Developing of Standards for Geothermal Resource Classification - an Update

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Economic and Social Council

Economic Commission for Europe

Committee on Sustainable Energy

Expert Group on Resource Classification

Seventh session
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Item 13 of the provisional agenda

Application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 to renewable energy resources

Draft Specifications for the application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) to Geothermal Energy Resources

Draft document prepared by the Geothermal Working Group

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UNFC-2009 What is it? What is it not?

- UNFC-2009 harmonizes the reporting about resources like oil, gas, coal, minerals and in future renewables.
- This is done by a standardized Classification system
- UNFC-2009 does not deal with the Quantification of geothermal resources
- UNFC-2009 is project based but accepts aggregation to a region or even country (corporate vs. nationwide)

Remark: Quantification of geothermal resources is a major issue and should be addressed and globally harmonized but it is not part of the INFC-2009 efforts.

Acronyms:

UNECE	United Nations Economic Commission for Europe
UNFC	United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources
EGRC	Expert Group on Resource Classification
TAG	Technical Advisory Group to EGRC
IGA	International Geothermal Association
WG	Working Group of IGA R&R Committee

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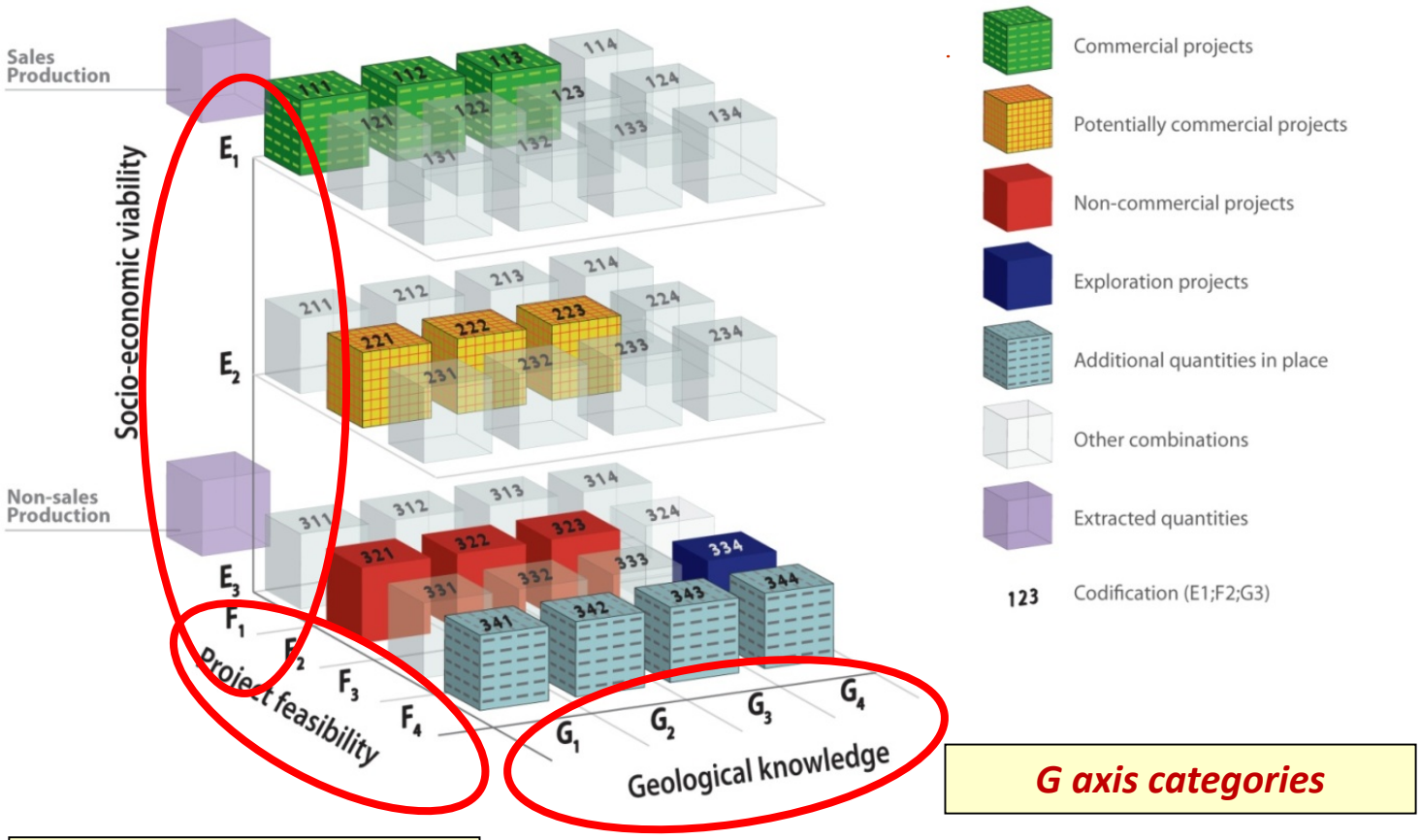
History

- During the **1990s**, UNECE took the initiative to develop a simple, user-friendly and uniform system for classifying and reporting reserves and resources of solid fuels and mineral commodities.
- In **2004**, the Classification was extended to also apply to petroleum (oil and natural gas) and uranium.
- A revised United Nations Framework Classification for Fossil Energy and Mineral Resources (UNFC-2009) was submitted and accepted **2009**.
- Since **2010** efforts to use UNFC-2009 for Renewables

UNFC – How it works

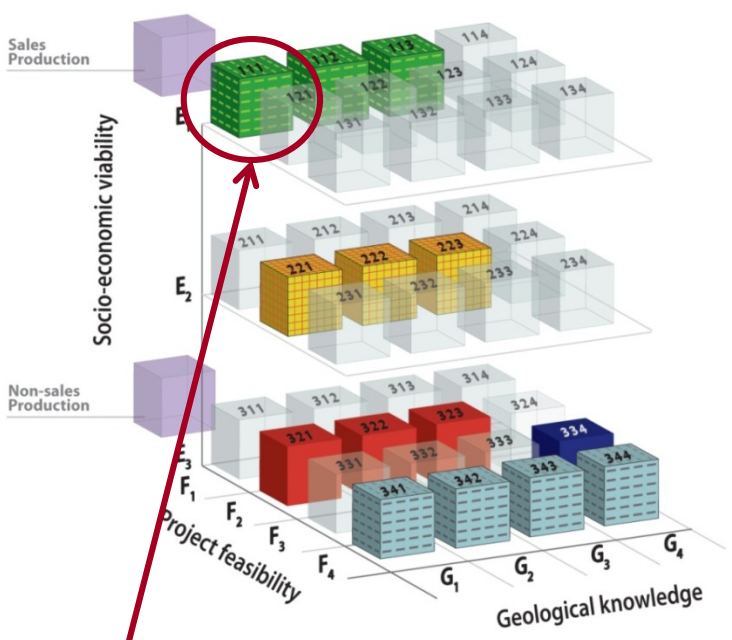
E axis categories

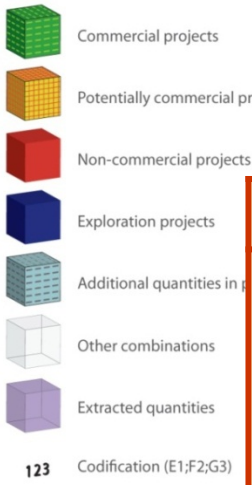


G axis categories

F axis categories

UNFC – How it works





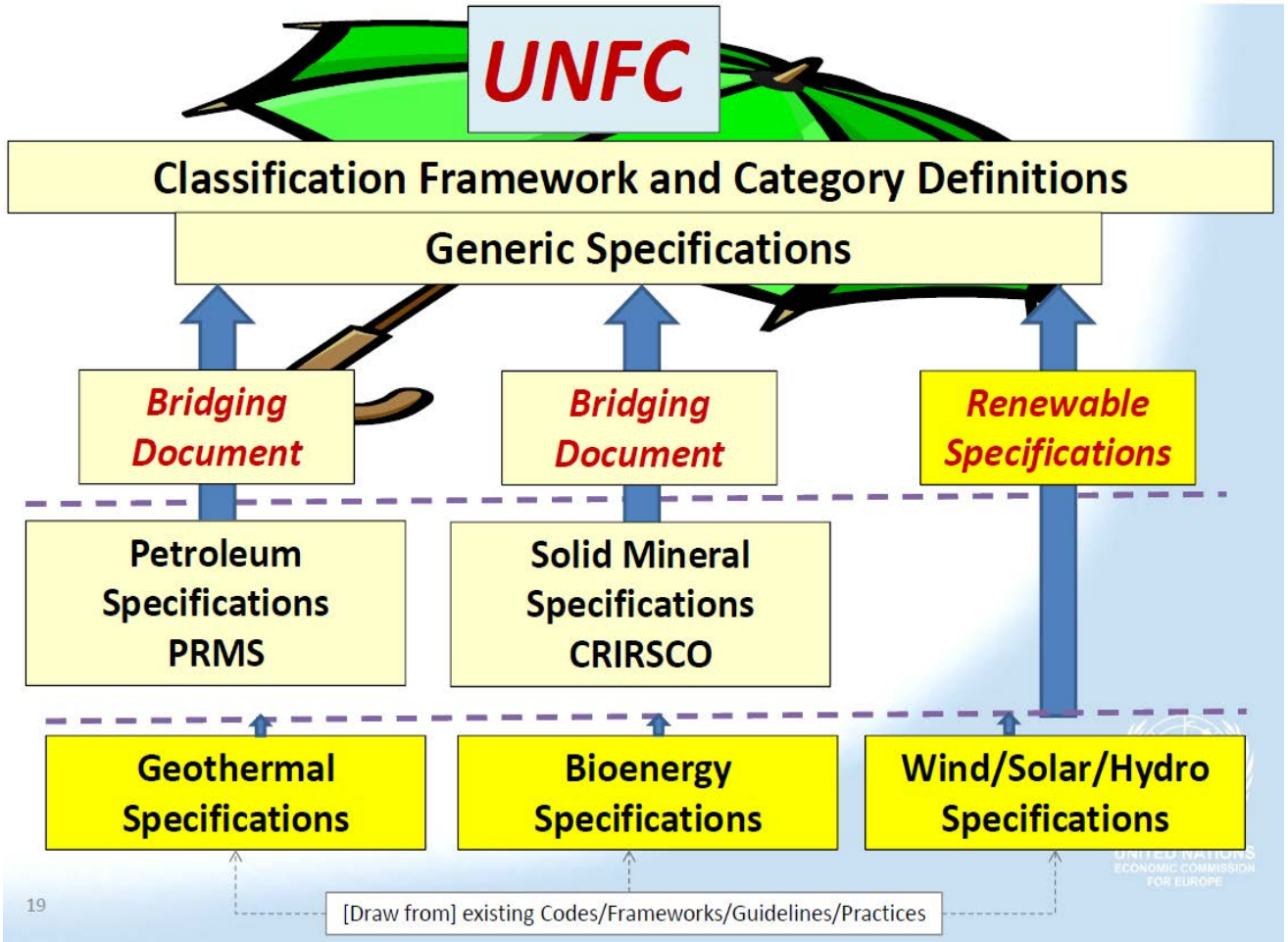
UNFC Class: 111

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.

Including Renewables



There will be no bridging to existing REN codes or specifications
The Geothermal Specification are not a stand-alone document

Groups working on the specifications

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Raffaella Christanetti	DuPont	
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Norbert Dolle	Shell (Secretary)	
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IGA Working Group (WG)		
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Observers		
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Process, the past

- 2014 — Start of the project, first meeting in Bonn
- 2/2015 — Start of group telephone conference series (total until oday: 14)
- 4/2015 — First White Paper WGC in Melbourne including a first draft of the 'specifications'
- 1/2016 — WG to submit draft specifications to IGA R&R Committee
- 2/2016 — WG to submit draft specifications to EGRC Renewables Task Force, EGRC Technical Advisory Group (TAG)
- 4/10/2016 — WG to submit final draft version (4/11/2016) to be accepted by EGRC at its 7th session 4/26-29/2016 (item 13 of the agenda)

Process, the future

- After review by EGRC, UNECE (6/2016) to post the draft specifications for a 3-month period (7-9/ 2016) of public comment administrated by UNECE
- WG to formally address all comments and modify the draft as needed
- Via UNECE, modified draft specifications and catalogue of comments and responses finally submitted to EGRC
- If the modifications implemented following the public comment period are substantial, re-submit draft to EGRC in 4/2017
- Final Publication at latest 4/2017

Contents of Geothermal Specifications

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Typical issues to be addressed (2 examples)

- Are ‚feed-in tariffs' subsidies or part of the market?

A comment 4/12/2016:
The definitions to distinguish between E1.1 and E1.2 need further clarification. Many policy scenarios and regulatory uncertainties are possible that could cause projects to fall into either category. For example, some renewable subsidies (such as carbon taxes, grants and loans, cap and trade dividends, or RECs) are permanent and would therefore help decrease costs permanently. Other subsidies (such as tax credits in the US) are temporary.

- What is about ‚internal use' of commodities, like electricity to power pumps?

4.1 When a Project requires significant input energy fluxes (e.g. electrical energy to drive heat pump compressors or well production/injection pumps), these quantities should be estimated and reported along with, but separately to, the Geothermal Energy Resources. Any Geothermal Energy that is consumed within the Project upstream of the Reference Point may be explicitly captured as separate but related quantities (with a different Reference Point) and reported as E3.1 (quantities that are forecast to be extracted, but which will not be available for sale).

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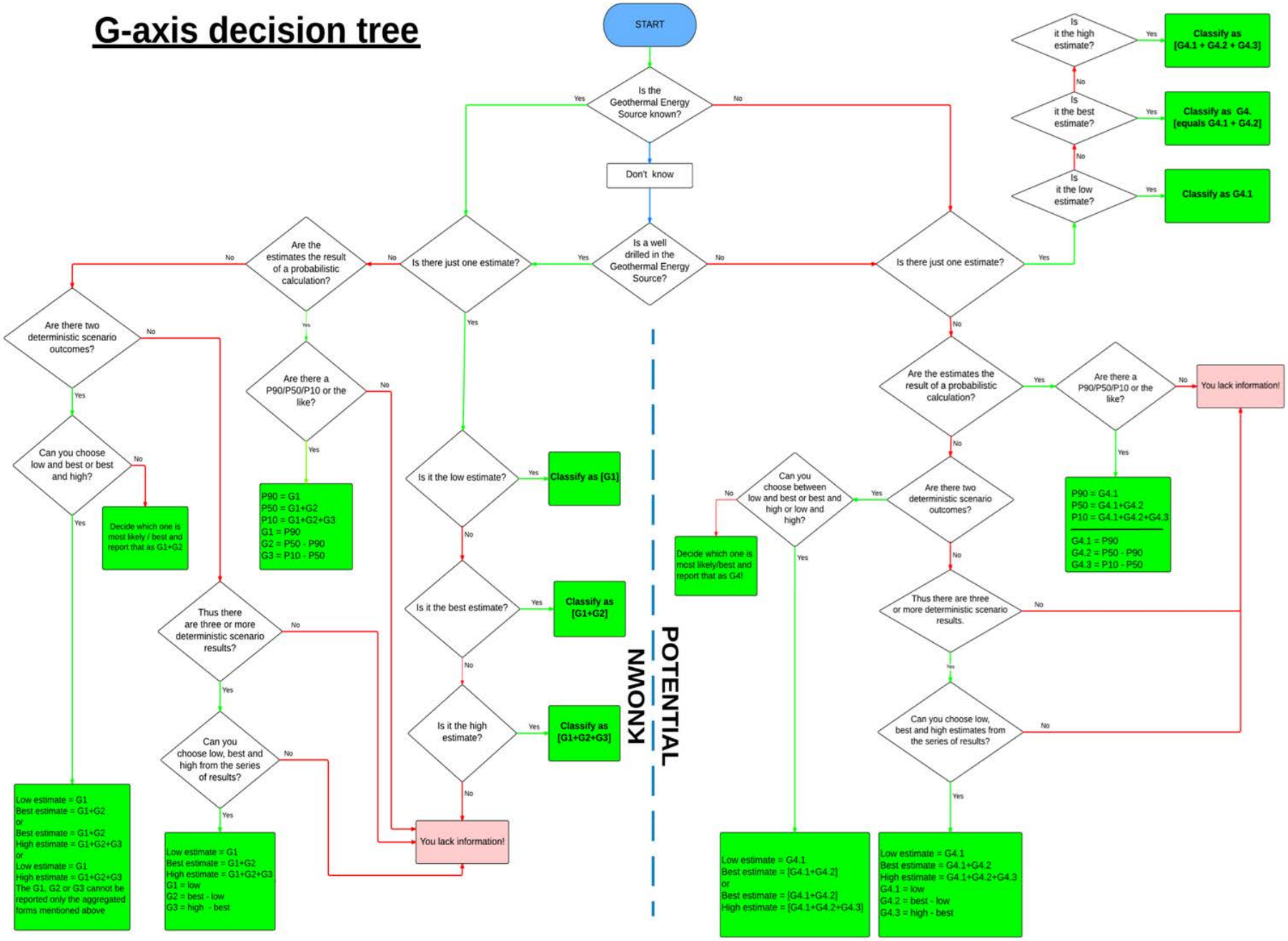
G-axis decision tree



Application Examples

Case study	Location	Type
1	Ngatamariki	Hydrothermal, electricity
2	Habanero	EGS, heat
3	Insheim	EGS, low enthalpy, electricity + heat
4	Rotliegend-3 Geothermal Project	Geothermal, heat
5	Dutch Rotliegend Play Area - Nationwide Play Resource Estimation	Geothermal, heat, aggregation
6	Hódmezővásárhely District Heating	Direct use (DH)
7	Alto Peak	Hydrothermal, electricity
8	Baslay-Dauin	Hydrothermal, electricity
9	Canavese GeoDH System	GWHP, heat
10	Vertical Ground-Coupled Heat Pump System	GSHP, heat
11	Aggregation GSHP-potential, NRW, Germany	GSHP, aggregation
12	Hanzhetka, Sibiria	Hydrothermal, electricity + heat

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Case Study 8: **Baslay-Dauin**

Project Location:	Baslay-Dauin, Negros Oriental, Visayas, Central Philippines
Data date:	August 2014
Date of evaluation:	August 2015
Quantification method:	Volumetric Heat Assessment
Estimate type:	Probabilistic

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Case Study 8: **Baslay-Dauin**

Project Summary

1. Baslay-Dauin geothermal project is located at the southern tip of Negros Island, Philippines and covers an area of 46 km^2 of the Southern Negros Geothermal Field.

2. Surface geothermal exploration activities were undertaken within the Baslay-Dauin Geothermal Project from 1973 to 1979 to investigate its geothermal potential. Drilling of two exploration wells, DN-1 and DN-2 were completed in 1982 and 1983, respectively. DN-1 encountered a temperature of 240 ^oC.

3. Baslay-Dauin I not yet producing.

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Case Study 8: **Baslay-Dauin**

Quantification

6. The quantification of energy for the project is based on the Volumetric Method using Monte Carlo simulation. The assumptions used about the volume of the reservoir are based on the result of the MT surveys done in 2013 and additional surface data from geology and geochemistry interpretations. Assumptions about the reservoir temperature are based on the well DN-1.

Input Variables	*Units*	*Most Likely*	*Min*	*Max*	*Mean*	*SD*	*Probability Distribution*
Area	km^2	4.43	3.58	7.63			triangular
Thickness	m	1800	1400	2400			triangular
Temperature	°C	250	220	270			triangular
Recovery factor					.06	.02	=f (porosity)
Load Factor		.92	0.8	1.0			triangular
Rejection Temp	°C	180					Single value

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Case Study 8: **Baslay-Dauin**

Product type

8. The product type is electricity.

Reference Point

9. The reference point is at the station switchyard, where power is exported into the national grid in the Philippines. Internal power use or parasitic load has already been subtracted.

Geothermal Energy Resource Geothermal Resources

10. Geothermal Energy Resource Geothermal Resources:

Low Estimate (P90):	16 PJ	(500 MW_e yr);	20 MW_e for 25 years
Best Estimate (P50):	28 PJ	(875 MW_e yr);	35 MW_e for 25 years
High Estimate (P10):	43 PJ	(1400 MW_e yr);	55 MW_e for 25 years

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Case Study 8: **Baslay-Dauin**

UNFC-2009 Classification
E category classification and subclassification

Category	*UNFC-2009 Definition*	*Reasoning for classification*
E3	Extraction and sale is not expected to become economically viable in the foreseeable future or evaluation is at too early a stage to determine economic viability.	The evaluation of the economic viability of the project shall depend on the result of a surface geoscientific study and modeling which will serve as basis for the formulation of the exploration and delineation drilling program.
Sub-category	*UNFC-2009 Definition*	
E3.2	Economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase).	Additional geophysical study and modeling (MT additional stations) to possible improve the quality of data. The MT data will be used to come up with a refine geophysical model which will serve as input in the stored heat estimates and revised volumetric stored heat estimates.

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Case Study 8: **Baslay-Dauin**

UNFC-2009-Classification and Quantification

Classification	*Energy Quantity*	*Supplemental information*
UNFC Class	Energy units used: Peta-Joules (PJ) =($x10^{15}$J)	
E3;F2.2;G1	16 PJ*	Low estimate of the geothermal energy resource; it is the P90 estimate.
E3;F2.2;G2	12 PJ*	Incremental between Best and Low estimates; the P50-P90 estimate (28-16 PJ), with G2 being incremental to G1.
E3;F2.2;G3	15 PJ*	Incremental between High and Best estimates; yhe P10-P50 estimate (43-28 PJ), with G3 being incremental to G1+G2.

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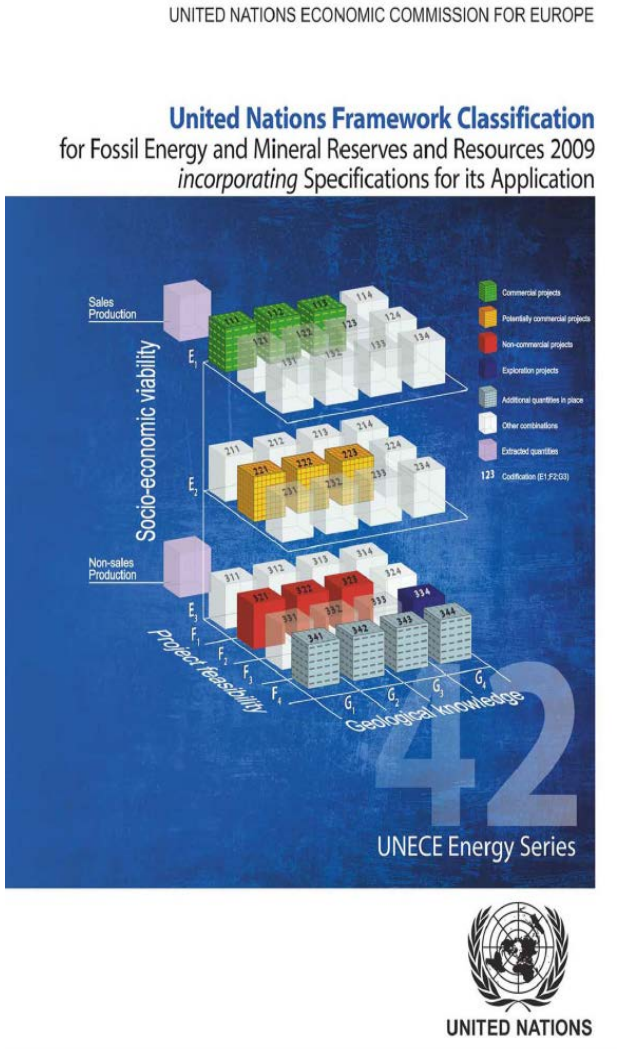
Thank you



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