Biography:

David MacDonald

David MacDonald is the Vice President Segment Reserves for BP, where he is the principal individual responsible for the governance of the estimation, classification and reporting of reserves and resources. He has worked for BP for over 30 years in a variety of engineering and management roles.

He is the current chair of the Bureau of the Expert Group on Resource Classification of the United Nations Economic Commission for Europe and a past member of the American Association of Petroleum Geologists' Committee on Resource Evaluation and the Society of Petroleum Engineers' Oil and Gas Reserves Committee.

Extending the Influence of the PRMS: The UNFC and Renewables

Abstract: The Petroleum Resources Management System published in 2007 (PRMS-2007) is firmly established as the most widely used resource classification system in the oil and gas sector. It also provides the foundation and keystones for consistent application to petroleum resources of the United Nations Framework Classification for Resources (UNFC). UNFC is designed as a generic classification system for any commodity, with extremely broad potential application. It comprises a set of high level specifications (rules of application) which provide the necessary "umbrella" framework for consistent classification across all commodity types, while the relationship with PRMS-2007 ensures consistency for the petroleum commodity type.

While UNFC provides a tool for classifying and comparing fossil energy projects, there is currently no global classification system able to address the rapidly-expanding sector of renewable energies. The development of a classification system for renewable energies is now required, and a project under the UN umbrella was started for that purpose in 2013. Such development draws on UNFC to ensure that all the existing knowledge and experience is used, while also achieving comparability of estimated future supplies from both renewable and fossil energy sources. This is where the three key principles behind UNFC will be of particular value to the renewable energy industry: the application of the project concept to resource classification, the description of the technical & commercial maturities of this project as key attributes of the resource, and the adoption of a range of uncertainty in estimated recoverable quantities from that project.

Generic specifications for the application of UNFC to renewable energies were developed over the last three years and are available. Commodity-specific specifications, related to the Generic specifications but addressing specific renewable energy commodities, are currently being developed. Geothermal-specific specifications were developed in 2015-16 and have now been approved. Work on bioenergy-specific specifications has been completed and these will be issued for public comment shortly, while development of solar-specific specifications is underway. Work groups addressing hydropower and wind, respectively, have been established as has a work group that is developing specifications for anthropogenic resources.

This talk will discuss how the key principles of UNFC, hence PRMS-2007, are being applied to the development of renewable energy classification and why this is of relevance to the petroleum industry in building a sustainable energy mix for future generations.

Extending the Influence of the PRMS: The UNFC and Renewables

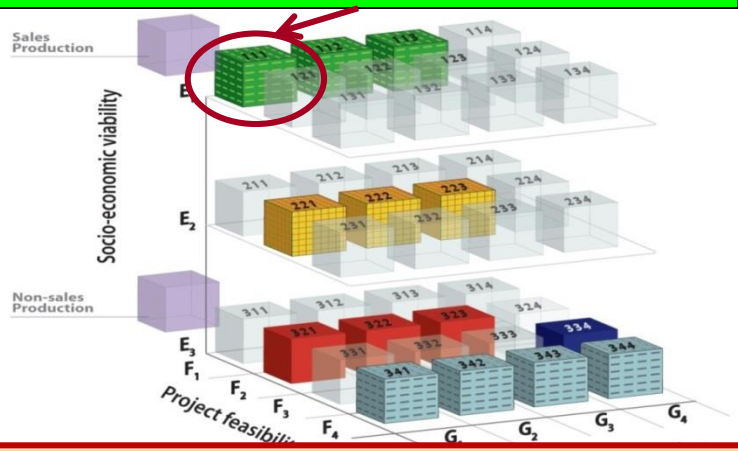
David MacDonald, BP

Isn’t a proved reserve proved?

- Petroleum Resources Management System
- US Security and Exchange Commission
- UK Statement of Recommended Practices
- Canadian Security Administrators
- Russian Ministry of Natural Resources
- China Petroleum Reserves Office
- Norwegian Petroleum Directorate
- United States Geological Survey

UNFC – How it works

UNFC Class: 111



Proved Reserves are those quantities of petroleum, which by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations.

Category	Definition
E1	Extraction and sale has been confirmed to be economically viable.

Category	Definition
F1	Feasibility of extraction by a defined development project or mining operation has been confirmed.

Category	Definition
G1	Quantities associated with a known deposit that can be estimated with a high level of confidence.

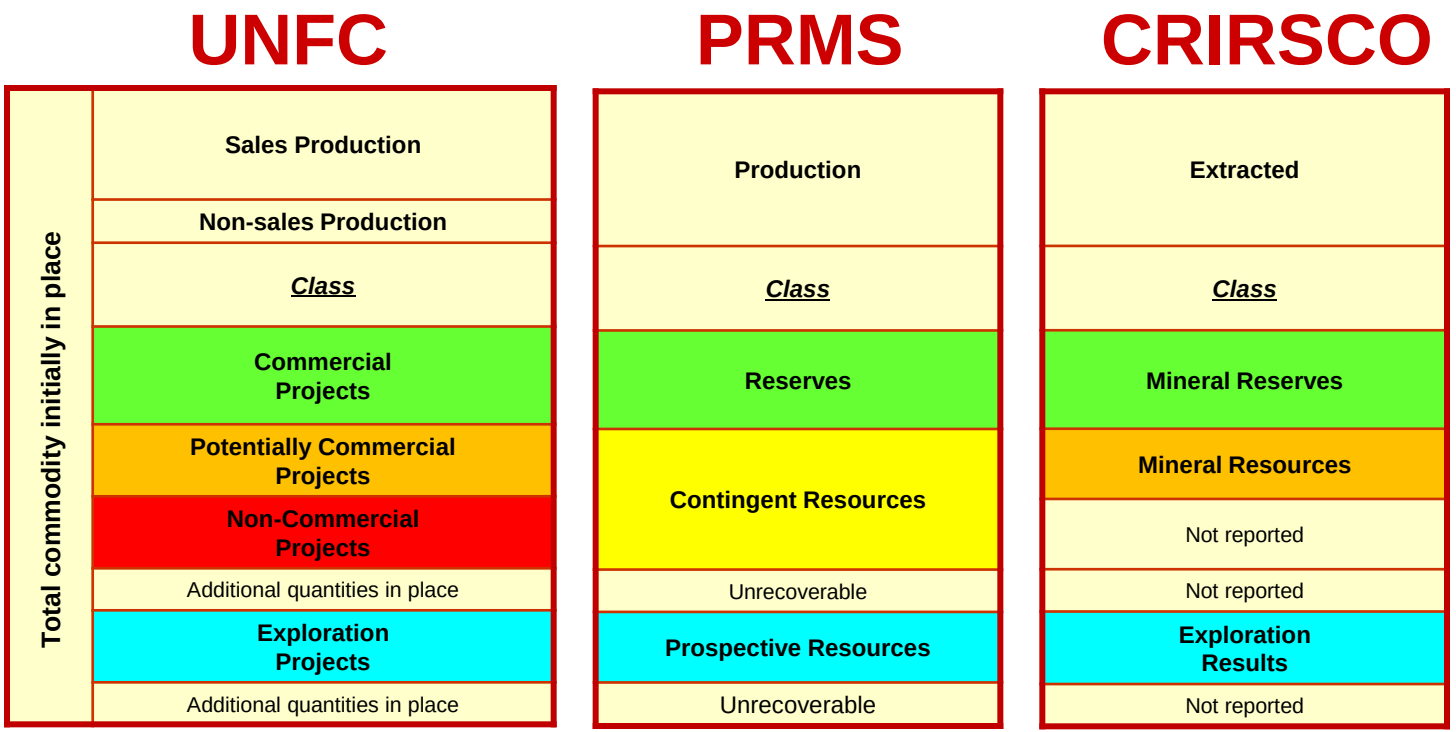
UNECE & SPE Partnership

The UNECE Group of Experts and SPE agree that these goals are mutually supportive and to establish a relationship to further their achievement. The UNECE Group of Experts and SPE further agree that the ultimate goal is to produce one common terminology through one common process. However, both parties recognize that there may be significant challenges in achieving this ultimate goal.

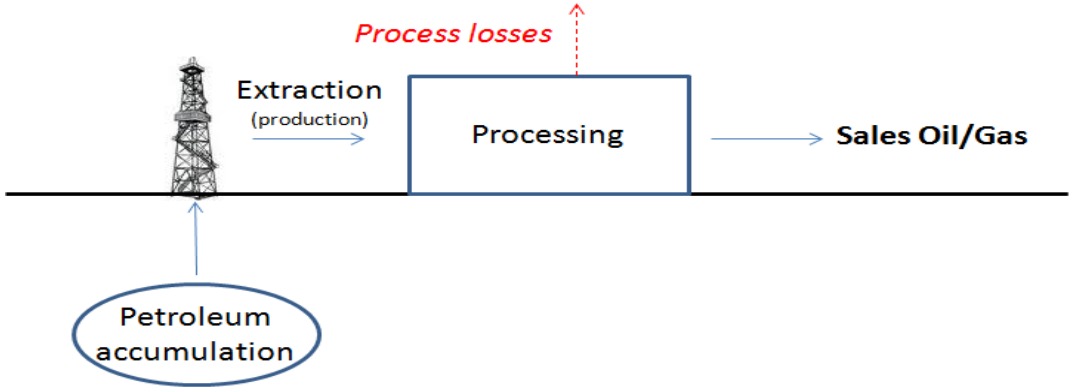
Memorandum of Understanding - 2006

The UNECE and SPE are working in partnership on the development of the UNFC and the PRMS. The SPE gains significant value from its work with the UNECE, including country access, introduction to new experts and access to ideas from other commodity groups applying the UNFC.

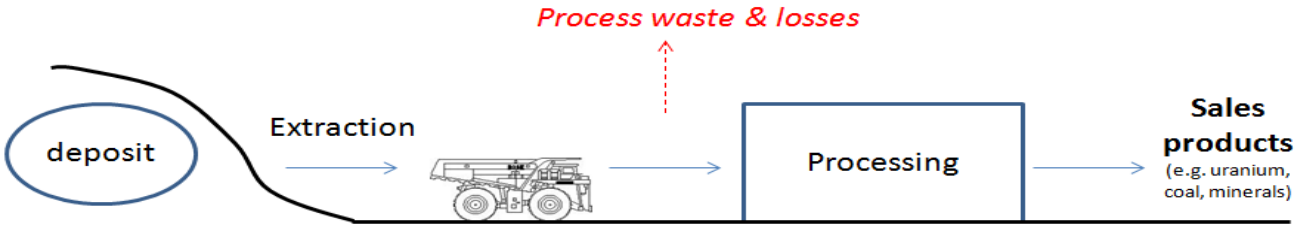
Alignment of systems (schematic)



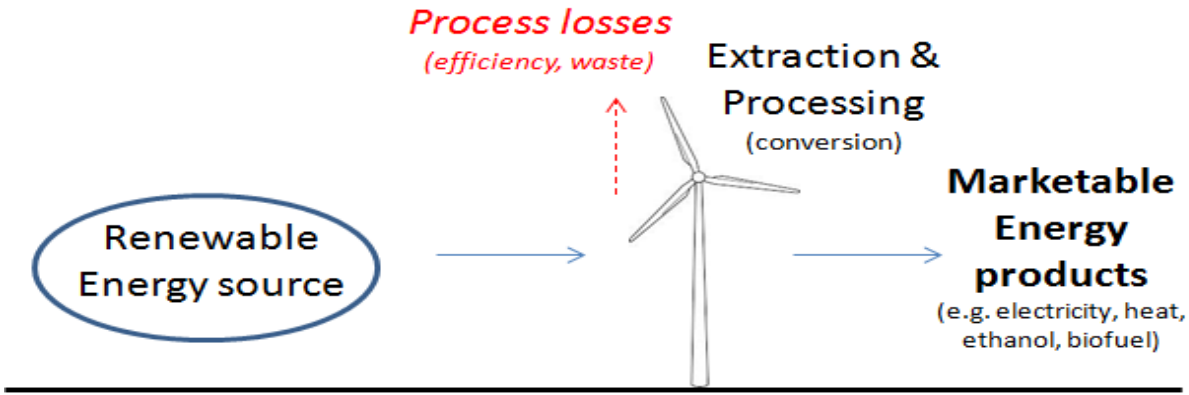
UNFC is “project-based”



The **project** generally represents the level at which a decision is made whether or not to proceed (i.e., spend more money)



Renewable energy projects are very similar to fossil energy or mineral projects

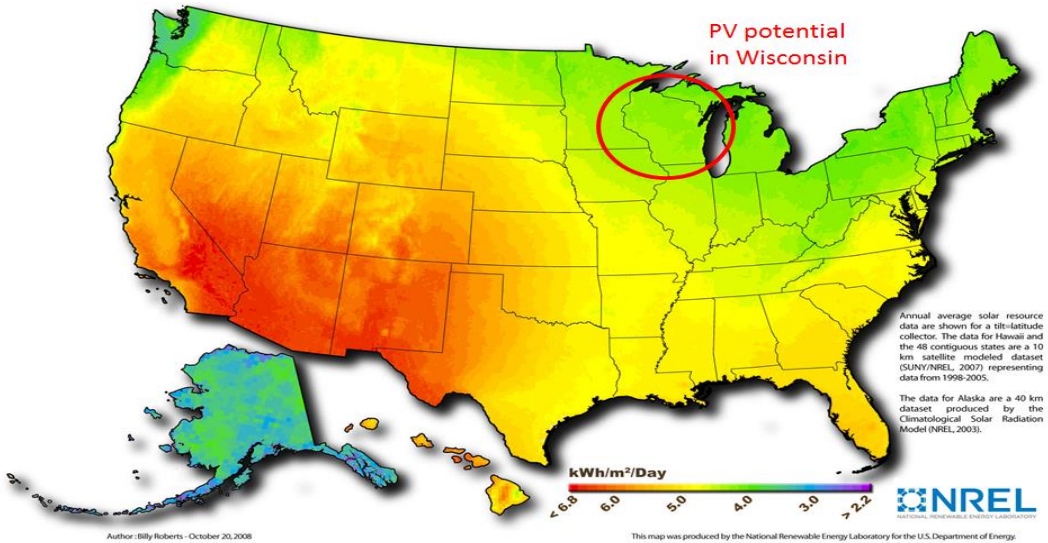


The Project is the link between the Renewable Energy Source and sales quantities of Energy Products and provides the basis for economic evaluation and decision-making

REN Projects

- **Renewable Energy Projects have similar characteristics as Fossil Fuel and Mineral Projects:**
  - **The Project requires access to the deposit, accumulation or source**
  - **The Project includes a "process" to extract or convert the sales products**
  - **The Project requires access to a market**
  - **The Project has elements of risks and rewards for the investor**
  - **The Project has an expected production (and revenue) profile**
- **The PRMS & UNFC principles can therefore be applied**

Example: PV Potential in State of Wisconsin



- Estimates of potentials assumed to be unconstrained by grid limitations such as lack of storage or transmission capacity.

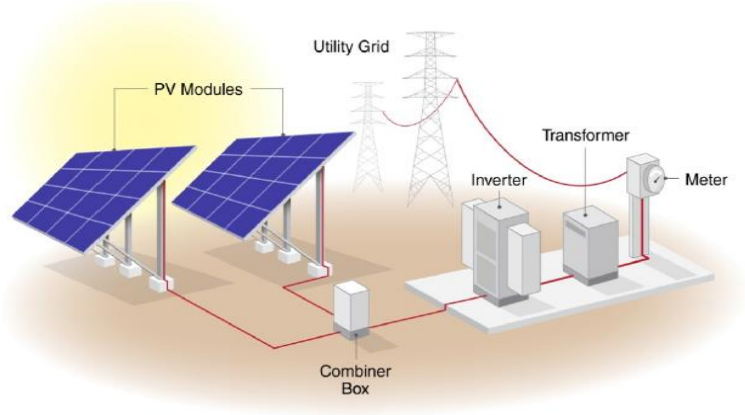
- Utility scale PV in rural areas was restricted by excluding federal protected lands, water features and wetlands, and allowing installations only where land surface slopes are <= 3%. Resulting areas must be >= 1 km^2 to be included in the potential. Installed capacity for utility scale PV assumes an installation density of 48 MW/km^2.

Solar Energy Project: Helios

Sunshine Ltd has taken an option for a 35 year lease of a 23-acre site in Wisconsin to build a PV Solar Park, **project “Helios”**

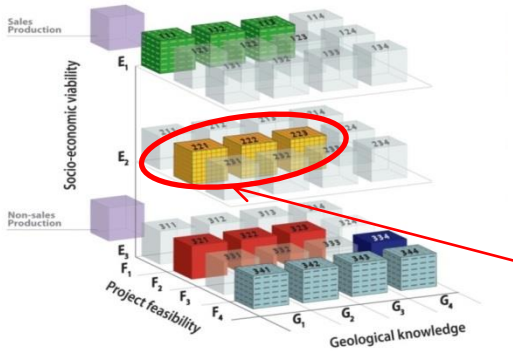
The electricity generated by Helios will be fed into the local grid and used to **offset non-renewable energy** used in a nearby city

Sunshine Ltd has not yet made an investment decision, but is in the process of completing **a feasibility study**



Classification of Project Helios Resources

- How to classify the Renewable Resources for Project Helios in terms of E- and F-axis?



Category	Definition	Supporting Explanation (UNFC-2009 ANNEX I)
E1	Extraction and sale has been confirmed to be economically viable	Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions. All necessary approvals/ contracts have been confirmed or there are reasonable expectations that all such approvals/contracts will be obtained within a reasonable timeframe. Economic viability is not affected by short-term adverse market conditions provided that longer-term forecasts remain positive.
E2	Extraction and sale is expected to become economically viable in the foreseeable future.	Extraction and sale has not yet been confirmed to be economic but, on the basis of realistic assumptions of future market conditions, there are reasonable prospects for economic extraction and sale in the foreseeable future.

Category	Definition	Supporting Explanation (UNFC-2009 ANNEX I)
F1	Feasibility of extraction by a defined development Project or mining operation has been confirmed.	Extraction is currently taking place; or, implementation of the Renewable energy Project is underway; or, sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a development Project or mining operation.
F2	Feasibility of Extraction by a defined development Project or mining operation is subject to further evaluation.	Preliminary studies demonstrate the existence of a Project in such form, quality and quantity that the feasibility of extraction by a defined (at least in broad terms) development Project or mining operation can be evaluated. Further data acquisition and/or studies may be required to confirm the feasibility of extraction.

Approvals and contracts not yet confirmed and some risk that lack of local community support may impact approval of permits

"…Still awaiting completion of Solar Resource Assessment (data from Satellite model and local ground measurements)" Will this data be critical to establish the feasibility of the project…?

Opportunities

- **Application of UNFC facilitates a more consistent language and terminology**

- **Application of UNFC leads to a more transparent comparison of Renewable Energies and Renewable vs. Non-Renewable Energies**
  - **Governments: Policy making – energy sustainability**
  - **Financial & Corporate sector: Capital allocation**
  - **Identification and removal common blockers**

Challenges

- **Many different stakeholders, relatively fragmented and limited global consolidation**
  - **How to get input and support from full spectrum of stakeholders**
  - **Who will “own” and “maintain” the Specifications?**
  - **Is this initiative too early?**
- **Common practice of using “Annual Capacity” and “Potential” is not aligned with UNFC project-based approach**
  - **Is there sufficient incentive among stakeholders to define a Project and Project Life Time**
- **UNFC is based on finite oil & gas or mineral deposits with associated geological uncertainties**
  - **How to apply in a useful manner to Renewable Energy?**

Where to go for more information

- www.unece.org/energy/se/reserves.html
- E-mail: reserves.energy@unece.org
  charlotte.griffiths@unece.org