

Carbon Capture & Storage (CCS) in Oil Production: Using Waste as a Resource

Lee Solsbery, ERM Energy & Climate Change Services

(lee.solsbery@erm.com)

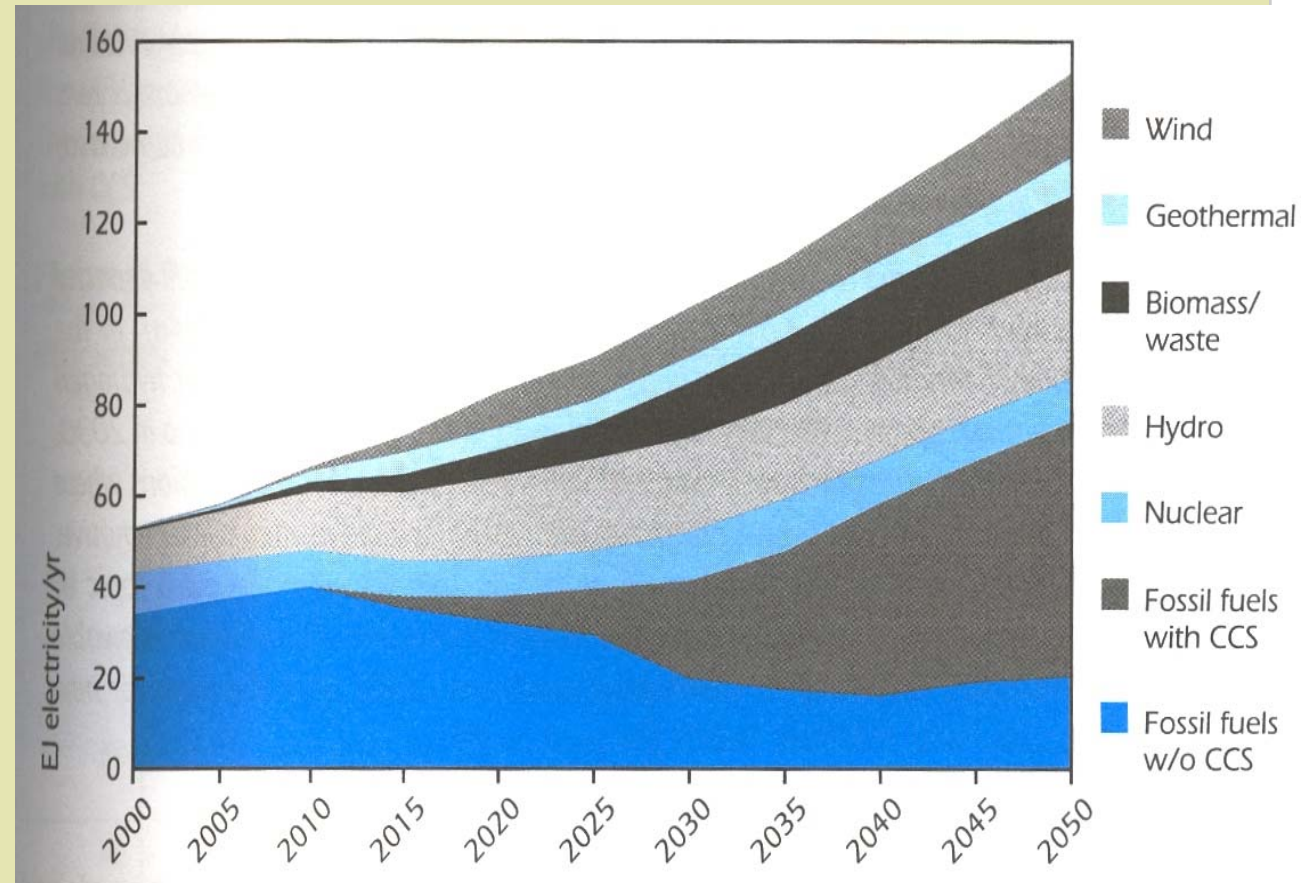
APHSSEC - Bangkok, 11th September 2007

CCS Critically Important to industry & govt

- Fossil fuels will remain a key part of energy mix for decades to come; energy security concerns will prompt full uptake of fossil resources
- Fossil fuel producers under significant pressure to reduce CO₂, but efficiency gains & process improvement options limited at wellhead
- Many major new gas fields have higher CO₂ content = higher venting at platform when gas is purified for pipeline/LNG quality product
- Most associated gas from remote oil fields has limited/no local market = flaring of natural gas at platform when no local gas market exists
- New ventures like oil sands, coal-to-liquids inherently carbon-intensive and also have limited process change/efficiency options at source
- Thus CCS is main option to deliver more than incremental reductions

CCS key to CO₂-friendly future energy mix

- Number of studies on future GHG abatement e.g:
 - Princeton “wedges”
 - WBCSD “pathways”
- **All show CCS with major role**



CCS deployment under a \$50/tCO₂ scenario

Source: IEA Prospects for CO₂ capture and storage

CCS take-up: policy as well as economic barriers

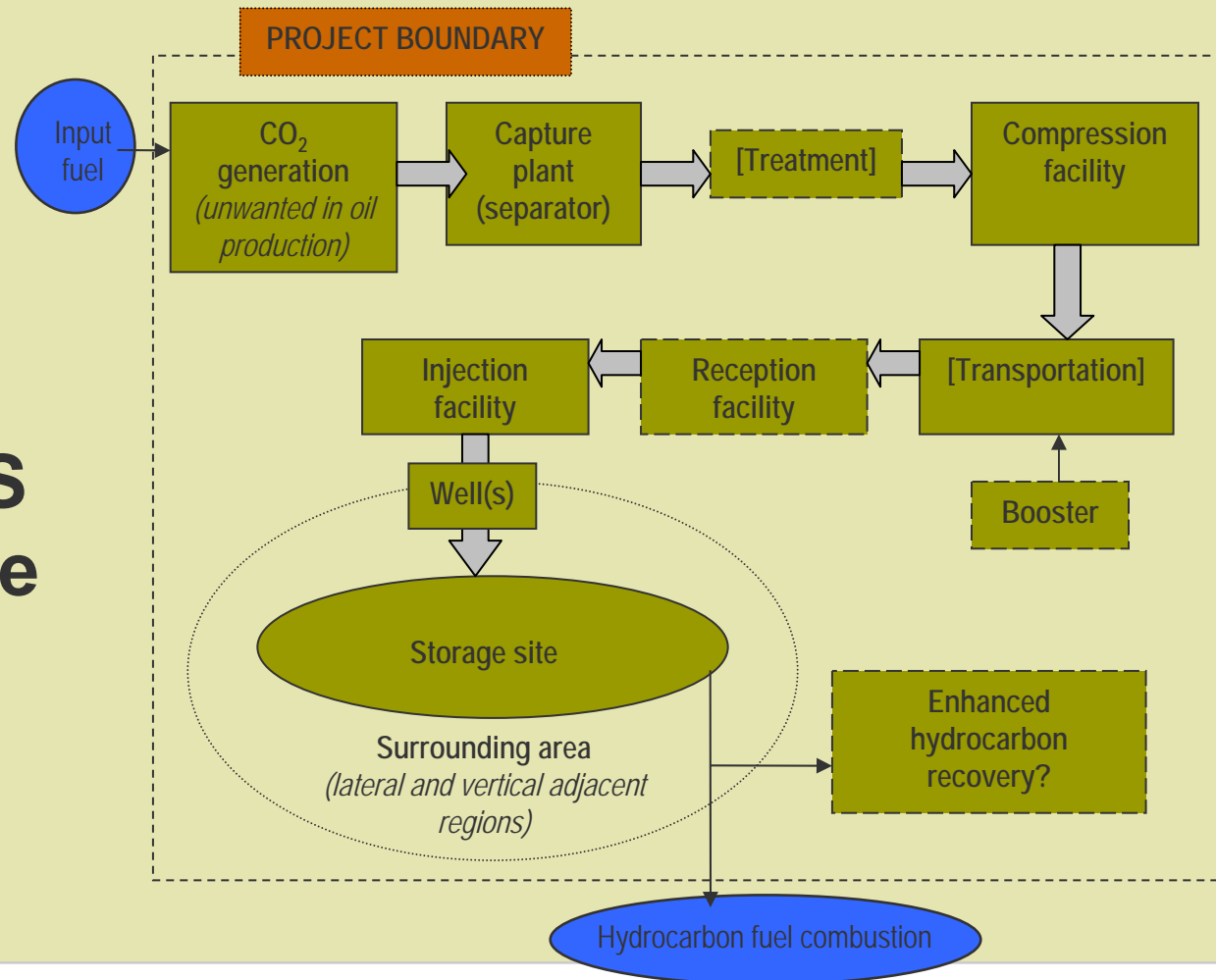
- CO₂ emissions are *inherent* in energy projects - especially in major new “mega” O&G projects and new carbon-intensive projects like oil sands or coal-to-liquids
- If CO₂ reductions mandated for O&G producers, CCS is only option after efficiency gains, except for shutdown
- EOR economics may be most favorable for CCS, and EOR can be monitored to fit new CCS requirements
- Govts must agree CCS rules to ensure this mitigation option is available to the O&G sector – not a technology question but a regulatory/policy matter to resolve

CCS project boundaries for CDM are clear

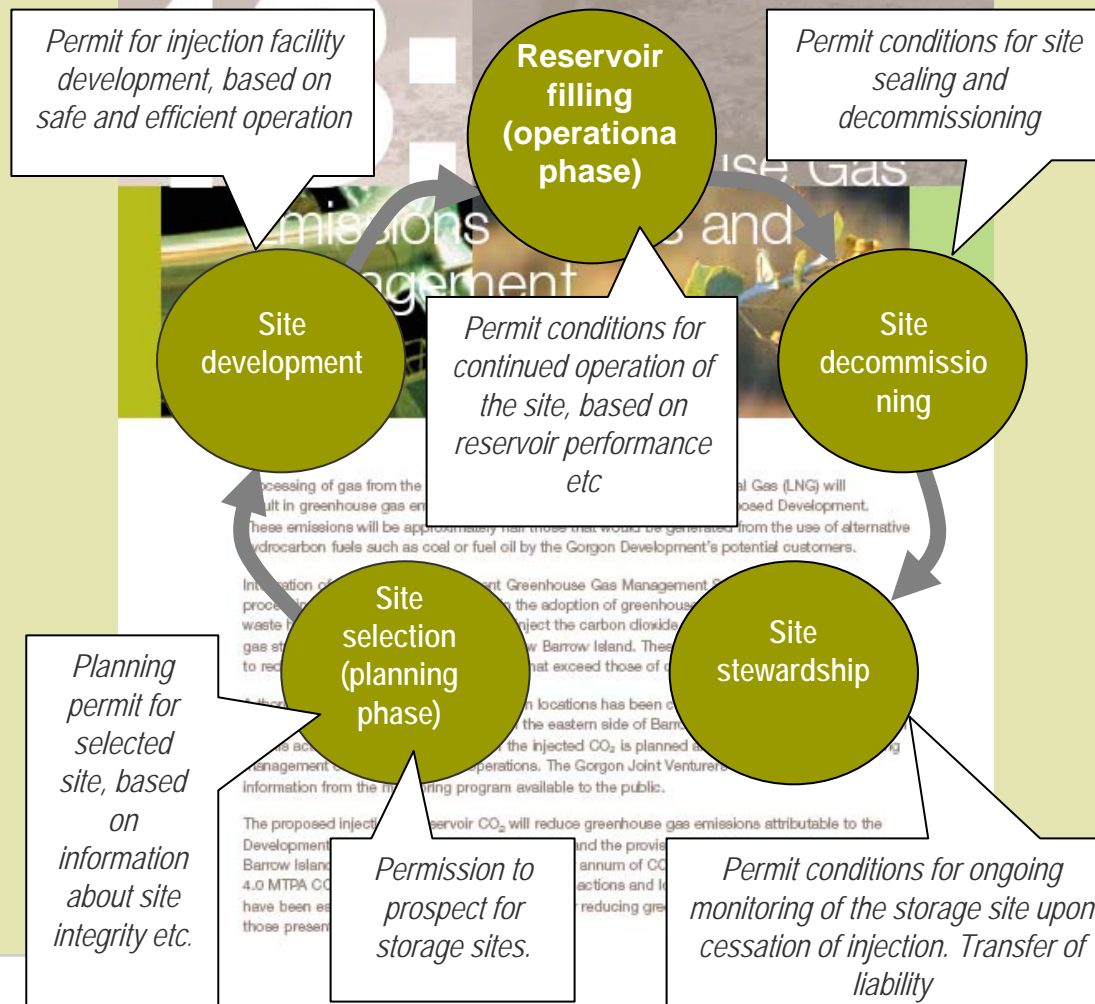
- CCS project boundaries *must* involve *all* steps in CCS chain:
 1. **Capture** of CO₂ at point source (when CO₂ separated, not emitted, and sent for *storage*, it is *mitigation*)
 2. **Transport** of captured CO₂ by pipeline to a geological storage site suitable and permitted for CO₂ storage
 3. CO₂ **injection** at permitted site (w/impurities check)
 4. **Continuous monitoring** of the CO₂ storage site to ensure storage integrity & note any seepage/breach
- *Must monitor* CO₂ at *each* step (volumes/leakage – if any)

Typical CCS Project boundary

- **All elements of the CCS chain to be included**



Regulatory process for a CO₂ storage site



- **Operator must show reasonable expectation of no significant leakage, & plan for management**
- **Govt to ensure post-closure monitoring & nat'l inventory cover of any I-t leakage**

Coverage for CCS Environmental Integrity

- **Fugitive emissions:** monitor and account for in whole CCS chain (capture, transport, injection)
- **Indirect emissions:** additional power requirements recorded for capture, transportation, injection (energy penalty, booster stations, etc.)
- **Seepage from storage reservoirs:** Any short / long term seepage to be monitored and accounted for
- **Responsibility for measurement:** Each operator across CCS chain must monitor and report
- **Verification:** verifiers must be qualified for CCS issues including sub-surface geology models

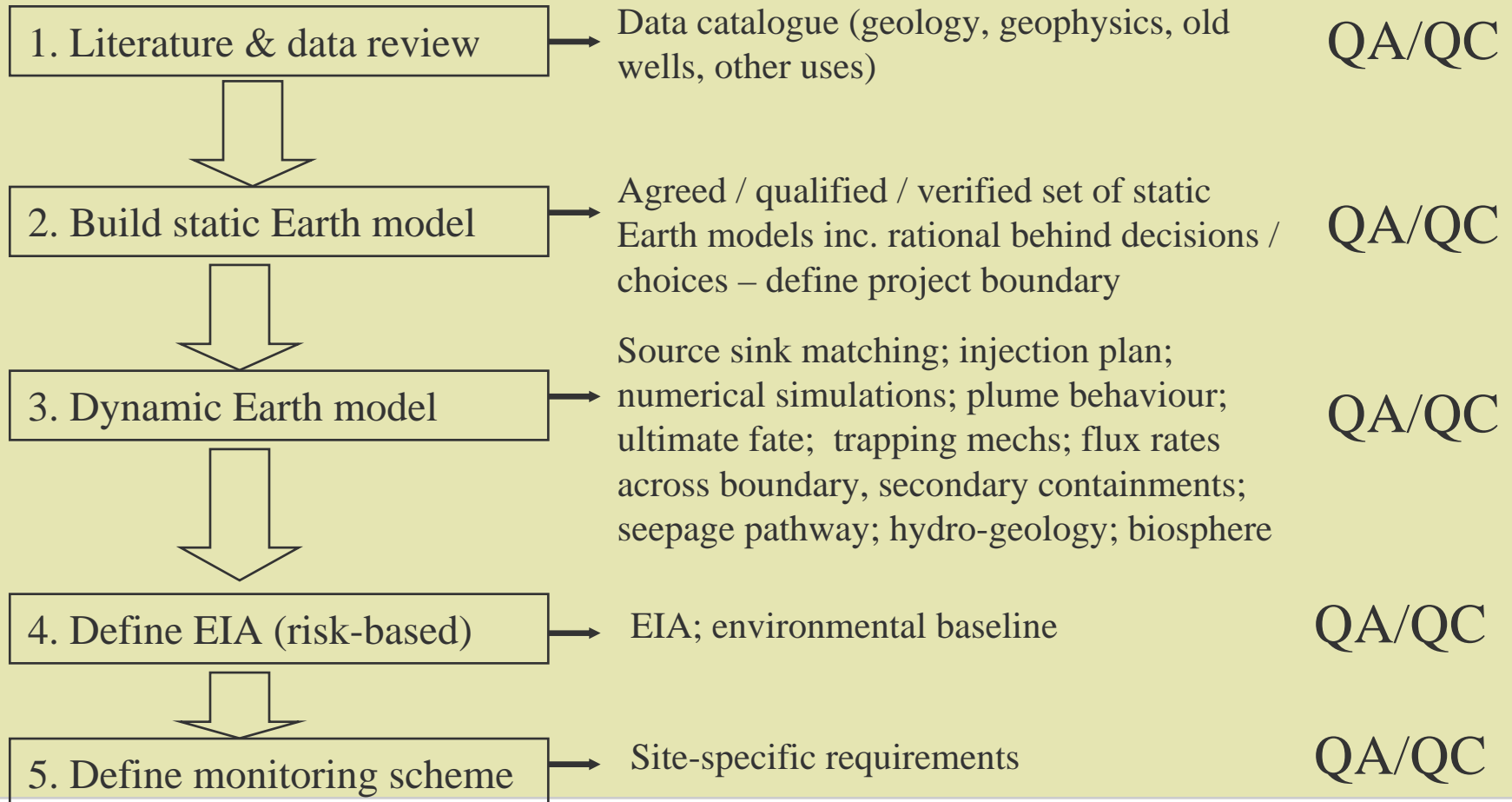
Key legal issue: site integrity & liability

- Operator due diligence – operator gives adequate evidence that storage site has no reasonable expectation of significant leakage and that an adequate site management plan is in place and published
- Emergency plan to control any short-term seepage
- Process to monitor, quantify and report seepage if any
- Include any seepage in National GHG Inventory
- Time limited license (TLL) subject to review based on storage performance and compliance w/requirements

M&R Below ground – key steps & documentation

Step

Documentation



Key Observations and Conclusions

- **Adequate means available to address the principal issues regarding CCS in a manner which ensures environmental integrity, safety & long-term confidence**
- **Above-ground CCS operations:**
- **Do not present new regulatory considerations**
- **Sub-surface elements:**
- **Permitting regime can be used to cover these issues in full conformance with environmental integrity requirements**
- **Site Monitoring and Reporting Plan adequate for verification**
- **Commitment to decommissioning/abandonment made**
- **Long-term liability issues covered via regulation, transfer**

Carbon Capture and Storing CO₂ from oil production:
Using Waste as a Resource

Thank you

Lee Solsbery, Paul Zakkour
ERM Energy & Climate Change Services

lee.solsbery@erm.com
paul.zakkour@erm.com