



CCS DEPLOYMENT - INSIGHTS FROM SHELL'S ACTIVITIES, ISSUES TO BE ADDRESSED

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***IEF/GCCSI SYMPOSIUM ON CCS
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SESSION ONE: LATEST DEVELOPMENTS***



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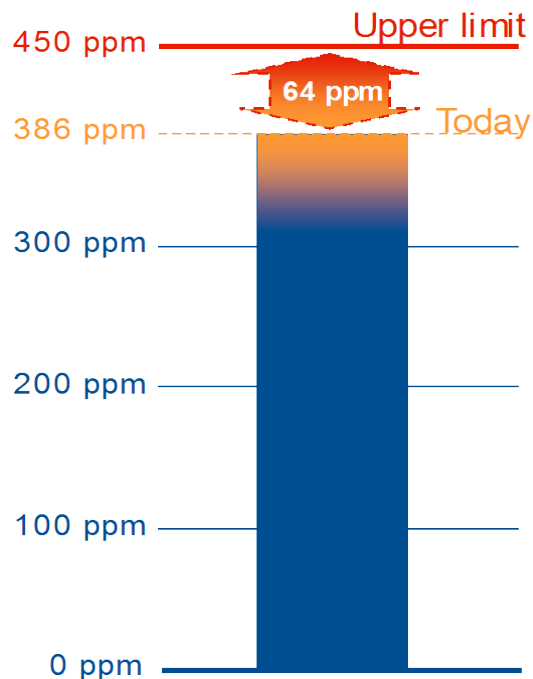
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THE ENERGY AND CO₂ CHALLENGE



CO₂ CONCENTRATION IN ATMOSPHERE

SCIENCE WARNS OF A 450 PPM UPPER LIMIT



EMISSIONS ARE RISING AT OVER 2 PPM PER YEAR



MEETING DEMAND WITH LESS CO₂

THE WORLD WILL NEED ALL OPTIONS IT HAS



ENERGY EFFICIENCY

AND



RENEWABLES

AND



NUCLEAR

AND



CO₂ CAPTURE AND STORAGE

AND

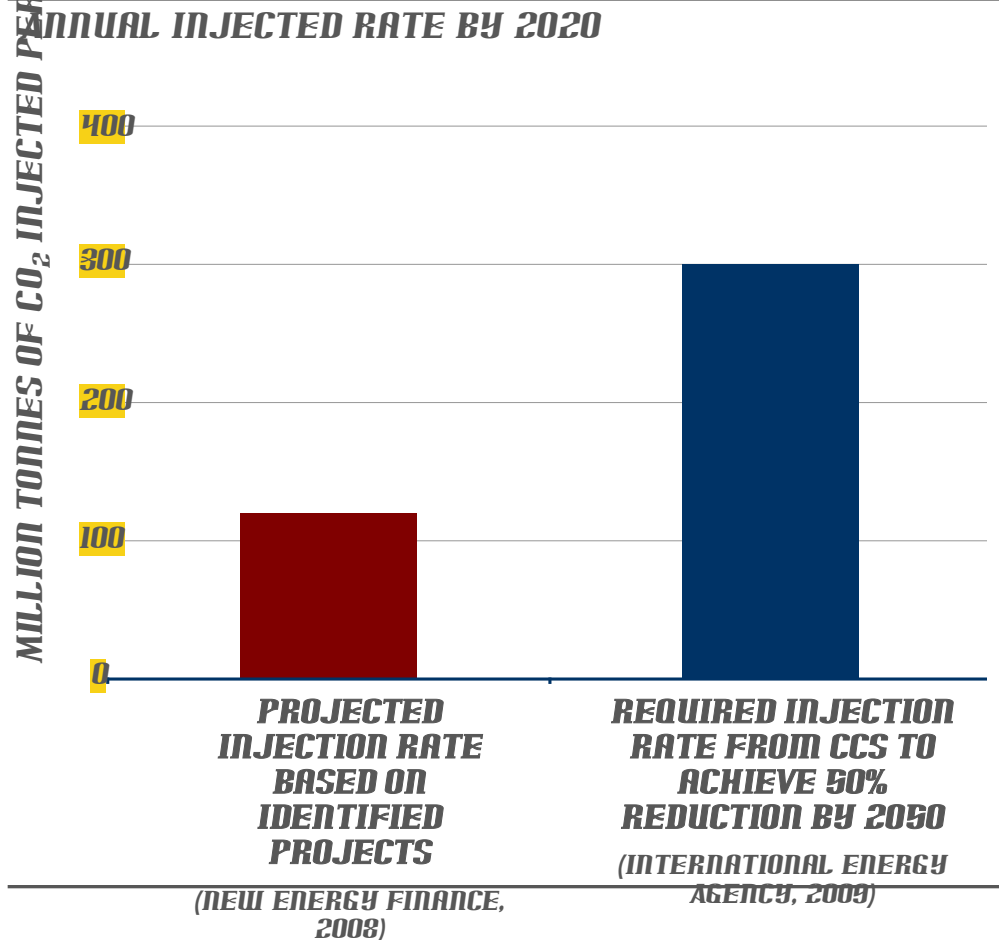


FORESTRY

ALL FIVE PATHWAYS ARE ESSENTIAL AND WILL BE NEEDED AT SCALE TO MEET ENERGY DEMAND THIS CENTURY AND TO LIMIT CO₂ EMISSIONS.

CCS - GAP BETWEEN REQUIREMENT AND DEPLOYMENT

OVER 150 MILLION TONNES CO₂ GAP TO THE REQUIRED LEVEL TO RAMP-UP DEPLOYMENT



- INTERNATIONAL ENERGY AGENCY (IEA) IDENTIFIED CCS AS HAVING THE POTENTIAL TO DELIVER UP TO 19% OF THE MITIGATION EFFORT NEEDED BY 2050, AND MORE THAN 50% BY 2100
- ALL IDENTIFIED PROJECTS ESTIMATE A TOTAL INJECTION RATE OF 120 MILLION TONNES OF CO₂ SEQUESTERED ANNUALLY BY 2020 - FAR FROM THE NEEDED 300 MILLION TONNES BY 2020 TO ACHIEVE 50% REDUCTION BY 2050

PANEL DISCUSSION POINTS

- **LATEST PROGRESS ON TECHNOLOGY, POLICY AND REGULATIONS**
- **NEW DEVELOPMENTS IN THE FUNDING OF CCS PROJECTS**
- **HOW HAS THE PUBLIC ACCEPTANCE EVOLVED?**
- **ASSESSMENT OF ECONOMIC AND BUSINESS CASES FOR CCS AND EOR**
- **FEASIBILITY ISSUES FOR STORAGE IN DEPLETED OIL AND GAS FIELDS**
- **APPROACH FOR SELECTING AND MONITORING STORAGE SITES**

DEVELOPMENTS SINCE 1ST IEF/GCCSI CCS SYMPOSIUM

- **COPENHAGEN OUTCOME**
- **LEARNINGS EXTRACTION & DISSEMINATION**
- **FUNDING ANNOUNCEMENTS**
- **BUSINESS CASE AND COMMERCIAL GAP**
- **PUBLIC ACCEPTANCE**
- **SUPPORT FROM INTERNATIONAL INSTITUTIONS;
GCCSI, CSLF, IEF, IEA, IPAC, ETC.**

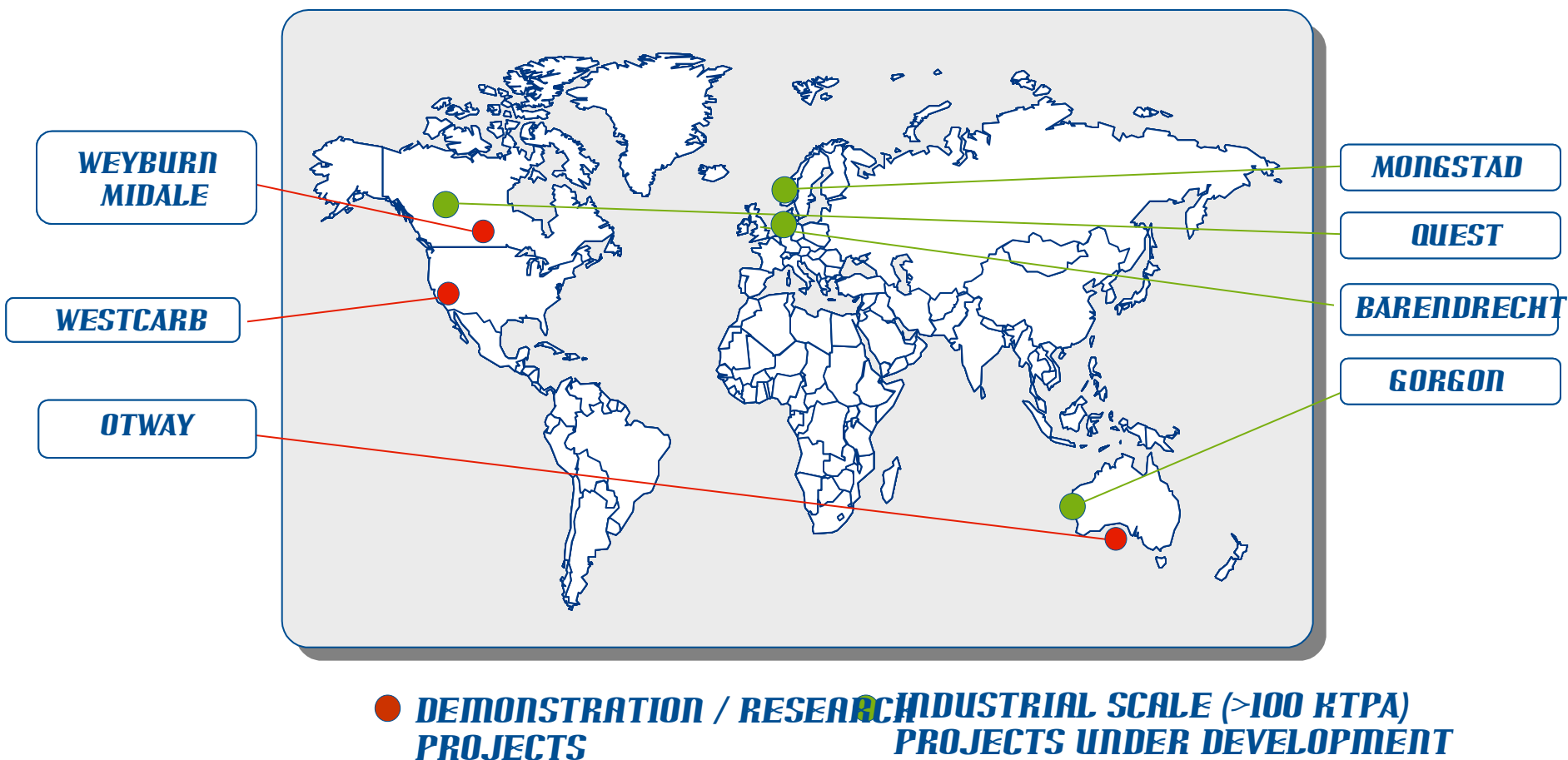
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SHELL RESEARCH, DEVELOPMENT, DEPLOYMENT OF CCS

DEMONSTRATION AND INDUSTRIAL PROJECTS

SHELL IS ALSO A MEMBER OF MULTIPLE CCS RESEARCH PARTNERSHIPS



SOME INSIGHTS FROM CCS PROJECTS DEVELOPMENT

■ CHALLENGING ECONOMICS:

- MOST FRONTIER CCS PROJECTS WILL NOT BE COMMERCIALY FEASIBLE WITHOUT SIGNIFICANT FUNDING SUPPORT

- CCS PROJECTS EXPERIENCE FIRST-MOVER COST DISADVANTAGES/RISKS WITHOUT UPSIDE

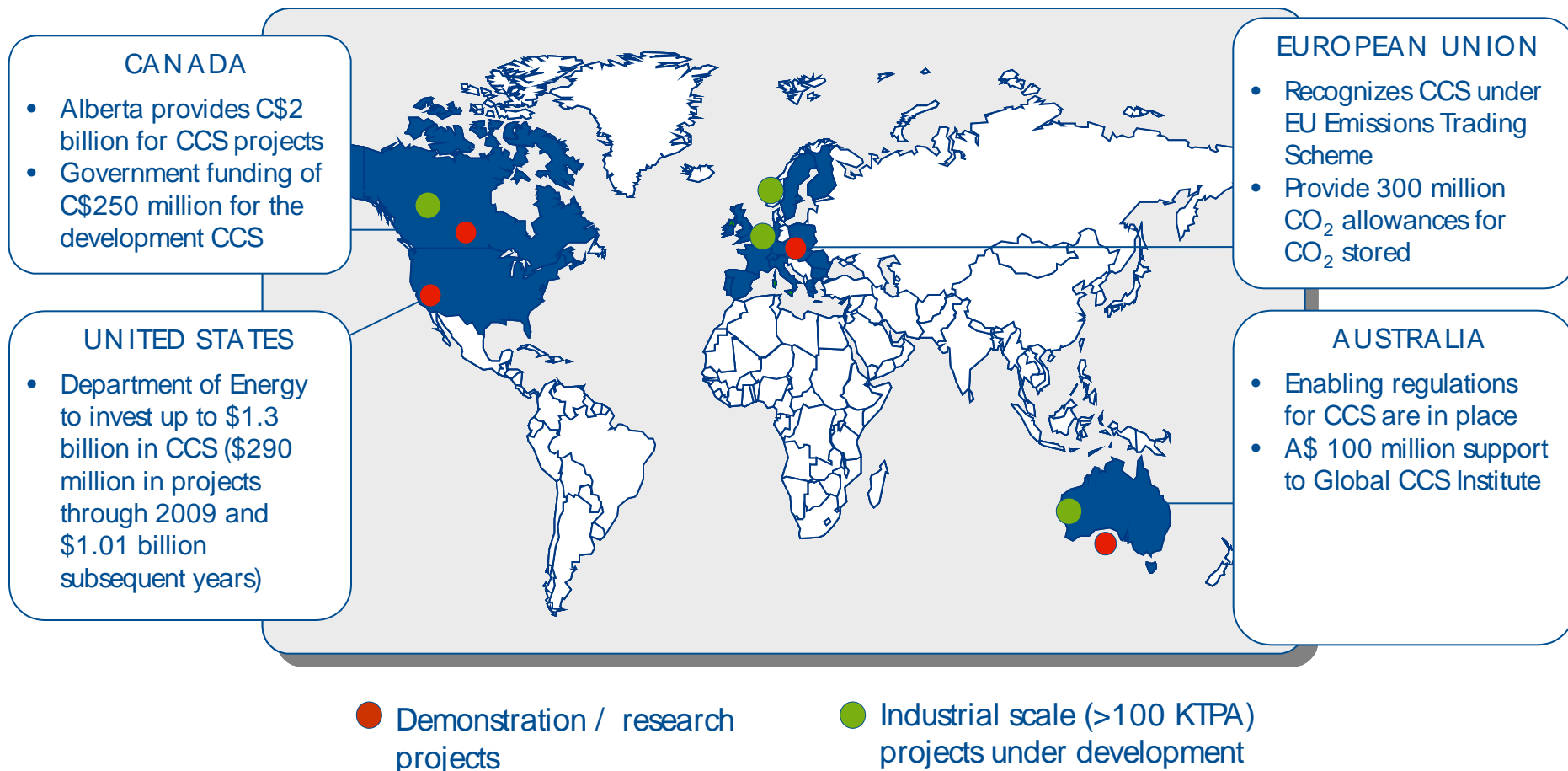
- THE REQUIRED DELIVERY COST&EFFICIENCY WILL ONLY COME WITH SCALE, AND V.V.

■ UNCERTAINTIES ON CONDITIONS FOR POST-INJECTION LIABILITY HANDOVER TO GOVERNMENTS HAMPERS CCS PROJECTS' PROGRESS

■ CCS PROJECTS ARE PUBLIC DOMAIN AND PUBLIC SUPPORT ON NEED FOR CCS AND INDIVIDUAL PROJECTS WILL BE ESSENTIAL FROM INCEPTION

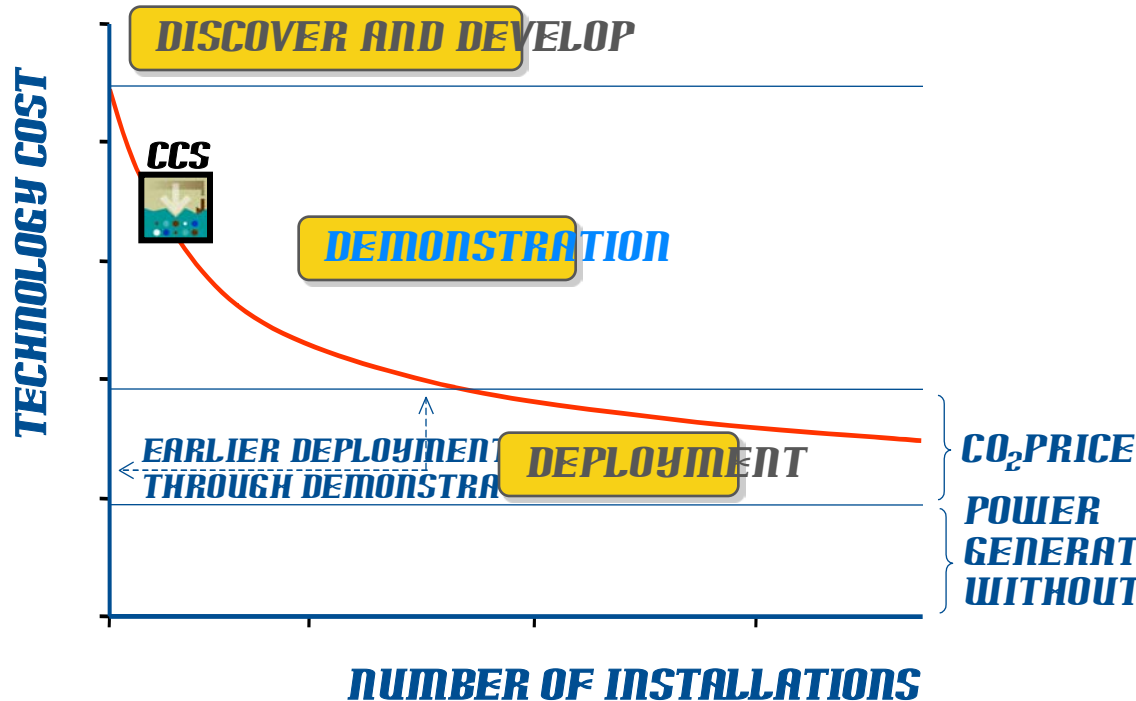
FRONTIER CCS PROJECTS REQUIRE FUNDING SUPPORT

EXAMPLE OF GOVERNMENT SUPPORT FOR CCS DEPLOYMENT



CCS COST & CO2 PRICE; THE COMMERCIAL GAP

BRINGING CCS DOWN THE COST CURVE



PHASES TO DEPLOYMENT

- **DISCOVER AND DEVELOP**
NEED TO REFOCUS AND RAPIDLY EXPAND RESEARCH AND DEVELOPMENT
- **DEMONSTRATION**
NO EARLY ADOPTERS AND HIGH START-UP COSTS - THIS PHASE NEEDS SUPPORT
- **DEPLOYMENT**
CCS IS DRIVEN ALMOST ENTIRELY BY CLIMATE CHANGE CONSIDERATIONS, THEREFORE REQUIRES CLEAR INCENTIVES LINKED TO POLICY GOALS THAT GIVES PRICE SIGNALS TO THE VALUE OF EMISSIONS AVOIDED

WHAT DOES IT TAKE TO ROLL-OUT CCS?

GOVERNMENTS

- ✓ **MARKET BASED APPROACH**
- ✓ **AN INTERNATIONAL FRAMEWORK INCLUDING A MECHANISM RECOGNISING CCS, AND A NEW TRADABLE CARBON STORAGE UNIT, VERIFYING STORED CO₂**
- ✓ **FUNDS OR ALLOWANCES TO SUPPORT COMMERCIAL SCALE DEMONSTRATION PROJECTS**
- ✓ **A GROUP OF COUNTRIES AGREEING TO IMPLEMENT, AS A SATELLITE ENDORSED BY THE INTERNATIONAL FRAMEWORK**
- ✓ **REGULATORY FRAMEWORKS**

RESOLVING LIABILITY, TECHNICAL AND LEGAL ISSUES

BUSINESSES

- ✓ **RESEARCH A WIDE ARRAY OF POTENTIAL TECHNOLOGY**
- ✓ **DEVELOP PROMISING TECHNOLOGY TO ADVANCE THE INNOVATION**
- ✓ **DEMONSTRATE AND DEPLOY TECHNOLOGY TO ROLL THE TECHNOLOGY OUT FROM LAB-SCALE INTO EVENTUAL COMMERCIAL SCALE, STEP-UP THE LEARNING CURVE, AND BRING COSTS DOWN AS EARLY AS POSSIBLE**
- ✓ **PROJECT IMPLEMENTATION -**

COMPETENTLY MANAGE AND INTEGRATE DIFFERENT ASPECTS OF THE PROJECT
- ✓ **RISK AND COST SHARING**

WHAT IS NEXT?

- **URGENCY - SPEED IS VITAL IF DEMO PROJECTS ARE TO BE OPERATIONAL BY 2015.**
- **KNOWLEDGE SHARING - POLICY MAKERS AND INDUSTRY NEED TO SHARE AT REGIONAL LEVEL TO PROGRESS THE TECHNICAL UNDERSTANDING OF CCS.**
- **PUBLIC ACCEPTANCE - WE NEED TO JOIN TOGETHER TO FURTHER UNDERSTANDING AND ACCEPTANCE.**
- **INFRASTRUCTURE - DEMONSTRATION IS KEY BUT WE NEED TO LOOK NOW AT HOW INFRASTRUCTURE IS TO BE SET UP (PLANT CLUSTERS, PIPELINES, HUB STATIONS SINKS) AND HOW IT IS TO PLANNED AND OPERATED.**



THANK YOU !

PUBLIC ACCEPTANCE - STATE OF PLAY



PUBLIC PERCEPTION OF CCS IS A POTENTIAL BARRIER TO THE IMPLEMENTATION AS A CC MITIGATION TECHNOLOGY.

ACTIVE PUBLIC ENGAGEMENT IS KEY TO BUILDING PUBLIC UNDERSTANDING

- **PUBLIC AWARENESS IS GENERALLY LOW, CASE FOR ACTION NOT FULLY UNDERSTOOD OR BOUGHT INTO.**
- **PERCEPTION THAT CCS INDICATES FAILURE TO REDUCE CO2 EMISSIONS IN OTHER WAYS, SUCH AS RENEWABLES.**
- **FEAR THAT CCS IS USED TO CONTINUE DEPENDENCE ON FOSSIL FUELS, ESPECIALLY COAL**

PUBLIC ACCEPTANCE -WHAT HELPS

- **NATIONAL POLITICAL CONSENSUS AND SUPPORT FOR CCS BEFORE ANNOUNCING THE FIRST ACTUAL CCS PROJECT**
- **ENGAGEMENT OF KEY PUBLIC OPINION FORMERS (ACADEMIA, NGO'S) EARLY IN THE PROCESS AND SUPPORT FOR CCS (PROJECT)**
- **PRO-ACTIVE COMMUNICATION STRATEGY WITH KEY STAKEHOLDERS AGREED UPFRONT AND REGULARLY RECALIBRATED**
- **SINGLE MINISTRY ORCHESTRATING CCS DEPLOYMENT**