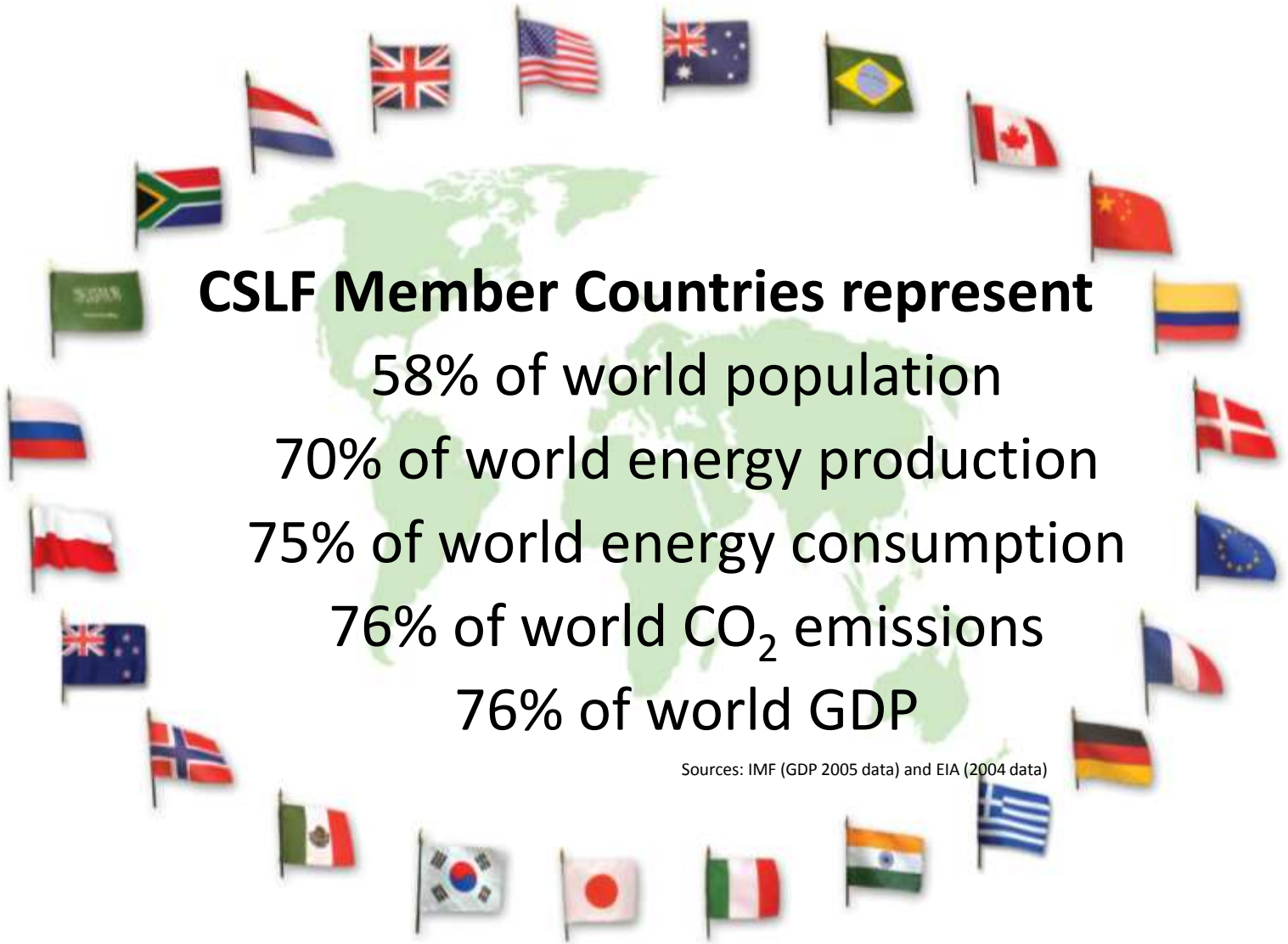
19-20 May 2010 – Berlin, Germany
2nd Carbon Capture and Storage
ACI

Accelerating the Development of Carbon Capture and Storage at the World Scale

Bernard Frois

CSLF, Chair of the Financing Issues Task force

Director, CEA, France



CSLF Member Countries represent

58% of world population

70% of world energy production

75% of world energy consumption

76% of world CO_2 emissions

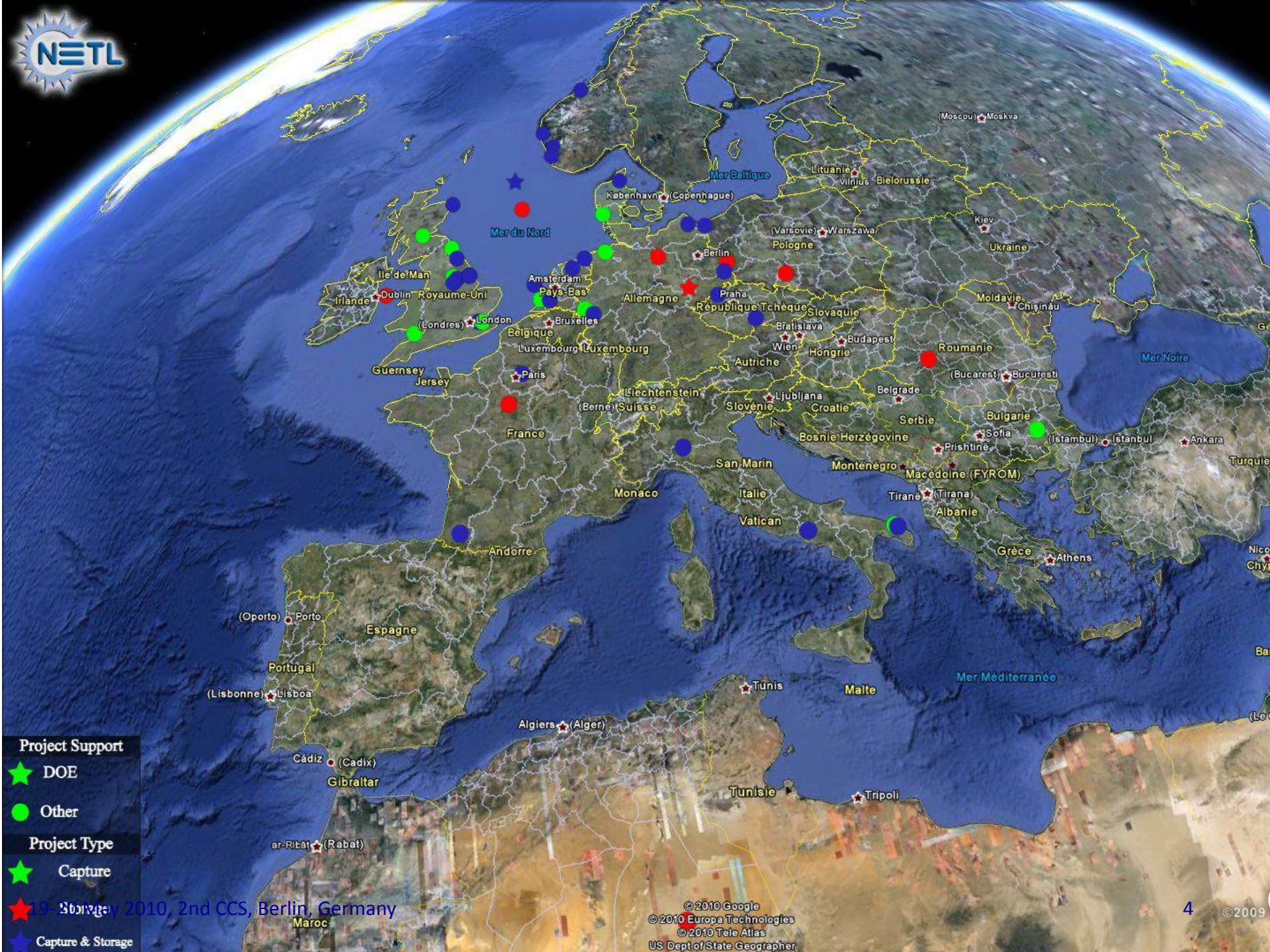
76% of world GDP

Sources: IMF (GDP 2005 data) and EIA (2004 data)

CSLF is an international climate initiative

- The actions of the CSLF are focused on the development of improved cost-effective technologies for the separation and capture of carbon dioxide (CO_2) for its transport and long-term safe storage.

- One of the most successful initiatives of the CSLF is to analyze in depth the situation worldwide and identify priorities on the most urgent actions to be implemented for using CCS to mitigate global warming.


Project Support
DOE
Other
Project Type
Capture
Storage
Capture & Storage
Mer du Nord
Mer Baltique
Mer Noire
Mer Méditerranée
Irlande
Royaume-Uni
Pays-Bas
Allemagne
Pologne
Belgique
Luxembourg
France
Suisse
Autriche
Hongrie
Slovaquie
République Tchèque
Roumanie
Bulgarie
Serbie
Croatie
Slovénie
Italie
Espagne
Portugal
Grèce
Albanie
Macédoine (FYROM)
Monténégro
Bosnie Herzégovine
Tunisie
Malte
Maroc
Algérie
Lituanie
Bielorussie
Ukraine
Moldavie
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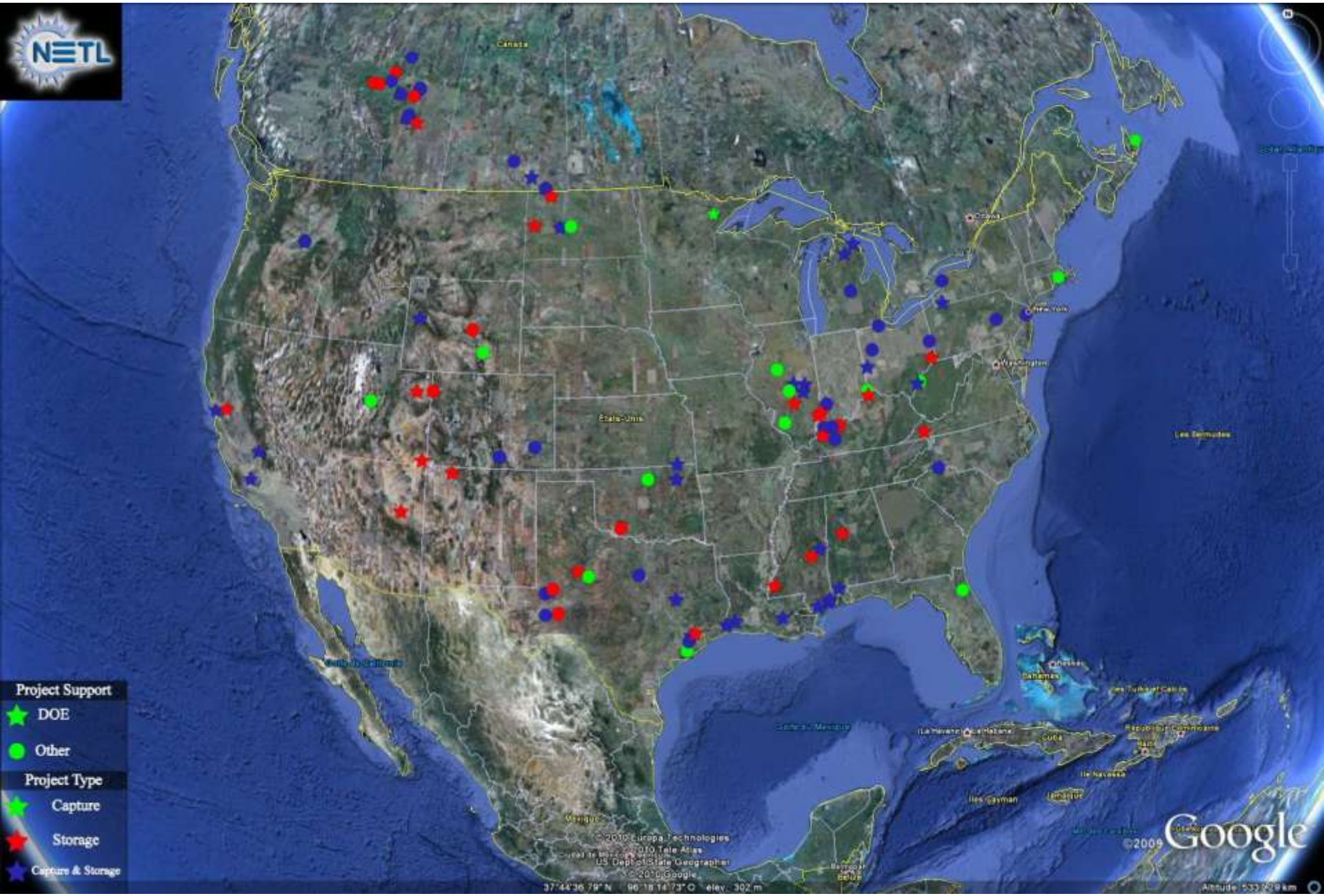
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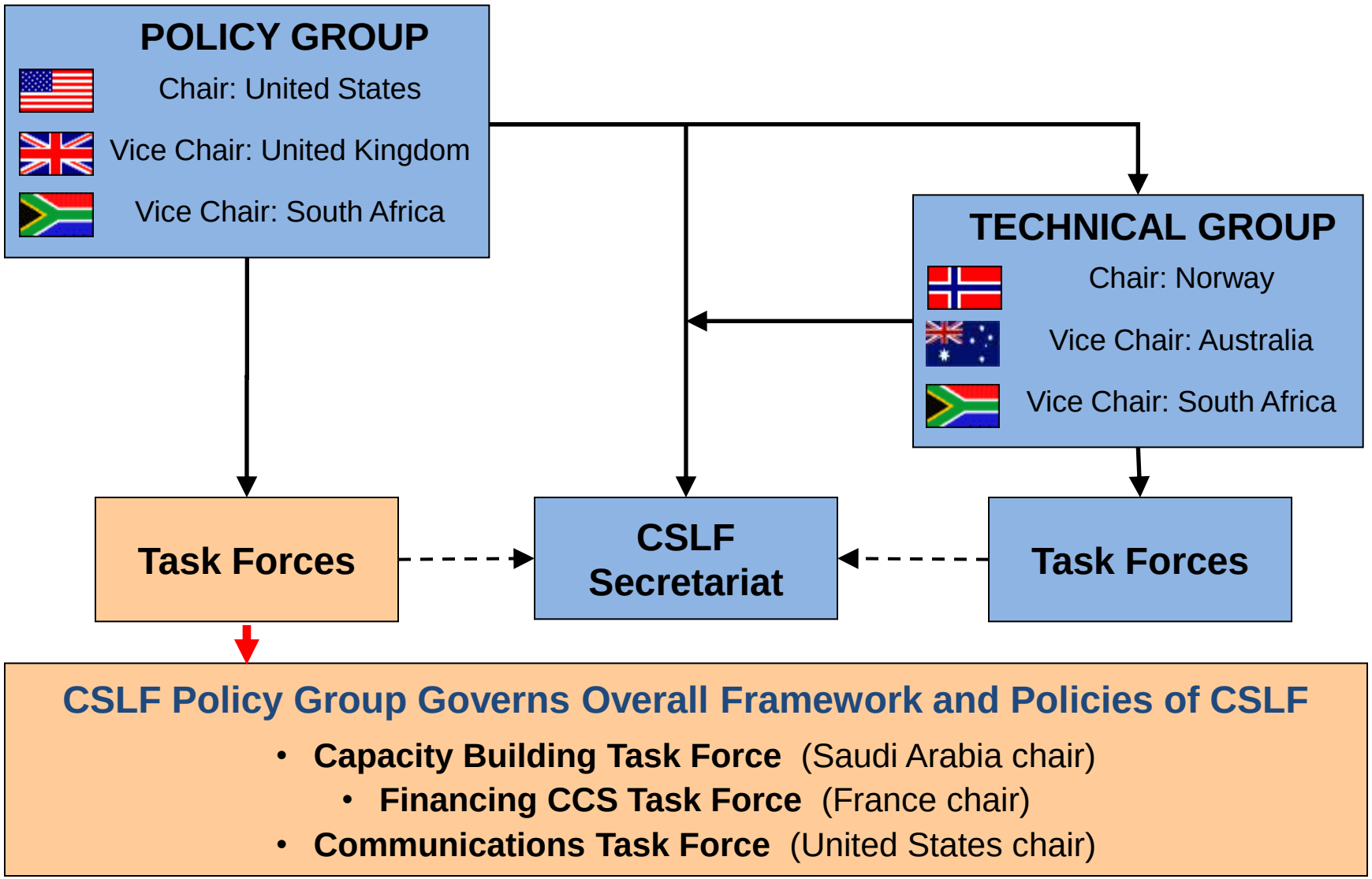
CSLF Goals

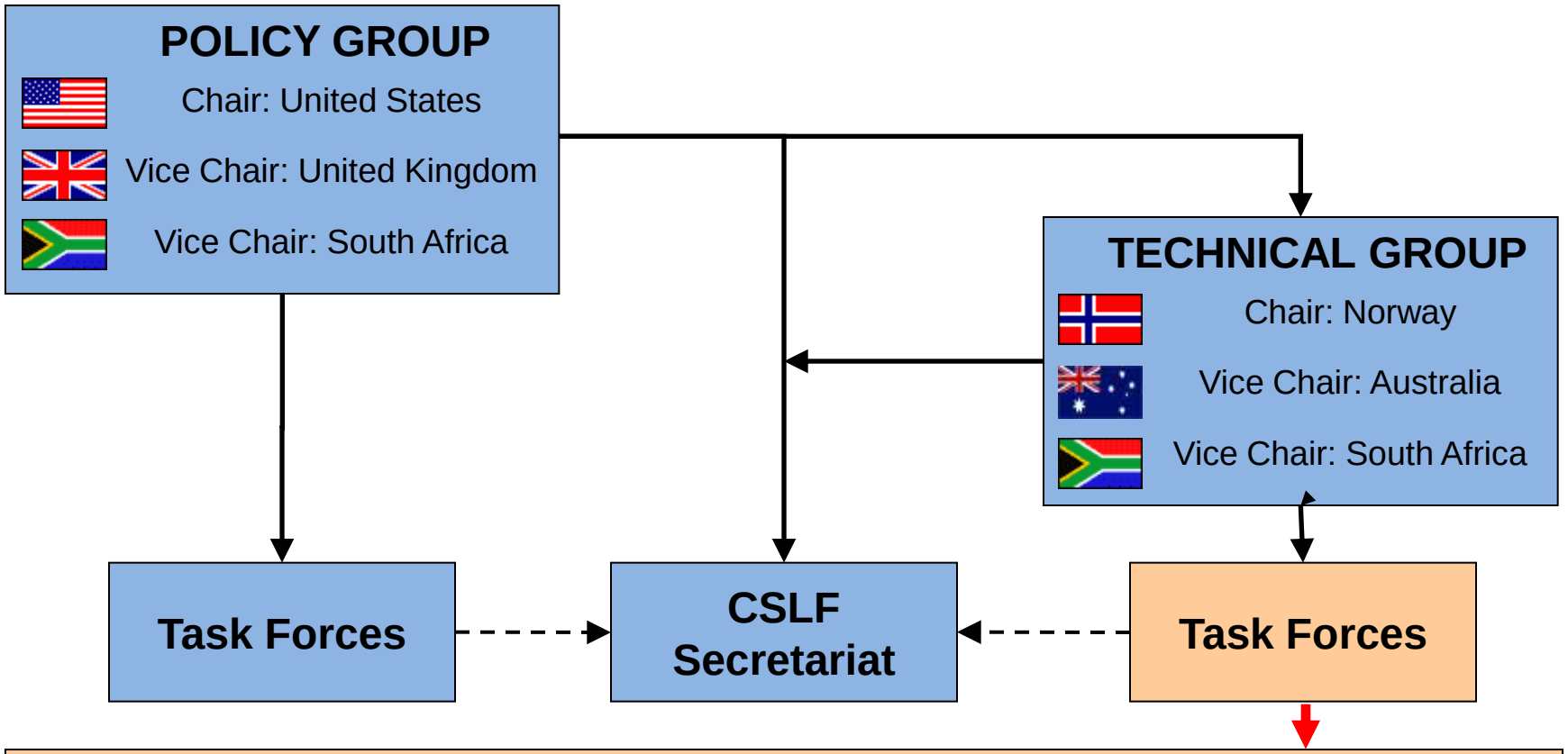
The CSLF advances technological capacity through collaborative efforts with all the stakeholders to address key technical, economic, regulatory and environmental obstacles to CCS development and deployment

This implies to find a clear legal and regulatory framework for CCS, accelerate the development of the demonstration phase and understand how to reach the commercial scale

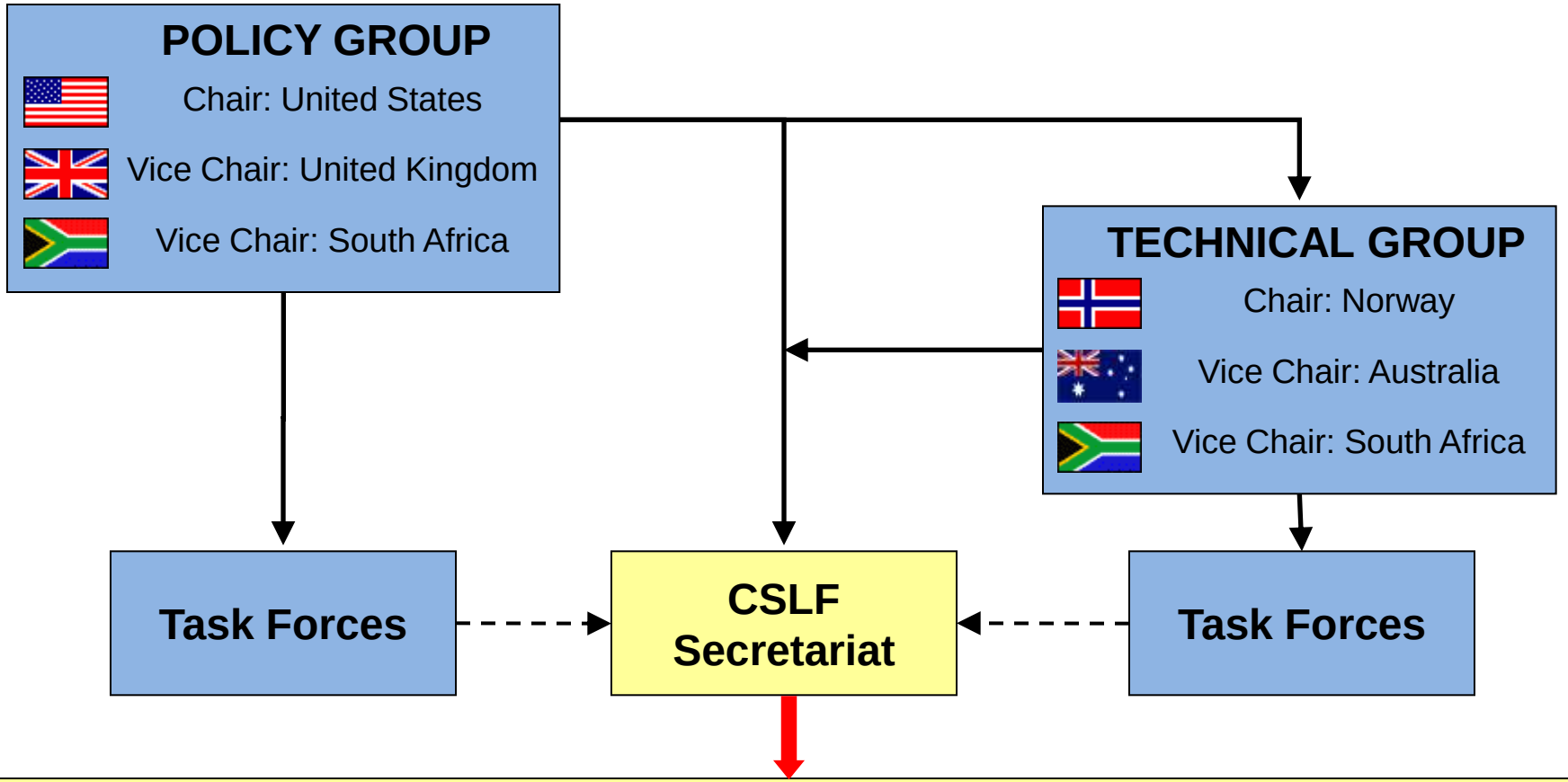
CSLF Structure



CSLF Structure



CSLF Structure



- Develops ideas and concepts for the CSLF and supports Policy and Technical Groups
- Develops and disseminates reports, data bases and other documents
- Maintains the CSLF Web site as a world-class information resource
- Convenes and staff meetings and workshops of CSLF, its sub-groups and task forces

CSLF Achievements (1)

- Accelerated the process of creation of a global legal and regulatory framework for CCS.
- Implemented a vigorous capacity building program that is bringing important information on CCS technologies to scientists, engineers, and researchers in emerging economy countries.
- Identified key R&D needs and technology gaps in the areas of CO_2 capture and transport, and measurement monitoring and verification of storage (MMV).
- Developed recommendations for technology risk assessment standards and procedures

CSLF Achievements (2)

- Developed a technology roadmap that will provide a pathway toward commercial deployment of integrated CCS technologies.
- Facilitated international cooperation on 30 diverse projects that demonstrate many CCS technologies and serve as a model for further international cooperation.
- In response to a request from the G-8 and working with the IEA, developed recommendations that now form the basis for global activities that will make CCS commercial and broadly available internationally by 2020.

CSLF Initiatives

- Formally recognized 30 CCS projects around the world.
- Launched, at the 3rd CSLF Ministerial Conference in London, a major new Capacity Building initiative which will assist its Members in implementing CCS demonstrations and commercial deployment.
- Working with the Australian Global Carbon Capture and Storage Institute (GCCSI) to meet G-8's goal of "20 in 2020".
- Expanding partnerships, including work with IEA to develop CCS roadmap.

CSLF Ministerial Meeting
London 11-14 October 2009

Financial issues

- The G-8 has welcomed the recommendations proposed by CSLF and IEA to build 20 demonstration projects in the next 10 years. (Where is the money?)
- Financing CCS at the **Commercial Scale** requires to solve the following issues
  - Long term liability.
  - Risks and Benefits
  - Public agreement
  - Finding Credit (Banks, Insurance Companies, Lawyers,…)

CCS: A significant financial investment

- Today's commercially available CCS technologies add around 80 percent to cost of electricity for post-combustion removal and 35 percent for pre-combustion removal
- Research goals should reduce these energy penalties to less than 30 percent and 10 percent, respectively
- Harvard Belfer Center, McKinsey, World Coal Institute studies: Coal plants with CCS likely to be competitive with other low-carbon energy sources, wind, solar, nuclear

CSLF Financing CCS Task Force

- A new CSLF Task Force on Financing CCS was created in June 2009, with France as Chair.
- Initially, the Task Force was tasked with investigating incentives and investments for CCS in both developing and developed countries.
- Task Force has organized two successful roundtables in London (Linklaters) and Washington (Hudson & Williams) with representatives of Banks, Insurances, Government, Industry, Research.
- A summary document on the roundtables and recommendations to the G8 is in preparation (A.D. Paterson and M. Pineda).

London Finance Roundtable (Jan. 2010)

- Regional development plays a central role
- Sharing experience with CCS, **across stakeholders**, will promote best practices, knowledge sharing and regulatory insights
- Public and private sector negotiate risk-sharing together
- Public funding: loans, tax credits, grants, capacity pmts
- Regulatory clarity, characterization and infrastructure must be in place to mobilize investment
- Projects in developing countries enhance engineering, system experience

CSLF Financing Roundtable April 6, 2010

Commercial and Financial Structuring of Commercial Scale Projects with CCS

Hosted by: CCS Alliance at the offices of: **Hunton & Williams LLP**

1900 K Street, Washington, D.C.

Roundtable Objective

To engage the investor community in a dialog on the critical policies and incentives needed to finance and build the initial wave of energy or industrial plants with CCS in the EU and North America, leading to recommendations for consideration by G-8 deliberations ***with global impact***. The roundtable will highlight additional risks (e.g., liability for CCS leakage, capital recovery). Several CSLF countries are evaluating or moving ahead on projects with CCS. The first Roundtable in London (January 2010) provided an "expert framework" for a wider dialog with industry, investors, and policy-makers.

Roundtable Co-Chairs:

Bernard Frois, *Director, Management Unit of New Energy Technologies for National Research Agency, CEA, France / Chair, CSLF Financing Task Force*

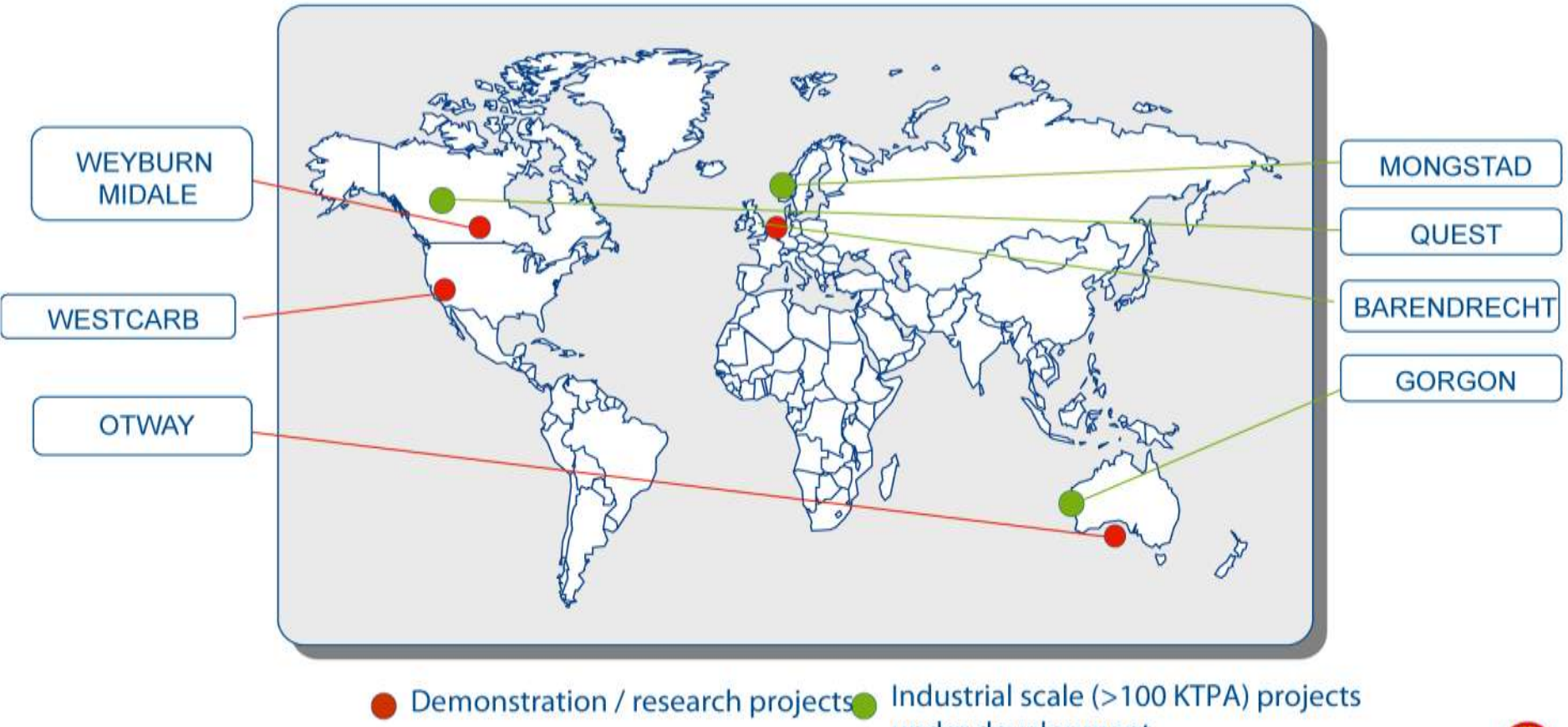
Martin Deutz, *Director of Cleaner Fossil Fuels, Department of Energy and Climate Change, United Kingdom*

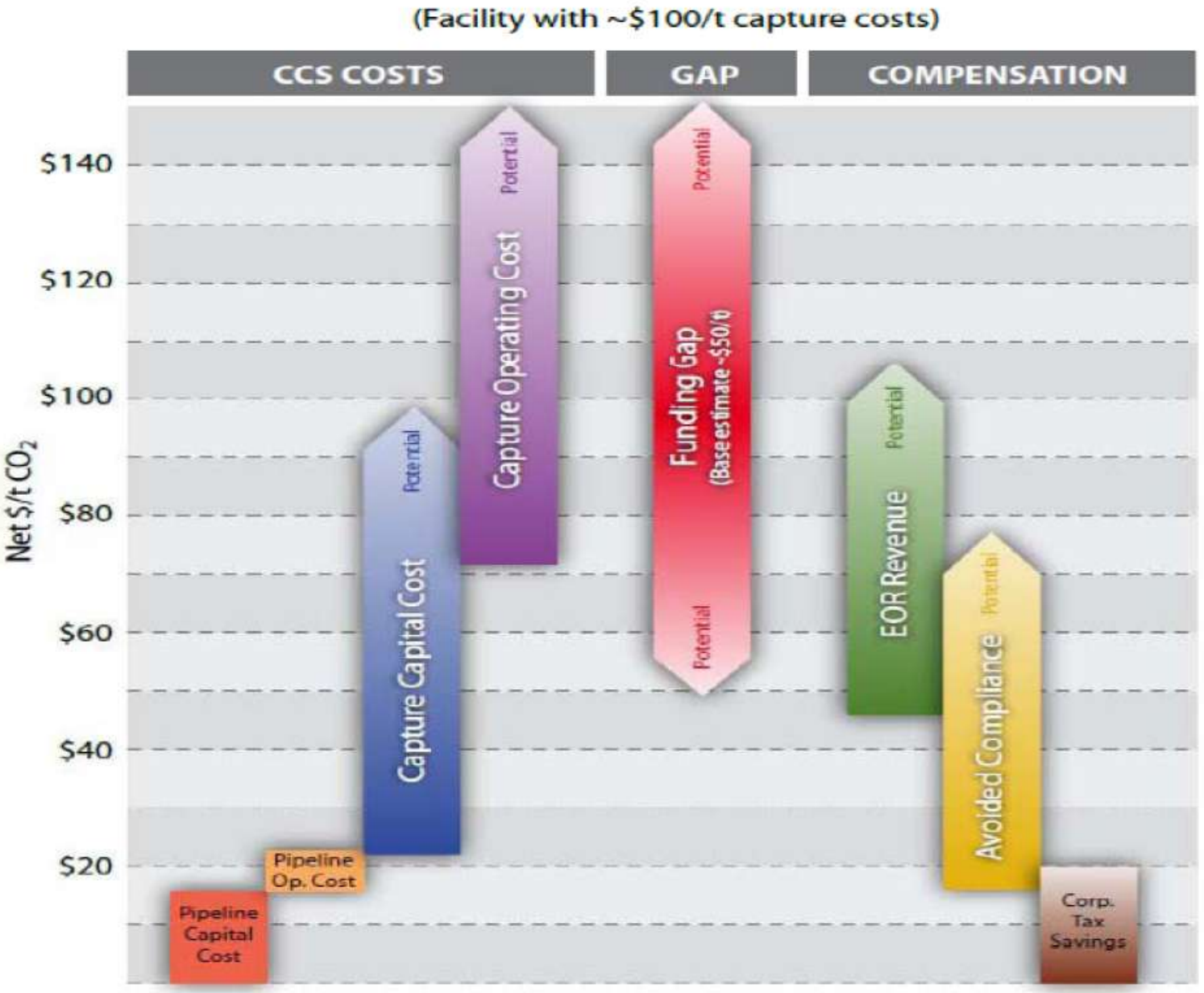

Workshop on
Commercial and Financial
Structuring of CCS

EXAMPLE: SHELL INVOLVEMENT IN PROJECTS

DEMONSTRATION AND INDUSTRIAL PROJECTS

Shell is also a member of multiple CCS research partnerships





From Sandra Locke, Alberta, Canada

Focus of the roundtable discussions

1) Costs are considerable. Subsidies are not sufficient.
2) Financing CCS is the key issue.
3) Today, CO_2 price is too low. 100$ possible? When?
4) Rewards not clear. How to make profit?
5) Liability is a major issue.
6) High risks. All risks need to be addressed.
7) Market uncertainties, emissions regulations and subsurface rules must be addressed as well.

Critical success factors for large scale use of CCS

- **Legislation**: CCS Directive offers adequate framework - MS must provide clear rules but should avoid excessive burden
- **Public interest and support**
- Adequate **transport** infrastructure : joint public private initiatives will be necessary
- Depleted gas fields are in the short term most appropriate sites for **storing CO_2**
- **Economic feasibility** : EU-ETS should become major driver : CO_2 market price must increase while energy penalty should decrease
- Imposing **emission performance limits or mandating CCS** is not appropriate

2 015 target for the implementation of EU CCS demo projects is achievable – but only if national regulatory frameworks are in place by end 2010 at the latest.

Conclusions: Key Financing Challenges to be Addressed

Projects are fundamentally uneconomic	■ **EOR provides the only positive cashflow to the Projects – no alternative market for product** ■ Where is the value if no EOR? ■ How to recover significant investment on the CCS infrastructure – particularly for "multi-user" schemes ■ **Economic subsidy and/or guarantee will be required for the Project to be bankable**
Risk Allocation & Interdependent Infrastructure	■ Integration of this Project with several independent operating businesses give challenges to risk allocation ■ Failure in any part of the chain may have knock on effect to the whole Project ■ **Emission level of the flue gas / processing gas is outside the control of the Project** ■ Termination Regime to be considered carefully due to single ender user for the Project
Technology	■ CCS technology has not been tested for large scale commercial use – Particularly Post Combustion ■ Construction and operation experience is limited ■ **Difficult to find a traditional EPC Wrap with warranty and damages provisions at economic cost** ■ **Lenders likely to require higher performance guarantees on early projects due to uncertainties**
Environmental Compliance	■ **CCS technology to be used for enhanced oil recovery could become NGOs' target** ■ Questioning of benefits of new coal fired generation even with CCS ■ **Credible monitoring and certification of sequestration crucial**
Un-tested in the Finance Market	■ Large financing needs call for diverse funding sources to secure largest possible financing component ■ Lenders have not been tested on the above risks ■ **"First of its Kind" risk** ■ **Until there is confidence in Government policy and technology there will be no project finance**
Key Message	■ **Currently no comprehensive legal and regulatory framework exists for CCS** ■ **Legal issues (CO_2 network and storage liabilities & monitoring are not clear** ■ **Policy and regulatory framework remains unclear** ■ **NO LONG TERM CLARITY = NO PROJECT FINANCE**






EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Financial Incentives for Deploying Carbon Capture and Storage:

How Much are they Worth?

Tom Wilson
Sr. Program Manager

CSLF Financing Roundtable 2010
April 6, 2010

Final Thoughts on Financing CCS

- The financing gap between a plant with CCS and one without is large and very sensitive to CO_2 price
  - CO_2 price is uncertain; lenders may/will assume it will be low or at the "floor"
- Incentive packages can address a range of risks – initial cost, poor operation, operation when CO2 price is low
- Incentive packages likely must find balance between insufficient incentive to build and excess revenues
  - Incentives can be designed to address excess revenues
- Ultimately, CCS will compete with nuclear, renewables, and natural gas in supplying lower-carbon electricity
- Flexible operation of CCS will likely be key

Government incentives provide value only if

they work for enough companies to get initial plants built

CCS – Risk Evaluation

Zurich
Climate Office

- Fatal Flaws
  - likely technology failure
  - significant natural resources reserves adjacent
  - site situated in a volatile environment
  - alignment of interest among parties is unclear
  - adverse contractual arrangements
  - weak financials

CONCLUSIONS

Technical, market, regulatory, risk costs and uncertainties need to be addressed:

- capital subsidies and loan guarantees for the additional equipment costs;
- operating subsidies (as feed-in tariffs or tax benefits or long-term off-take agreements) for capture and storage;
- early co-funding of engineering;
- insurance;
- performance standards for old and new units;
- clear regulatory guidance for land use, injection, storage, groundwater protection, and stewardship and liability.

Carbon Sequestration leadership forum

www.cslforum.org

Thank you for your attention