

A few career reflections

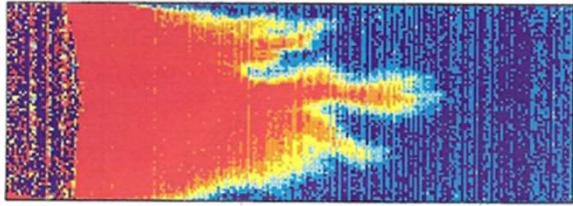
Alistair Jones



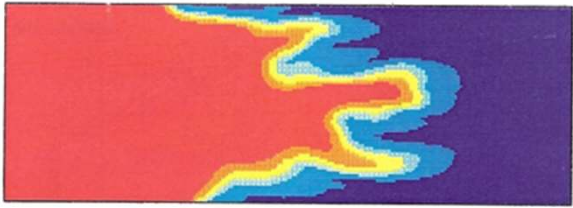
Outline

- ▶ The privilege we have in working in the oil industry and in reserves
- ▶ Some challenges we face in estimating or assuring reserves - and how developments in PRMS could help
- ▶ Opportunities we have to continue to make a difference

R&D



Experiment



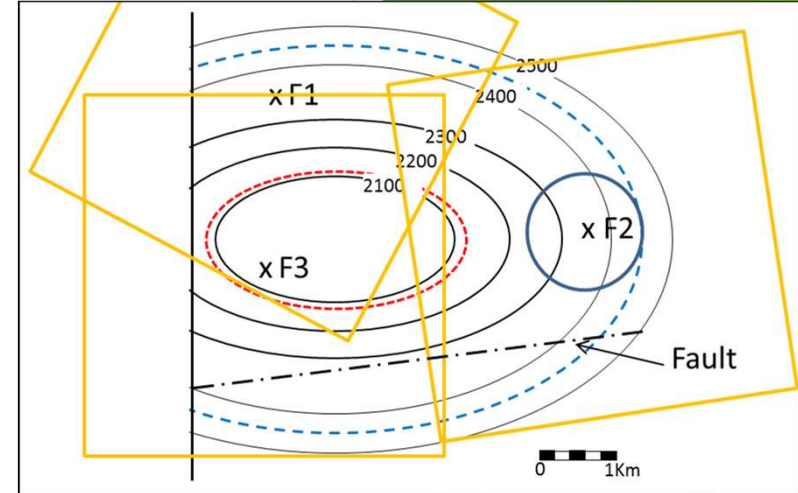
Simulation



Field Development



Reserves Assurance



A privilege to have worked in the Oil Industry and BP

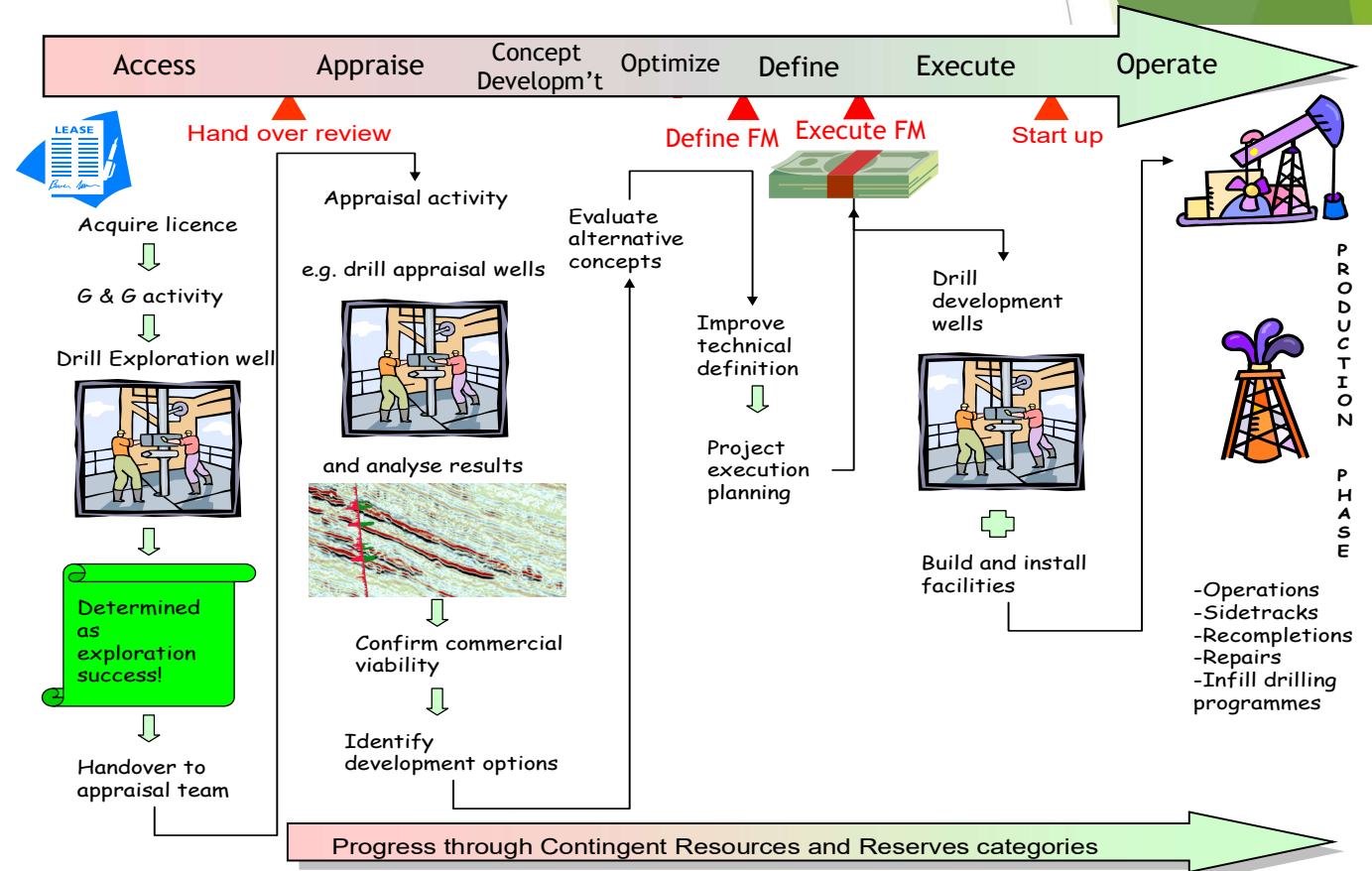
- ▶ People
 - ▶ Capability, integrity, multicultural, a pleasure to work with
 - ▶ A common thread between companies & countries
- ▶ Technical challenge
 - ▶ Interesting, challenging problems
 - ▶ Variety and breadth
- ▶ Opportunity for impact
 - ▶ Help supply world's energy
 - ▶ Help individuals

A privilege to work in Reserves Assurance

- ▶ More than auditing!
 - ▶ Great opportunity for involvement with people and for stimulating work
- ▶ Responsible for assurance, guidance and training
 - ▶ N Africa and ME fields
 - ▶ Big oil, conventional gas, tight gas,
 - ▶ Mature fields, new developments
- ▶ Collaborative Developments
 - ▶ training course based around an example field from discovery to decline
 - ▶ approach to assessing reliable simulation
 - ▶ UNFC bridging (Russian, Chinese systems), specifications (Bioenergy, Solar)

Challenges in estimating or assuring reserves and resources

- ▶ Technical
- ▶ Commercial
- ▶ Behavioural



What is a feasible development plan?

What plans meet proved status?

PRMS requirements for commerciality

- A. Evidence of a technically mature, feasible **development plan**.
- B. Evidence of financial appropriations either being in place or having a high **likelihood** of being secured to implement the project.
- C. Evidence to support a reasonable time-frame for development.
- D. A reasonable assessment that the development projects will have positive economics and meet defined investment and operating criteria. This assessment is performed on the estimated **entitlement** forecast quantities and associated cash flow on which the investment decision is made (see Section 3.1.1, Net Cash-Flow Evaluation).
- E. A reasonable expectation that there will be a **market** for forecast **sales** quantities of the **production** required to justify development. There should also be similar confidence that all produced streams (e.g., oil, gas, water, CO₂) can be sold, stored, re-injected, or otherwise appropriately disposed.
- F. Evidence that the necessary production and transportation facilities are available or can be made available.
- G. Evidence that legal, contractual, environmental, regulatory, and government approvals are in place or will be forthcoming, together with resolving any social and economic concerns.

Will the plan be achieved? E.g.

- Drilling schedule
- Water injection e.g. start-up time, injectivity, conformance, sweep
- Retrofitting of gas lift
- On time and efficiency improvements

Some useful tests

- Do the relevant discipline managers take full responsibility for the plans?
- Are they integrated?
- Is there evidence that the plans are achievable? E.g. track record, studies & analogues

Suggestion for PRMS

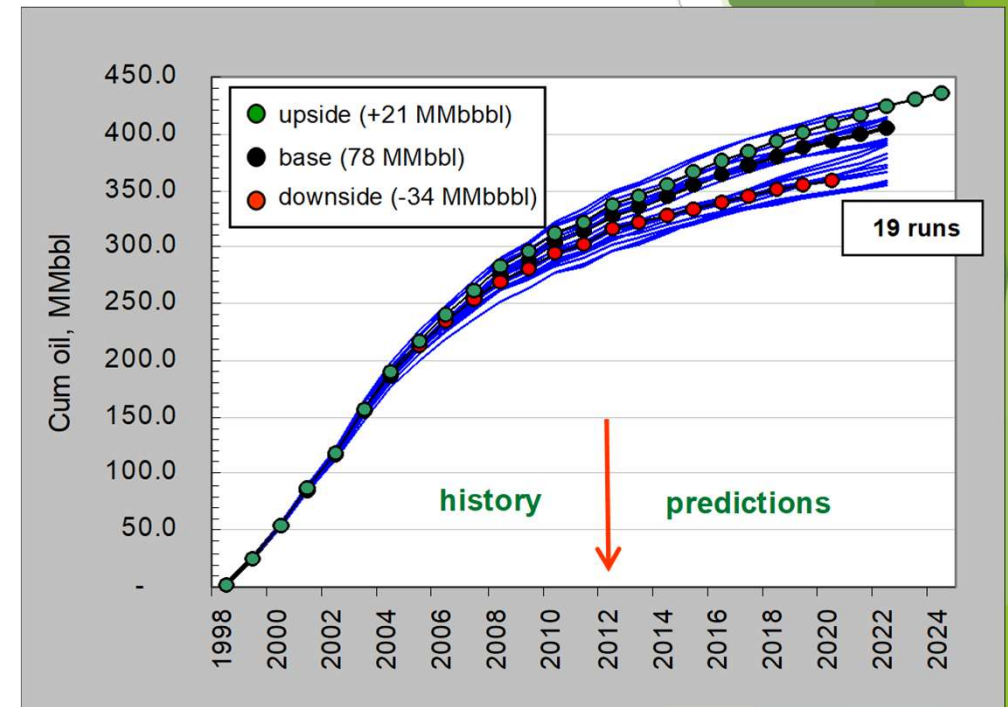
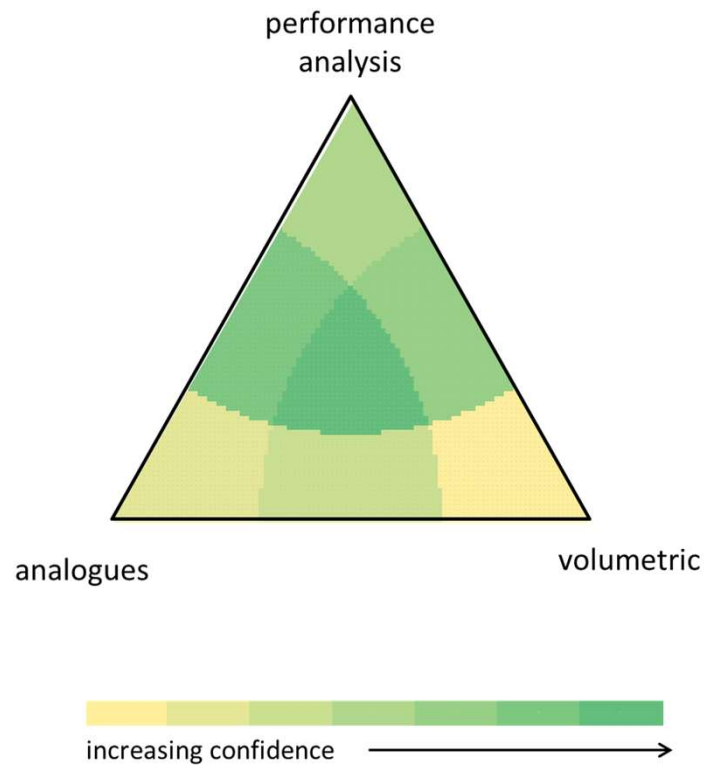
- guidance on assessing robustness of development plan

Is the technical analysis sound?

- ▶ Prerequisite for defining proved or 2P cases
- ▶ Considerations
 - ▶ Knowledge and experience of the technical team
 - ▶ Ownership
 - ▶ Knowledge and experience of reviewers



Are the proved and 2P cases robust?



Are the proved and 2P cases robust?

- ▶ Which approach?
 - ▶ Incremental analysis only makes sense in special cases - these are covered by the other methods
 - ▶ Probabilistic or geostatistical analysis can be a black box which appears sophisticated but hides assumptions
 - ▶ Deterministic scenarios can give coherent cases
- ▶ Clear evidence required for deterministic cases or probabilistic or geostatistical inputs

Suggestion for PRMS

- remove incremental analysis
- Concise standards of technical evidence for deterministic and probabilistic methods

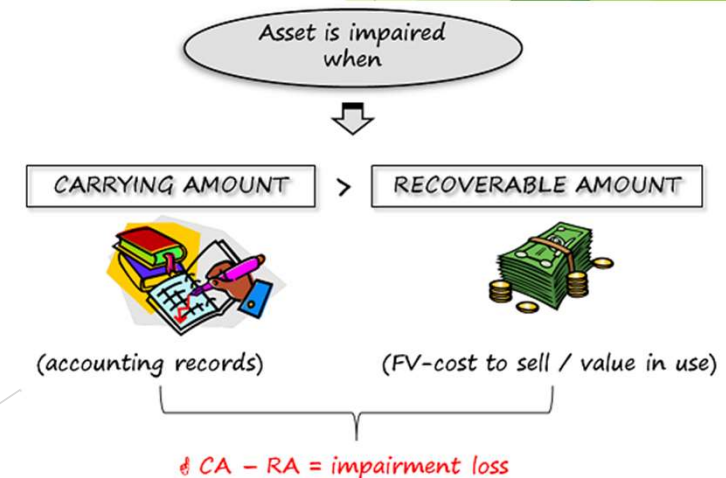
Technical Evidence - example

SPEERE August 2016

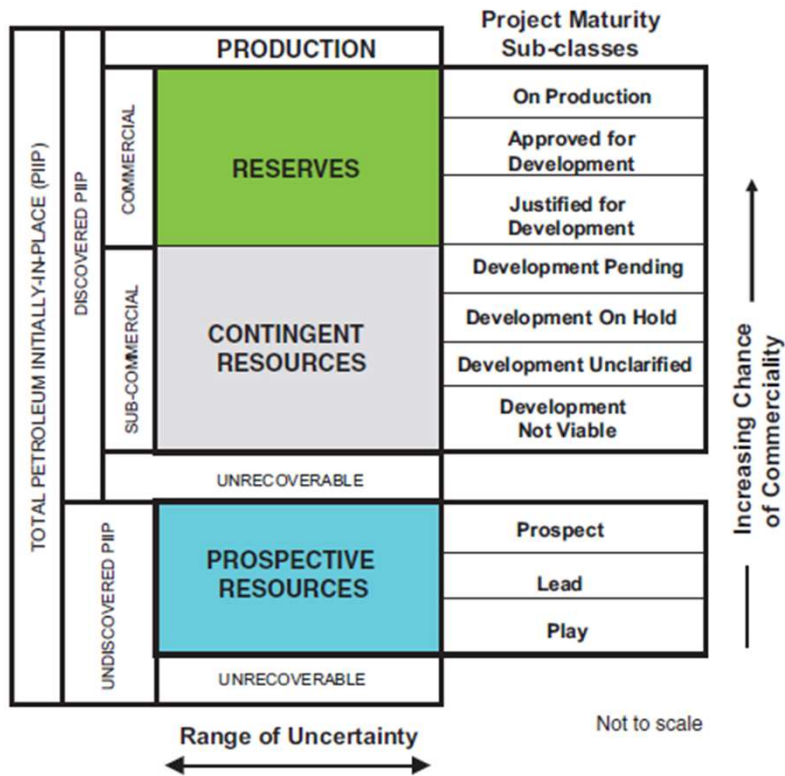
Component	Technical Element	Evidence
Reservoir and Fluid Description	Reservoir Container	Top and bottom surfaces mapped by reliable seismic. Average reservoir thickness of each unit compared with well averages and thickness does not increase away from well control.
	Hydrocarbon Column	GOCs defined by gas and oil RFT pressures from the same reservoir unit. OWCs in all but one unit defined by oil and water pressures from the same reservoir unit. Contacts consistent with logs. In one unit LKO was logged and deeper contact defined by intersection of oil pressure from the reservoir unit and regional water pressure.
	Reservoir Properties	Net-to-gross mapped from wells log and reliable seismic. Porosity and permeability mapped from logs calibrated to core. Average rock properties of each unit compared with well averages. In one unit there is improvement away from well control. Saturation is based on log measurements with Archie exponents derived from laboratory measurements and calibrated to core measurements. Relative permeability is defined from laboratory measurements and response consistent with logged saturations behind flood front and with observed watercut.
	Reservoir Fluids	laboratory analysis of fluid samples from 8 appraisal wells. Four horizons have the same description. One has a slightly heavier oil and one a significantly lighter oil. PVT samples gathered since startup are consistent with this description.
	HIIP	Integration of description of Container, Column, Reservoir and Fluid Properties.
Development	Defined Reservoir Area	Production continuity from pressure established by interference tests supported by FTT, tracer, 4D, geological and reliable seismic correlation, fault seal analysis.
	Economic Producibility	Rate for new wells predicted by analysis of measurements of permeability, fluid and pressure. Supported by use of existing wells as analogues
	Wells, Facilities and Export	Track record of performance supports design production and injection capacities. Historical data supports analysis of lift curves and production/injection network. Track record defines on-time trends. Some improvement in on-time assumed in business case. Schedule of new well start-ups, surveillance and facility shut-downs supported by committed business plans consistent with delivery track record.
Prediction	Recovery Factor	Prediction from history-matched simulation model where predicted profile is supported by performance data and where recovery factor is consistent with analogue fields
	Production Profile	Prediction from history-matched simulation model consistent with analytical predictions from performance data

Commercial issues can be challenging

- ▶ Commercial issues can have a large impact e.g. maturity meets reserves or not?
- ▶ Technical teams may not be aware of commercial issues or implications: e.g. Take-or-pay agreements, DD&A, Impairment
- ▶ Consistency of technical and commercial assumptions required
- ▶ Requires clear guidance and good communication



Reserves or Contingent Resources? Can be difficult to decide



2.1.3.5.4 Projects that are classified as Reserves must meet the criteria as listed in Section 2.1.2, Determination of Commerciality. Projects sub-classified as **Justified for Development** are agreed upon by the managing entity and partners as commercially viable and have support to advance the project, which includes a firm intent to proceed with development. All participating entities have agreed to the project and there are no known contingencies to the project from any official entity that will have to formally approve the project.

2.1.3.5.5 Justified for Development Reserves are reclassified to Approved for Development after a FID has been made. Projects should not remain in the Justified for Development sub-class for extended time periods without positive indications that all required approvals are expected to be obtained without undue delay. If there is no longer the reasonable expectation of project execution (i.e., historical track record of execution, project progress), the project shall be reclassified as Contingent Resources.

Suggestion for PRMS

- Further guidance on what evidence required to meet “Justified for Development”

Commercial Evidence - UNFC example

much commonality between resources

Criteria	Requirements
Access and Entitlement	Beneficial rights exist to access and exploit the <i>Bioenergy Source</i> , as well as rights to utilize a conversion process (via either an existing asset or an investment) to convert the <i>Bioenergy Source</i> into marketable <i>Energy Products</i> .
	The entity shall be exposed to risks and rewards associated with both the <i>Bioenergy Source</i> and the Conversion asset(s).
	A supply framework (see Part II Section D) for defined quantities of the <i>Bioenergy Source</i> for a determined time period is in place. If the supply framework is dependent on contractual agreements, these are signed and/or there are expectations that this will occur within a reasonable time frame. The time period for which rights exist should be defined; moreover, the contracts shall at least cover sufficient quantities to support economic operation of the <i>Project</i> .
Market and Sales Connectivity	Infrastructure with sufficient capacity to transport or otherwise transfer the production to the markets in question for sale either exists or is planned and approved for implementation.
	Any necessary off-take or sales agreements required to monetize the <i>Energy Products</i> and any associated non- <i>Energy Products</i> are in place, as evidenced by signed documents, for a determined time period or there are <i>Reasonable Expectations</i> that these will be secured within a <i>Reasonable Time Frame</i> .
	The <i>Project's Energy Product(s)</i> meet any relevant standards or specifications, and any necessary registration, approval, or qualification required for the <i>Energy Products</i> to be recognized under any relevant legislation is either in place or there are <i>Reasonable Expectations</i> for this to occur within a <i>Reasonable Time Frame</i> .
Economic Case Validation	An economic case exists that demonstrates the <i>Project</i> is economically viable, either as a new investment or as an existing operation.
	Consistency exists between capital investment, operating costs, and the expected production profile and <i>Project</i> lifetime.
	Economic indications demonstrate positive cash flows over the determined lifetime of the <i>Project</i> .
Authorisation	All necessary regulatory and permitting approvals required by governments and/or relevant regulatory authorities are either in place, supported by documentary evidence for a defined time period, or are expected to be in place within a <i>Reasonable Time Frame</i> .
Feasibility & commitment	The <i>Project</i> is in commercial operation; the <i>Bioenergy Source</i> is being accessed, the conversion plant is operational, and the infrastructure is in place to deliver the <i>Energy Product(s)</i> to the relevant markets, or;
	Capital funds have been committed for all elements of the <i>Project</i> and implementation is underway, or;
	Sufficiently detailed studies have been completed to demonstrate the feasibility of all elements of the <i>Project</i> by implementing a defined development plan.

Suggestion for PRMS

- Concise guidance on commercial evidence to meet proved reserves

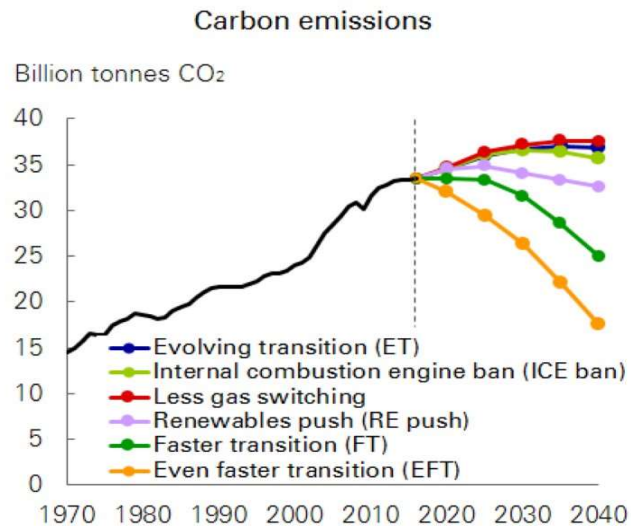
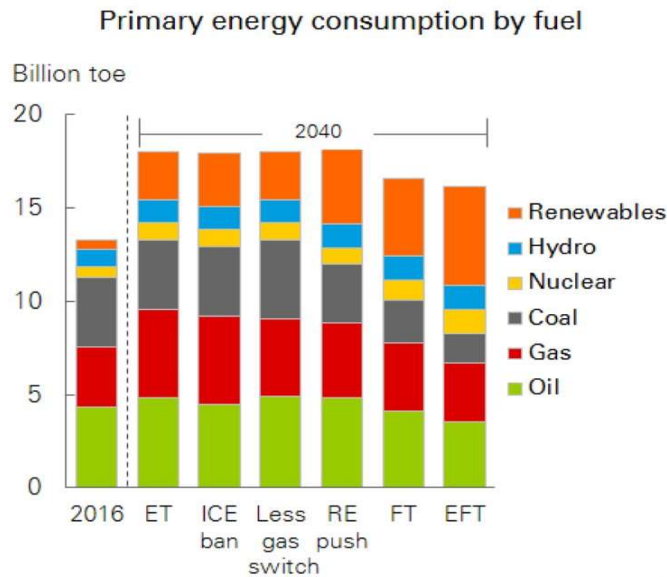
Rules and guidance are not enough


- ▶ All involved act in good faith, use a factual basis and best judgement, and seek advice where needed
- ▶ Recognise technical and commercial gaps and work to fill them. Bring in relevant experts where needed
- ▶ Establish good working relationships. Promote and prize respect, inclusion, openness, honesty and high technical standards. Be an example of these.
- ▶ Don't rush to judgement - gather the facts and the thoughts of those involved
- ▶ Focus your efforts on the most important things e.g. reservoirs with large volumes, material changes
- ▶ Be clear and decisive
- ▶ Be firm when required but be willing to be challenged and to change your mind for good reasons

Future role of reserves estimation & reporting?


- ▶ Increased emphasis on sustainable development
 - ▶ Social and environmental aspects
 - ▶ Other resources

Alternative scenarios





AFRICAN MINERAL AND ENERGY RESOURCES CLASSIFICATION AND MANAGEMENT SYSTEM (AMREC)

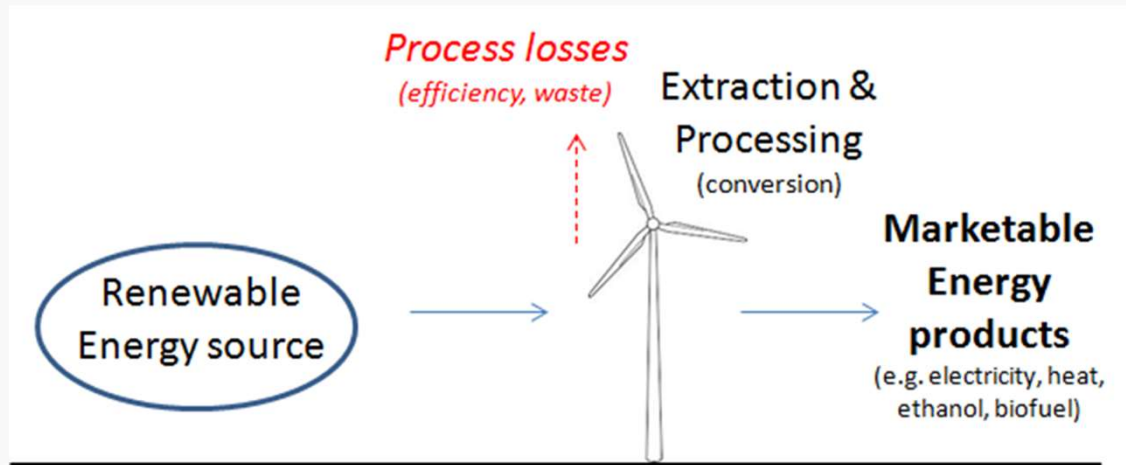


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A project-based classification

... applicable to fossil and other energy resources

- Projects link energy sources and energy products
- They are the basis for economic evaluation and decisions



Opportunities to contribute to sustainable development

- ▶ Assist socially and environmentally responsible development
 - ▶ O&G industry should be enablers not blockers. We have a lot to contribute.
 - ▶ PRMS has some comments on social & environmental considerations, intent to include more in guidance update
 - ▶ SPE developing standards for CO2 sequestration “reserves”
- ▶ Collaborate with UN EGRM on these issues and support development of specifications for other resources - EGRM, SPE and SPEE should not be in competition
- ▶ Promote the reporting of social and environmental measures of projects in addition to reserves