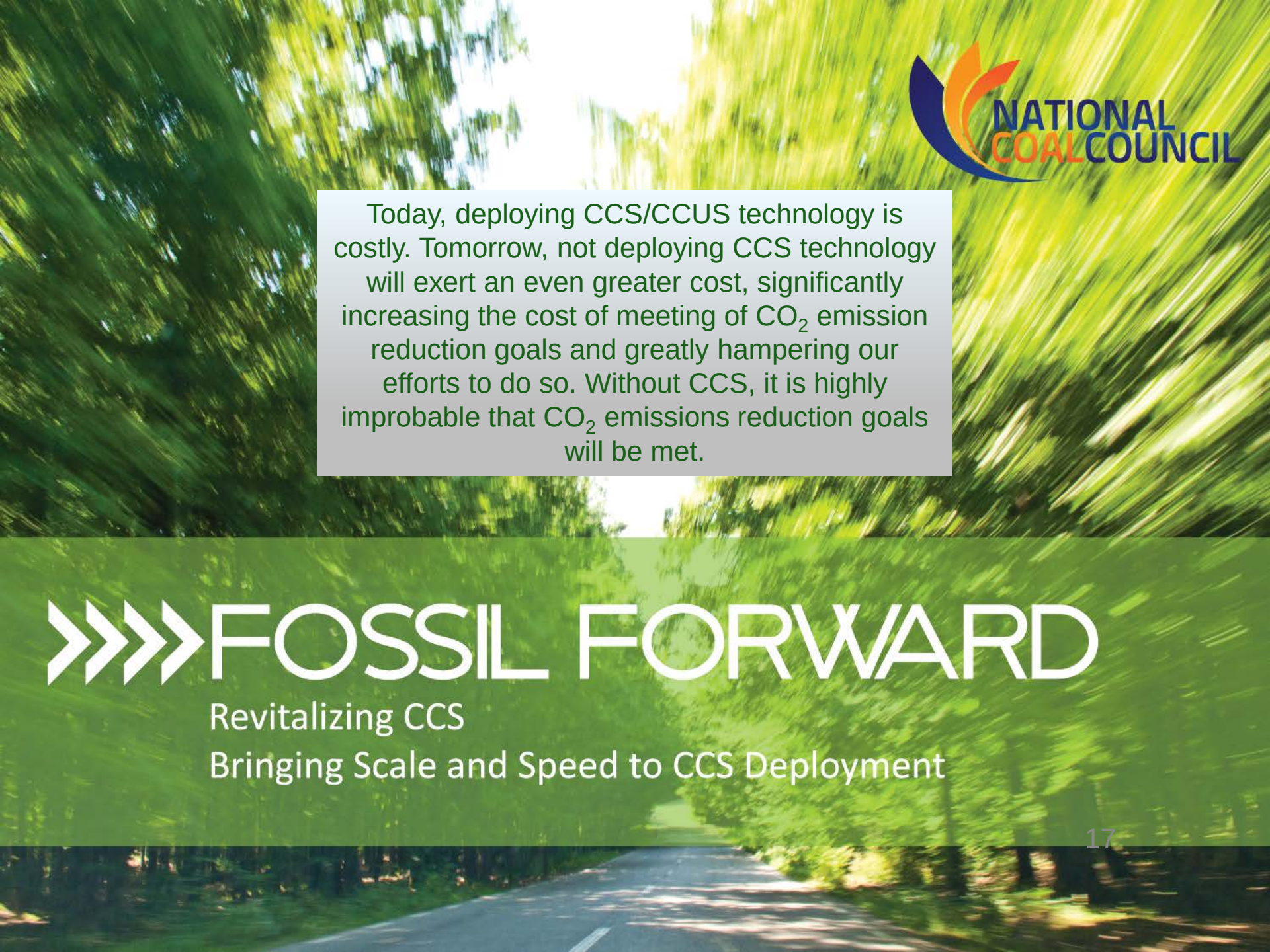
NATIONAL COAL COUNCIL
Today, deploying CCS/CCUS technology is costly. Tomorrow, not deploying CCS technology will exert an even greater cost, significantly increasing the cost of meeting of CO_2 emission reduction goals and greatly hampering our efforts to do so. Without CCS, it is highly improbable that CO_2 emissions reduction goals will be met.
FOSSIL FORWARD
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