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Development, maintenance and implementation of the United Nations Framework Classification for Resources: Commercial aspects and financial reporting

The United Nations Framework Classification for Resources applied to Commercial Assessments - Introductory Guidance

Prepared by the Expert Group on Resource Management Commercial Applications Working Group

Summary

This introductory guidance on application of the United Nations Framework Classification for Resources (UNFC) to commercial assessments shows how effects of policy changes on projects and assets as well as the evolution of projects and assets over time can be presented. This involves the identification of projects that may be impaired by policy changes and projects that may be enhanced by them. Policy changes are highly likely to be implemented over the project lifetimes, but it is uncertain how, when and where. This forces commercial assessments to be made considering what likely changes could be, and what the likelihood for their implementation is. In addition, or consequently, the project metrics change over time. The report also shows how this may be presented. Valuation and reporting will need to honour the policy uncertainties. Valuation may help ascertain or not the realism of implementing the changes. The introductory guidance recognizes that complex quantitative research is required to assess the global and national consequences of policy changes, and to help design effective ones. The same research is required to value projects, assets and portfolios and to produce understandable and simple aggregated reports to meet stakeholders' needs including impacts on and demand from other stakeholders, e.g. communities, Non-Governmental Organizations etc. For this a global UNFC (1) based open source data structure with applications is required and a solution is suggested. Whilst the standard data structure must be global, applications will need to be tailored to stakeholders' needs. They vary between jurisdictions and over time. The structure to be developed will benefit from building on existing structures such as that of the Open Group,[1] the European Union Inspire Directive, the European Geological Data Infrastructure and others. None of this will be of value without securing quality in data, work processes and governance.

[1] www.opengroup.org

Acknowledgements

This report is produced by the Commercial Applications Working Group of the United Nations Economic Commission for Europe (ECE) Expert Group on Resource Management.

Alistair Jones, Catherine Witt and Jean-Marc Dumas of the Technical Advisory Group have provided invaluable advice through their thorough and quick review of the draft document.

The Technical Advisory Group, through its Chair Alistair Jones, recommended publication of this report The United Nations Framework Classification for Resources applied to Commercial Assessments - Introductory Guidance as a parliamentary document for the twelfth session of the Expert Group on Resource Management.

The Bureau of the Expert Group on Resource Management has reviewed the document and accepted the recommendation of the Technical Advisory Group.

The members of the Commercial Applications Working Group have shown exemplary cooperation in shaping this report which deals with exceptionally complex issues. The members of the Working Group are:

- Ms. Kathryn Campbell (Attorney)
- Ms. Carolina Coll (CGG)
- Mr. David Elliott, Member Emeritus after his retirement (Consultant)
- Mr. Matthias Hartung (Target Energy Solutions)
- Mr. Sigurd Heiberg, (Chairperson), Petronavit a.s.
- Mr. Julian Hilton (Aleff Group)
- Mr. Donald Roy Lessard (Professor Emeritus, Massachusetts Institute of Technology)
- Mr. Michal Lynch-Bell (KAZ Minerals)
- Mr. Dominique Salacz (Abu Dhabi National Oil Company (ADNOC))
- Mr. Nick Stansbury (Legal & General Investment Management)
- Mr. Danny Trotman (EY)
- Mr. Claudio Virues (Alberta Energy Regulator, Canada)
- Mr. Jeremy Webb (UNDP).

The Working Group agreed submit the document for publication.

It would not have been possible to complete this document in the way it has been without the continued dedication, inspiration and support of Charlotte Griffiths and Harikrishnan Tulsidas of the ECE Sustainable Energy Division.

Contents

I. Introduction

1. The two previous reports of the Commercial Applications Working Group (2) (1) have discussed applications and the issues involved. This introductory guidance builds on those papers.

2. The Commercial Applications Working Group supports the United Nations Economic Commission for Europe (ECE) Expert Group on Resource Management by clarifying commercial issues impacting effective resource management. This must be done to the level necessary for a rational design of the instruments that the United Nations (UN) and the UN alone must use for the Sustainable Development Goals (SDGs) to be attained in time.

3. Clarification of the commercial issues are achieved by building on the characteristics of the projects that the activities consist of.

4. The commercial applications aim to facilitate the securing of affordable and sustainable energy and mineral services during the policy changes required to meet the SDGs and the Paris Climate Accord.

5. The Commercial Applications Working Group recognizes the importance of facilitating necessary innovation in the partnership between the UN, governments, industry and capital allocators for the necessary policy changes to be effective.

6. In keeping with its mandate, the Commercial Applications Working Group's work is based on the United Nations Framework Classification for Resources (UNFC). This report, together with the two previous ones, addresses:

(a) How commercial considerations may affect the classification of projects and of each stakeholder's interest in the projects. The Commercial Applications Working Group advises on considerations relevant for the application of UNFC at the level of stakeholders;

(b) How UNFC may be applied to facilitate capital allocation, including through lending, project finance, divestment, mergers and acquisition, fundraising and in reports to project and corporate owners. The Working Group advises on how to inform users about the values that asset owners can expect to derive from the projects.

7. The Commercial Applications Working Group does not prescribe methodologies for making assumptions about future commercial conditions, but rather identifies the considerations that need to be made to assess the commerciality of projects, including long lived projects.

8. The Working Group considers a full spectrum of project characteristics.

9. The work outlined in this introductory guidance seeks to complement and support the ambitions, plans and initiatives of a number of important entities including:

(a) The UNECE Committee on Sustainable Energy, its member States and subsidiary bodies, in particular its Expert Group on Resource Management;

(b) The efforts of the UN Department of Economic and Social Affairs (UN DESA) to design and implement standards for national statistics, including its System of Environmental Economic Accounting (SEEA) and the SEEA Experimental Ecosystem Accounting (SEEA EEA);

(c) The UN Convened Net-Zero Asset Owner Alliance;

(d) The European Union (EU) in its implementation of the European Green Deal;

(e) The International Energy Agency (IEA) in its efforts to quantify the energy and related extractive activities;

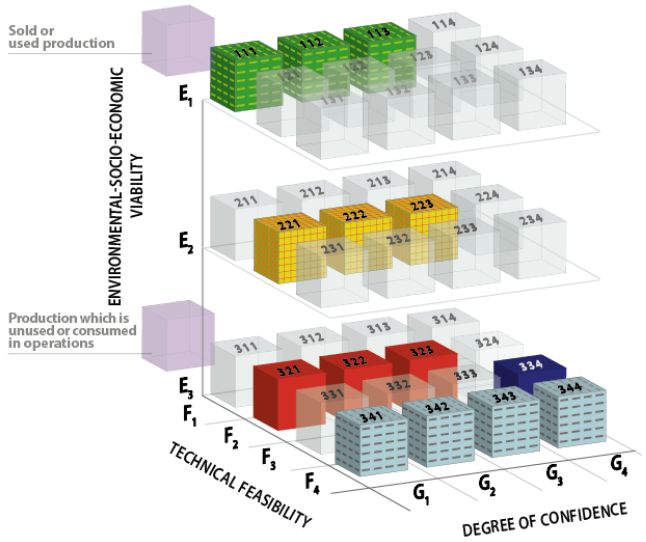
(f) The International Financial Reporting Standards (IFRS) Foundation in its consideration of establishing Climate Related Reporting Standards Board, and its International Accounting Standards Board's (IASB's) research on an IFRS for Extractive Activities;

(g) The Financial Stability Board's Task Force on Climate-Related Financial Disclosures.

II. Structured Integrative Resource Analyses for Improved Commercial Assessments

10. UNFC (3) is integrative in that it addresses technical, environmental, social, economic and technical/industrial aspects and values of resource-based projects. It is systematic in that it builds on primary data regarding the asset/product source potentials, the capital and operating costs to produce the products, the taxes and/or royalties imposed, the market prices at which they can be sold, and the impact of environmental and social considerations included either as constraints on operations or as monetary equivalents (shadow prices, carbon prices). To do this, it classifies projects as shown in Figure I where categories marked "1" indicate the most mature categories and highest confidence in estimates and categories marked "3" indicate the least mature projects and estimates of lowest confidence.

Figure I
United Nations Framework Classification for Resources



11. In Table 1, project classes[2] are shown by their E and F categories only. The G Categories reflect the degree of confidence in the estimates and are reflected in the values entered in the matrix. Estimates have traditionally been estimates of resource quantities (sources and products). Other quantitative information carried by the projects and mentioned above is automatically included through the structure of UNFC.

[2] The project class is defined by the combination of its categories. They are sometimes named as "reserves", "contingent resources", in-place quantities" etc. UNFC does not use names, but refers to Category combinations, i.e., E1F1G1 is a class. In extractive activities this class is often referred to as "proved reserves". UNFC specifies that Categories always must be quoted in the same order (in English alphabetical order), which allows letters to be dropped. Class E1F1G1 becomes Class 111, a name that is independent of languages.

Table 1
Project classification where numbers or indicators are entered in the matrix with recognition of their degree of confidence.

		Confirmed feasibility	*Feasibility under evaluation*	*No evaluation due to lack of data*	*No projects identified*
		F1	**F2**	**F3**	**F4**
ESE Viability confirmed	**E1**				
ESE Viability under consideration	**E2**			Not often used	
Production of unused material, too poorly defined or ESE not considered / considered unviable	**E3**				

Notes:
ESE: Environmental-Social-Economic.
Feasibility: Technical/industrial feasibility
Colour coding: green for commercial projects, yellow for projects contingent on information becoming satisfactory for commerciality, red for projects where commerciality is not likely or cannot be assessed.

12. In Table 1, for full names and definitions of Categories and Sub-categories, consult UNFC (ECE Energy Series No. 61 and ECE/ENERGY/125).

13. The static presentation shown can be supplemented by a dynamic account of the effect of alternative policies. An account can also be produced showing changes in classification and quantities[3] from one period to the next. Both can be achieved by adaption of the Design Structure Matrix (DSM) (4) concept taken from project management practices or from input-output tables taken from national statistics (5). This is shown schematically in Table 2.

Table 2
Matrix revealing the source and effect of changes in classification

			Closing balance									Revision
			Sold or used	Produced and not used	E1F1	E1F2	E2F1	E2F2	E3F1	E3F2	E3F3	E3F4	
Opening balance	Sales production				Not applicable								
	Non-sales production												
	E1F1												
	E1F2		Not often used										
	E2F1												
	E2F2												
	E3F1												
	E3F2												
	E3F3												
	E3F4												

Impairment
Output Columns
Input Rows
Improvement

Note: Colour coding is as in Table 1.

[3] Quantities can be source or product quantities as is normally used, or emissions, labour, costs, revenues, values, physical and monetary flows over time or any other metric of interest that is carried by the project.

14. Table 2 shows the quantities of a project class as defined by the combination of their E and F Categories. The initial quantities, shown as the opening balance are entered in the column to the left. If projects split up or change Class, the new quantities of the project or subprojects will be entered in the row of its position in the opening balance and in the column identifying its classification after the change. Projects that remain in the original class are found on the diagonal of the matrix. If the material balance is not maintained over the change, the increase or decrease of quantities is shown in the column to the right. The closing balance after the change is found by aggregating the quantities in the columns and entering them in the top row. This then becomes the opening balance for the next change or period examined and is entered in the left column for that evaluation.

15. When used to investigate effects of policy changes with respect to the impairment or improvement of projects, the account will show the changes in classes of the projects in the input rows and the portfolio effects in the output columns. Impaired projects will plot above the diagonal and the improved projects will plot below the diagonal. Unchanged projects remain on the diagonal. If the analyses are quantitative, the quantities will be linked to the cells of the matrix in Table 2. Examples of how a mineral project may change due to policy changes is shown in the report United Nations Framework Classification for Resources. Case Studies from Finland/Estland, Sweden and Norway – Norkalk limestone and Forsand sand and gravel mines (ECE/ENERGY/GE.3/2020/10) (6).

From quantities to values

16. For UNFC activities, the traditional metrics are the measures of sources and of products expected to be realised from a project's activities. In order to judge the commercial viability of these assets and/or projects, and therefore the likelihood that they will remain or move to class E1F1 in Table 1 it is necessary to convert these into cash flows and valuations, where valuation as explained in chapter IV comprises consideration of the environmental and social contingencies in addition to the economic values. The proposed approach is to utilize net present values of the development and extraction costs and of the revenues derived from the products to be produced (1). A first step in computing such net present values (NPVs) is to recognize that they may differ from the perspective of different stakeholders. The government/fiscal entity within which the resource lies will consider the value accruing to government pursuing to its legal rights from exploitation of the asset, e.g. the value of the taxes, royalties, production sharing benefits and cash flows from its direct financial participation etc. It will also consider the net benefits that will accrue to the investing parties. The enterprise will look only to values accruing to it under its legal rights and may apply a higher discount rate to reflect commercial opportunity cost of capital. A security holder, e.g. lender, bondholder, or shareholder, will focus on those (post tax and royalty) flows that they have a claim on, etc. Different stakeholders may be exposed to different risks and opportunities and thus calculate the net present values differently.

17. It is also important to recognize that different stakeholders may desire different summary measures of the value of an asset or project. Financial investors will tend to focus on NPVs, while regulators, NGOs, or members of affected groups concerned with environmental impacts are more likely to focus on full lifecycle values. Others may look at per unit or average costs, e.g. levelized costs in the case of electricity where there are both capital costs and operational costs. In moving activities towards fulfilment of the SDGs, stakeholders will need to investigate the prospects of measuring value relative to the fulfilment of the goals as explained in Chapters III and IV.

III. Assessing the impact of future policy changes

18. Public policy changes i.e., changes in legal, fiscal, regulatory and resource management polices affect projects. A few illustrations of this relevant to commercial assessments are as follows:

(a) Policy changes may impair or improve project implementation directly. Reducing greenhouse gas (GHG) emissions, closing nuclear plants and allocating land to other activities are measures that may impair GHG emitting energy projects and possibly favour non-GHG emitting ones;

(b) Policy changes may also affect projects indirectly, e.g. by changing legal, fiscal or regulatory conditions or by creating incentives in the form of infrastructure, subsidies etc;

(c) Policy changes may be formulated to shield industry and finance from the consequences of change. This may take the form of tax credits or direct financial participation by government etc. These policy changes may not impair projects but would affect asset values, particularly for the government who pays for the measures.

19. Impaired projects will either remain on the diagonal in Table 2 if their E and F Categories remain unchanged, or plot above the diagonal if these have worsened. Projects enhanced by policy changes will either remain on the diagonal or plot below it. A single policy change may cause projects of different maturities to be impacted differently. A policy change may not impair a project with the investments behind it. It may continue to produce and remain in its class, while the development of a new project may be impaired.

20. A particularly pressing policy issue is the imposition of a cost on GHG emissions. This is one of the factors that will put pressure on the value of fossil energy products at the source of production. While the cost may be imposed on the emitter, that for the most part is the user of fossil fuels, the pressure on prices will come about if producers maintain production as they instinctively will try to do. They must then reduce their prices to clear the market by compensating consumers for their GHG costs. Some projects may reach their economic limit as a result and thus see a reduction in the maturity of their categories. These projects will then plot above the diagonal in Table 2. Others may be able to absorb the reduction in price and continue to be commercially viable, albeit producing less commercial value. They will remain on the diagonal. With the imposition of carbon taxes/fees, some asset holders may seek to accelerate production to prevent a drop in revenues for the asset holders and move below the diagonal, contributing to an increase in GHG emissions, and possibly moving these projects below the diagonal.

21. Unless the GHG fees are spent on preventing GHG emissions through carbon capture and storage (CCS) or otherwise, the imposition of fees will merely cause a transfer of economic rent from the ultimate payer of the costs (the producers) to the collectors of the fees, normally the host county of the consumer, unless the producing country insists on collecting it to partially mitigate its loss of revenues.

22. GHG costs are of course not the only factor impacting market prices of fossil fuels or their values at the source for the asset holders. An example of this was seen in 2020 when oil prices fell partly due to the COVID-19 pandemic and partly due to a struggle for market share among large producers (7). The Norwegian Government, for example, then adjusted the taxes to prevent an impairment of new investments and a loss of jobs (8). Projects that may have been impaired remained unaffected on the diagonal or where advanced, plotting on or below it.

23. It is well recognized that policy effects are complex to analyse and quantify. This requires substantial infrastructure in the form of quality information and analytical capacity. More on this is provided in Chapter V. A positive sign that the UN is shouldering its responsibility in this regard came when the ECE Committee on Sustainable Energy at its twenty-ninth session (Geneva, 25-27 November 2020) agreed that the following decision be submitted to the Economic Commission for Europe at its sixty-ninth session for consideration:

> ***"Decision to study the impact of subsidies as well as carbon pricing options.***
>
> *The Economic Commission for Europe requests the Committee on Sustainable Energy to continue studying how best to address efficient use of energy resources, and in this regard the impact of subsidies as well as carbon pricing options."*[4]

24. The work of the Commercial Applications Working Group has facilitated reviews of several internal and external studies pertaining to policy issues. A principal comment has been to emphasise that measures need a UNFC project approach to reflect the physical

[4] https://unece.org/isu/documents/2020/12/presentations/report-committee-sustainable-energy-its-29th-session §35, Page 13, subsection 3

activities to function as intended. Where appropriate, ECE has submitted comments as shown in some of the references below:

- ECE projects[5]
- Pathways to Sustainable Energy
- Framework for attaining Carbon Neutrality in the UNECE Region by 2050 (ECE/ENERGY/GE.5/2020/8)
- U.N.-Convened Net-Zero Asset Owner Alliance Inaugural 2025 Target Setting Protocol (9)
- UN System of Environmental Economic Accounting – SEEA Experimental Accounting Revision (10) (11)
- IFRS Foundation Consultation Paper on Sustainability Reporting (12)
- Financial Stability Board – Task Force on Climate Related Financial Disclosures (13).

IV. Reporting of project metrics, including quantities and values

25. Once an assessment of the effects of future scenarios, such as policy changes, on the classification of projects and assets has been performed, the impact on relevant project metrics must be assessed. This is a natural part of applying UNFC for commercial assessments and will substantiate or not the changes in classification that policy changes are assumed to cause.

26. UNFC is complete, but schematic with respect to specifying how these quantities should be estimated to meet various stakeholders' needs. Stakeholders may welcome further normative efforts of the Expert Group on Resource Management in this regard.

27. The extent of reporting of such metrics will vary by stakeholder, as will the availability of such metrics to other interested stakeholders, this being impacted by local practice and regulatory requirements. For instance, the metrics available internally to a company with a direct interest in a project will be extensive, but those reported externally to other stakeholders are likely to be more constrained and more aggregated. An example is the public reporting of oil and gas quantities under the regulations of the United States Securities and Exchange Commission (SEC) (14) (15) where the focus of reporting is on mature projects generally classified as E1F1, with some options to also report on some less mature projects.

28. Clarity around the scope of reports and contingencies around reported metrics is critical.

29. The quantities of products is a key input into valuations for multiple commercial applications. They also affect financial reporting to the extent that they are used in the calculation of depreciation/amortization and the estimation of recoverable amounts in areas including testing for impairments. For extractive activities, estimates are included in financial reports and may serve as indicators of future value, when this is not reported more explicitly.

30. Stakeholders may wish to assess risks and opportunities associated with the projects as well as the values of options to mitigate risks and capture opportunities. This requires inter alia estimates of the upsides and downsides for mature projects and full assessment of immature projects.

31. Project and asset valuation for commercial assessments and for resource management by international organizations, governments (16), industry and finance require cash flow information, either in full or described by indicators. For a more detailed discussion, see the 2020 report of the Commercial Applications Working Group (1). Additionally, metrics supporting the use of Categories may be included.

[5] https://unece.org/sustainable-energy/events/29th-session-committee-sustainable-energy

32. UNFC E-axis Categories reflecting environmental, social and economic conditions may need to be supported beyond economic valuation by environmental and social information (17). This may include references to the status of regulatory actions and permissions in this space, and the underlying factors affecting whether such actions or permissions may be forthcoming or not.

33. The UNFC F-axis Categories chosen may need to be documented by reference to project definition, project management as well as the physical and industrial risks and opportunities often associated with exploration illustrated in an example from geothermal exploration (18) and with the execution of large engineering projects (19).

34. Projects and the assets associated with them will need to be assessed with respect to their sensitivity to policy changes that may occur over their lifetimes. Consideration needs to be given to the changes in policies required to meet commitments with respect to reaching the SDGs (20). In the previous chapter we saw that it is particularly important to address the consequences of measures to mitigate climate change. The same applies to measures required to adapt to them. As energy is intricately linked to both climate change and development it is becoming increasingly important to assess correctly the values put at risk by future changes in framework conditions. It is recognised that changes are necessary, which increases the probability of them happening. The values involved multiplied by the probability of the policy change occurring give the values at risk.

35. To perform commercial assessments in this space will require deep insight in the consequences of policy change in addition to challenges involved in conventional commercial assessments. This requires broad based and comprehensive data structures and repositories supporting UNFC and the work of the Expert Group on Resource Management.

36. A recommendation based on the above is to first implement work that will develop examples of the calculation of commercial values (subject to environmental and social considerations) for a set of typical mineral, oil/gas, and renewable energy projects, see Chapter V for details, also of further steps.

37. This should lead to the development of specifications on the commercial application of UNFC meeting the needs of a complete set of stakeholders, including the UN and government policymakers and regulators, project operators, asset holders, capital allocators, portfolio managers, accounting and reporting entities, energy and development planners, and entities seeking climate related financial disclosures to mention some.

V. Standards for data repositories

38. This chapter elaborates on a structure of required data repositories.

A. Problem Definition

39. The problem definition is outlined:

(a) Work done by the Expert Group on Resource Management as well as the need to do thorough quantitative research on the effects of contemplated UN and national policies shows that there is a need for quantitative assessment of resource projects on their environmental- socio- economic viability, their technical feasibility, maturity, and the confidence in the estimates made. To meet the global challenges and engage global industrial capabilities and capital allocators, this needs to be done on global standards including globally available open source data standards;

(b) This is the reason why UNFC has been developed and promoted under United Nations Economic and Social Council (UN ECOSOC) Decisions. UNFC provides the global framework for informed decisions of resource projects by disclosing information that links to the SDGs and reflects societal expectations, amongst others, for securing affordable and sustainable energy and raw materials services;

(c) With the Paris Climate Agreement, the urgency is prevailing across industries and nations. The world is changing rapidly, as expressed in the UN 'Decade of Action' in support of the 2030 Agenda for Sustainable Development (20);

(d) Whilst some governments have already reported aggregated resource volumes in UNFC terms and for specific industry sectors (21), few figures have yet been reported on environmental footprint (e.g., GHG emissions) nor socio-economic impact (e.g., employment numbers, cashflow). A fully respected application of UNFC for commercial assessments can therefore also not be complete with today's tools;

(e) Governments, investors, operating companies, and society alike need the underlying data of relevance including that carried by projects to use UNFC for their purpose of deciding, disclosing and being informed;

(f) Anyone wanting to adopt UNFC will need to build a data solution. Implementation requires in-depth domain expertise of UNFC and of resource management, to facilitate value generation in terms of well-informed decisions on resource projects and portfolios.

B. Proposed solution

40. A proposed solution is outlined:

(a) A first step is to build a reference implementation of a UNFC data repository, including requirements and guidelines on data content, structure, quality/provenance [auditability];

(b) Internationally applicable standards should be used, inter alia of past and future stocks and flows, both in physical and monetary terms of a variety of relevant metrics, including quantities of resource/products, GHG emissions, in-country value, employment, financials, asset entitlements etc. to facilitate like-for-like comparison of investment choices and testing of investment project viability scenarios against policy instruments (e.g., to manage GHG emissions and secure affordable and sustainable energy and raw materials services) ;

(c) A demonstration solution would validate feasibility and attractiveness of UNFC in the form of a Minimum Viable Product (MVP) for classification, assessment and management of resource projects; projects will be classified and assessed both backword looking (UNFC reporting) as well as forward looking (United Nations Resource Management System (UNRMS) assessment of viability against possible future scenarios) ;

(d) The demonstration will incorporate capabilities to verify the completeness and quality of ingested project data (with options to automate and audit data quality against standard requirements);

(e) Facilities to visualize classification of captured project information with time and against various scenarios could be added to demonstrate the viability of the approach;

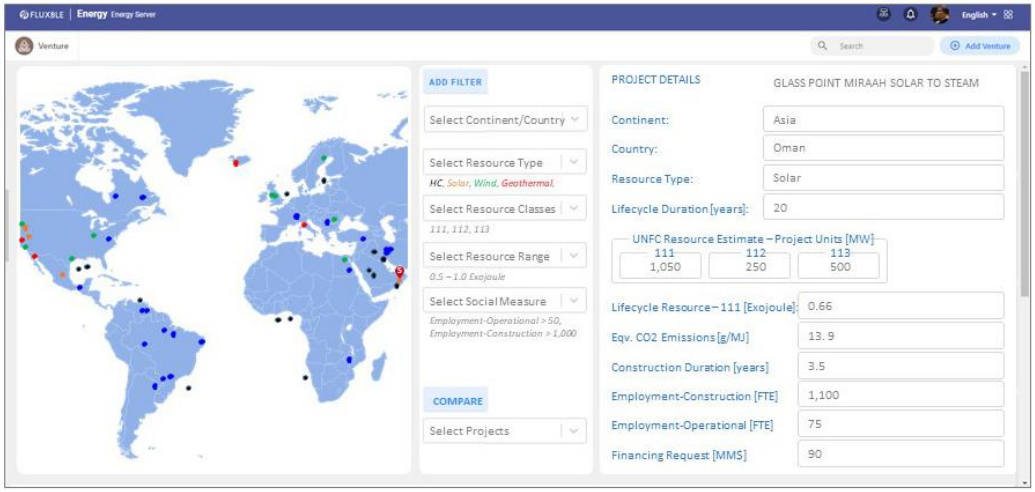
(f) The efforts should be conducted in open communication and consultation with respective ECE bodies and Expert Groups.

41. In short, such efforts will bring the advantages of UNFC to life with direct and early benefits to interested stakeholders.

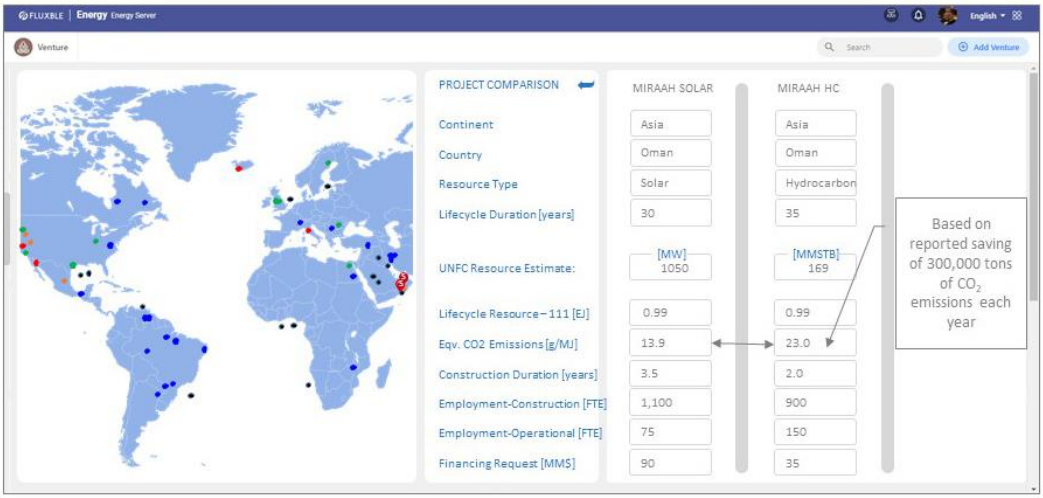
42. Figure II shows how a simplified dashboard of a Minimum Viable Product of such a data repository could look.

Figure II
Example of simplified dashboards of a Minimum Viable Product

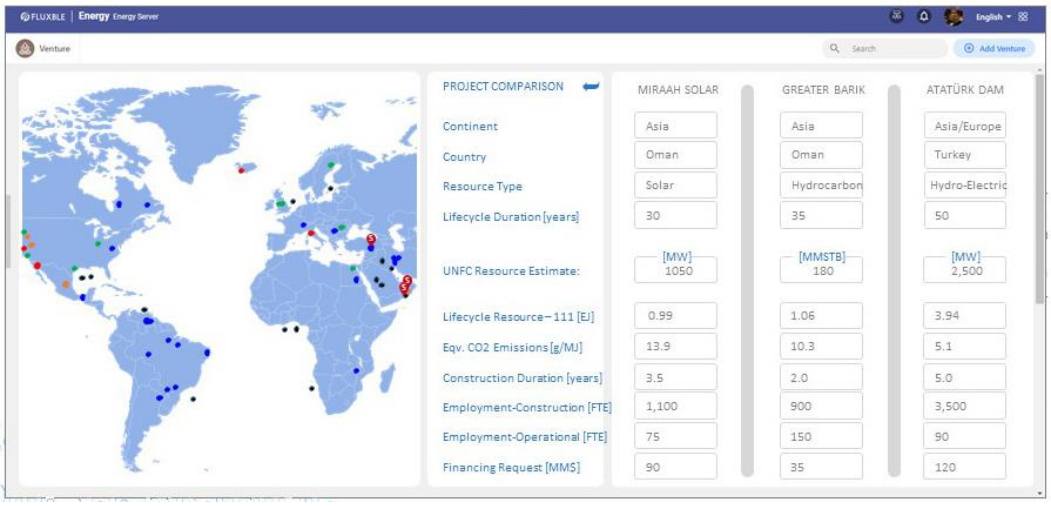
MVP Data Foundation – Project Overview



Example E&P Project Comparison Steam generated by Solar verus Methane



Dashboard – Project Comparison: Solar versus Hydrocarbon versus. Hydroelectric



43. An important driver for such a project is the need to have a data structure that supports the public-private partnership where the public side sets framework conditions which allows industry to deploy its best capabilities to reach the goals in ways that the capital market can finance. This includes the assessment of policy instruments and the collection of aggregated data to advise their member (states) on management of resources and raw materials, e.g., in support of energy transition. The beneficiaries are:

(a) Policymakers and authorities setting framework conditions and approving energy and other resource management projects, such as the UN, national mining, petroleum, raw materials and anthropogenic resource management, including nuclear energy regulators, geological surveys, ministries for economic affairs, social, environment and climate;

(b) Public and private industries as well as information service providers in energy, extractive and other raw material industry sectors. These could be fossil, nuclear and renewable energy, mining, underground storage, groundwater, and anthropogenic resource developers as well as utility companies, research organisations, consultancies and academia;

(c) Investors, financial analysts, and information service providers concerned with allocating capital and informing policy makers on their capabilities to do so under alternative policy envelopes. Informing their stakeholders on the consequences to the capital market of the reforms implemented and assessing the effects that the portfolio of projects they finance has on global temperature change;

(d) Intergovernmental organizations, such as EU (e.g., the European Green Deal and Raw Materials challenge to enable the aspired energy transition), UN, including ECE, UN Environment Programme and UN Committee of Experts on Environmental Economic Accounting (UNCEEA), International Atomic Energy Agency (IAEA), IEA, Organisation for Economic Co-operation and Development (OECD);

(e) Industry associations such as the national mining associations, e.g. Finnish Mining Association (FinnMin), Swedish Association of Mines, Mineral and Metal Producers (SVEMIN), Mining Association of Canada, and Norwegian Mining and Quarrying Industries Association (Norsk Bergindustri);

(f) Financial standards bodies such as the IFRS and IASB, and financial associations like the Financial Stability Board's Task Force on Climate-Related Financial Disclosures;

(g) Non-Governmental Organizations with influence on primary or secondary decision makers;[6]

(h) Standards bodies such as The Open Group providing open source data architectures, and other professional associations.

44. Value statements for beneficiaries are as follows:

(a) Standard and consistent reporting on project viability (environmental- socio-economic), technical feasibility, maturity and risk; ready to compare and use for investment decisions (maturation, sanctioning) of individual projects or portfolios, within or across industry sectors [coal, hydrocarbon, renewable energies, mining, anthropogenic waste, storage, nuclear, groundwater); enabling an auditable, fact-based engagement with stakeholders with transparent figures based on the universal standard. Testing robustness of projects and portfolios against scenarios in fiscal or legislative or societal expectation terms and shaping investment portfolios;

(b) Beneficiaries may use the tools developed to test the viability of their projects or portfolios in UNFC terms in a safe and secure test environment.

45. Other beneficiaries are:

[6] A primary decision maker is one who takes the decision, i.e. a person with direct management influence. A secondary decision maker is a person with power to frame the decision space such as a lawmaker or a shareholder.

(a) National and regional research programs and academia in their research and educational efforts to structure relevant knowledge and understanding of the reform processes required to reach the goals set;

(b) In the longer term, communities or societies potentially impacted by resource projects will need reports of quality assured plans and figures in UNFC terms to be well-informed; subsequent hearings and engagements to resolve conflict or seek public support will be fact-based, which is likely to improve long lasting consensus required to preserve the investment climate and accelerate regulatory approval and sanctioning.

46. The information on beneficiaries just outlined will not be available to all stakeholders as mentioned in Chapter IV. A key principle is however to ensure that the data standards are common and open source, i.e. freely available for anyone to express themselves on.

47. The work outlined above is costly and will require pooled financial resources. There is no business case for competing on data standards and solution implementations. Competition in this space is cost-prohibitive, highly ineffective and yet, the development of various 'competing standard' solutions may happen in lack of a concerted effort, which is what the Commercial Applications Working Group aims to avoid. Throughout industrial history, the lack of common standards providing guarantees that an investment can be used once completed has impaired economic development (22).

VI. Quality assurance and control

48. Quantitative assessments must have known quality if they are to support decisions. The very varied and complex set of factors that impact commercial assessments requires known and systematic quality assurance.

49. There must be satisfactory quality standards in the processes that underlie the commercial assessments. It is assumed that the physical processes of exploring, observing and measuring resources are quality assured. The same applies to the design, construction and operation of facilities up to the UNFC reference points where the quantities of products are estimated. This is achieved through conventional quality assurance, often regulated international standards of where International Organization for Standardization (ISO) standard 9000 (23), ISO 9001 (24) and ISO 8000 are in common use.

50. Confidence in the UNFC estimates that this report addresses should be developed by building on the industrial standards that apply to the underlying processes. This includes the following principles:

(a) A reporter of information, here referred to as the responsible person remains responsible and sometimes liable for the appropriateness of the estimates and the report communicating them. A responsible person could be the head of a public entity authorised to provide estimates, or the Board of Directors or owner of a company etc;

(b) Notwithstanding the above, the authority to develop the estimates, but not the responsibility for them may be delegated to entities under the responsible person's control. They can be internal organisations or contracted entities;

(c) The estimation process, including the checks that the estimates align with the level of confidence assigned to them must be aligned with other international standards and described;

(d) The information on which the estimates are made must be readily available in a form that allows the estimates to be made within the available time and resources;

(e) Commercial estimates often build on estimates for each part of a value chain (quantity of products, cost of facilities, emissions, employment etc.). In these cases, estimates may need to be made and quality assured for each subsystem, whereafter a quality assurance of the interfaces will need to be made prior to a quality assurance of the end product. This may facilitate the quality assurance and minimise costly rework processes;

(f) Personnel performing the estimation must be qualified for the part of the work that they are authorised to do (15). Ultimately, it is the responsible persons responsibility to

ensure that this is the case. She or he may draw on requirements for qualifications set by educational institutions, reputable professional bodies or government statutes that regulate relevant professionals;

(g) Quality assurance of the communication of estimates is required;

(h) The estimation process and its quality assurance must be documented and auditable;

(i) Non-conformance to the quality assurance requirements must be identified and corrective actions taken to minimize any damage that this may have caused to the entity making the estimates or its customers. Non-conformance may trigger a review of the quality assurance process to avoid future non-conformances;

(j) In industries, the quality assurance process is often subject to audit by an independent person or body, whose governance in turn is overseen.

VII. Conclusions and recommendations

51. Commercial applications of UNFC requires that commercial estimates be made to reflect the environmental- social- and economic conditions that may govern projects and assets over their lifetimes. This can span decades after the decision to implement has been taken. The estimates must relate both to possible policy changes and to the evolution of projects and assets over time.

52. Valuation must consider the conventional elements of valuation, including uncertainties associated with each activity along the value chain. In addition, valuation must take into consideration the effects of policy changes and the probability of their occurrence. The probability for change is quite high given the resolve to reform economies to meet the SDGs and the Paris Accord. Finally, options to capture the opportunities and mitigate the risks resulting from the uncertainties must be valued.

53. This requires adequate information. Information must be captured and made available through adequate and global UNFC data standards, structures and processes.

54. The information generated must have known quality and reliability. For this, relevant quality assurance and control processes must be in place.

55. The Commercial Applications Working Group recommends that substantial support is provided, first and foremost to allow the UN to detail and implement the measures that the UN can and must implement to secure the commercial application of UNFC, and that this support be shaped in a manner that serves the other key stakeholders as well.

56. The introductory guidance provided in this document should be complemented by three activities:

(a) A well-financed effort to produce demonstrations of an open source data structure for inventories and for how this can be used to quantify the effects of policy changes, and to compare and contrast projects and portfolios by key stakeholders;

(b) A detailed review of the needs of key stakeholders, including communities, NGOs etc as detailed in Chapter V;

(c) Consideration of the development of UNFC specifications for commercial applications.

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