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**Application of the UNFC-2009 to  
Renewable Energy Resources**

**“The Concept”**

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UNITED NATIONS  
ECONOMIC COMMISSION  
FOR EUROPE

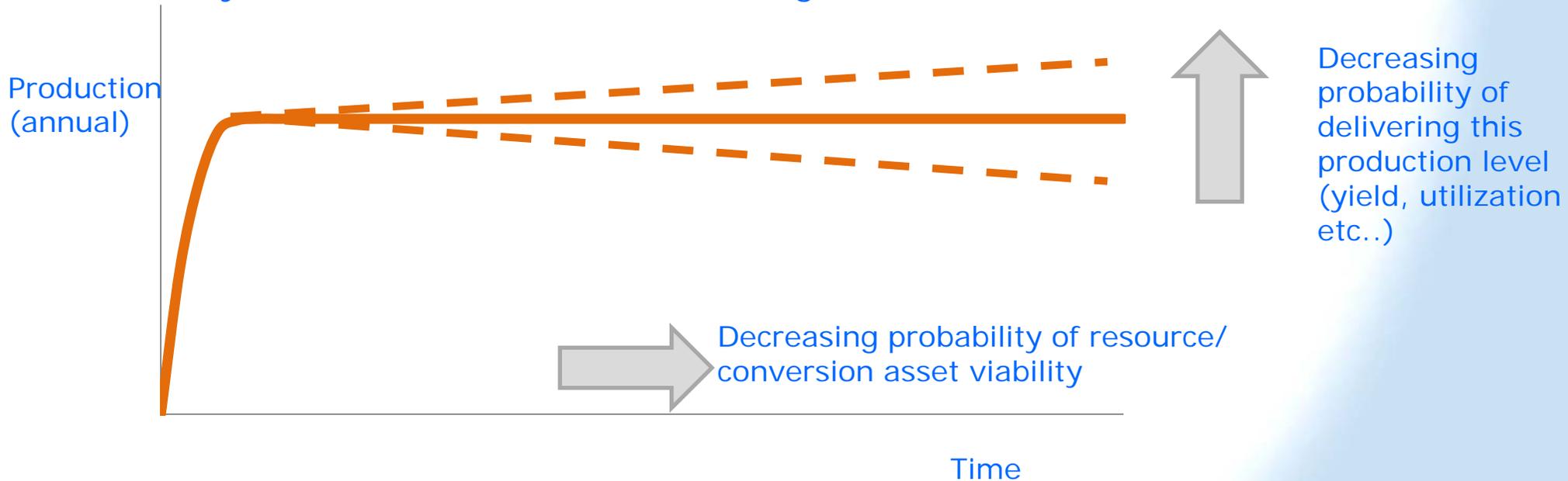
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# Purpose of this session

- Present the concept of “Renewable Energy Resources”
- Set-out the similarity between Renewable Energy Projects and Fossil/mineral Projects in the context of resource classification.
- High-level mapping of the UNFC 2009 framework to Renewable Energy Projects.
- Identification of key underpinning concepts / principles governing the methodology.

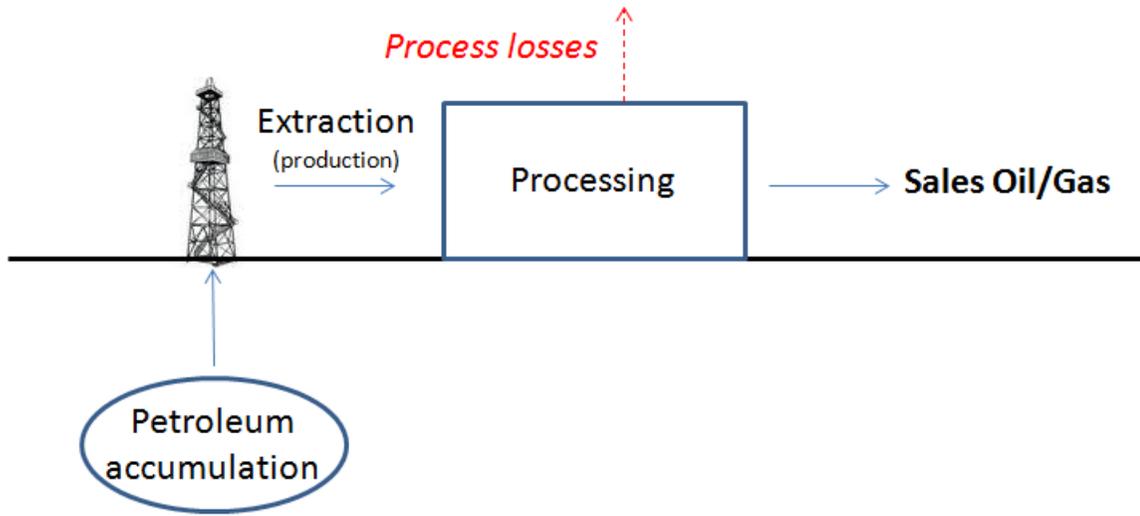
# The Concept of a Renewable Energy Resource

Stylised Production Profile from a Sugarcane Ethanol Plant

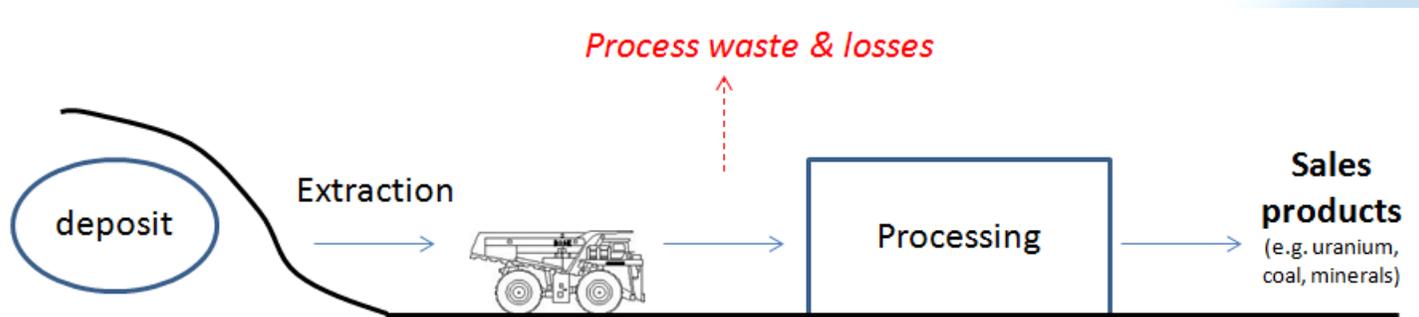


- A renewable resource is almost wholly analogous to a conventional resource.
  - A conventional resource represents an **expectation of energy in place** that can be economically produced/extracted and brought to market.
  - A renewable energy resource represents an **expectation of the renewable energy production potential** that can be economically produced / converted and brought to market.
- A renewable project's future production potential must be bounded by the same or similar constraints as an assessment of a conventional resource's energy in place.

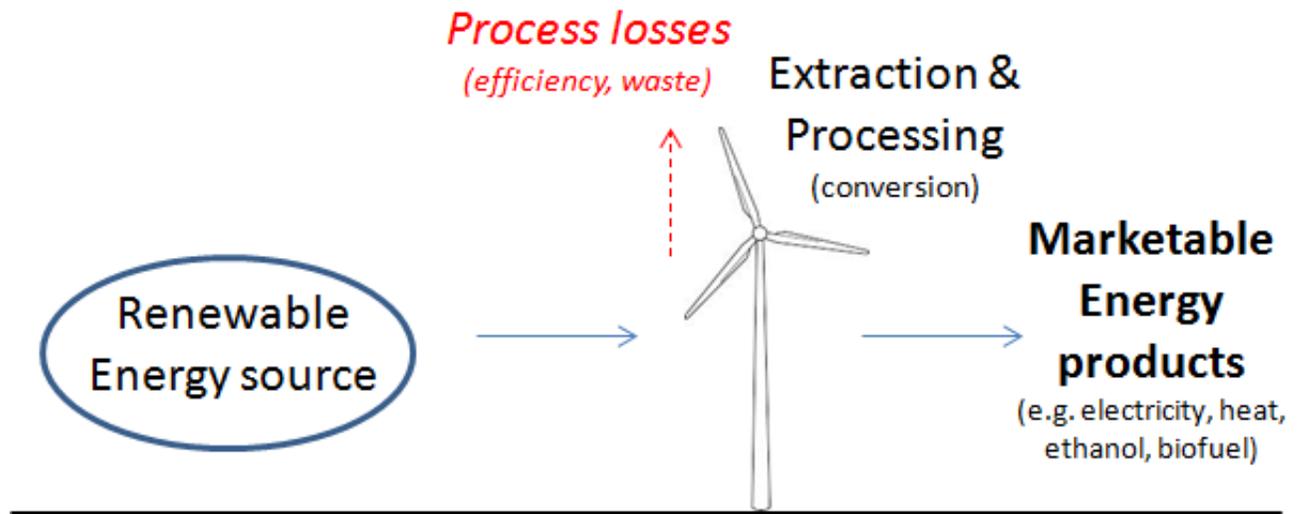
# Typical elements of Fossil/mineral projects



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

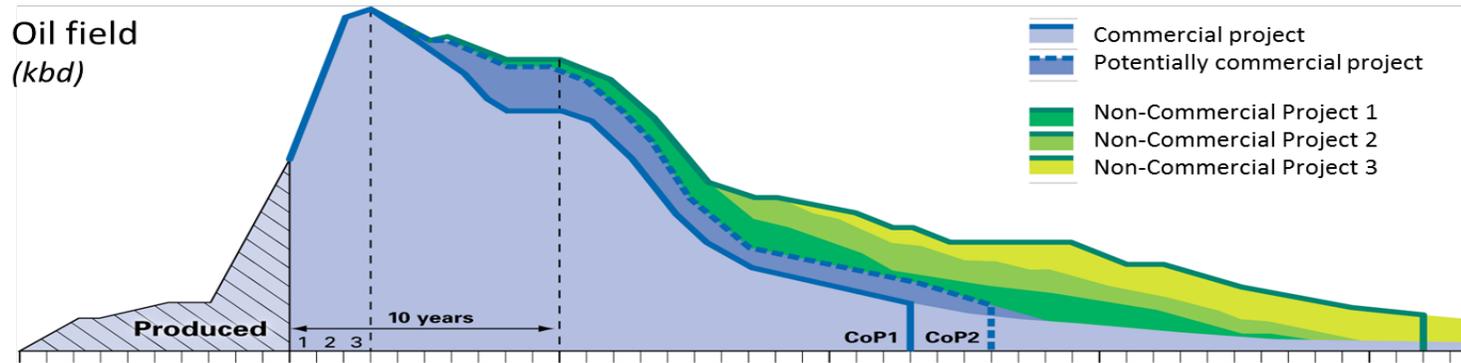


# Renewables vs. non-renewables

Common characteristics	Key differences
Projects have a defined level of investment, with an expected production profile	The renewable energy source does not deplete (SE4ALL definition: "... is replenished at a higher rate than consumed")
Common prerequisites for project feasibility, such as gaining access to the resource and market, receiving authorisation, and validation of the economic case	Geological risks do not apply to most Renewable energy projects, but similar uncertainties exist (e.g. meteorological variations, seasonal variations etc)
As the project develops, risk declines and <i>certainty</i> of returns improves	

# Oil field vs. Wind Farm example

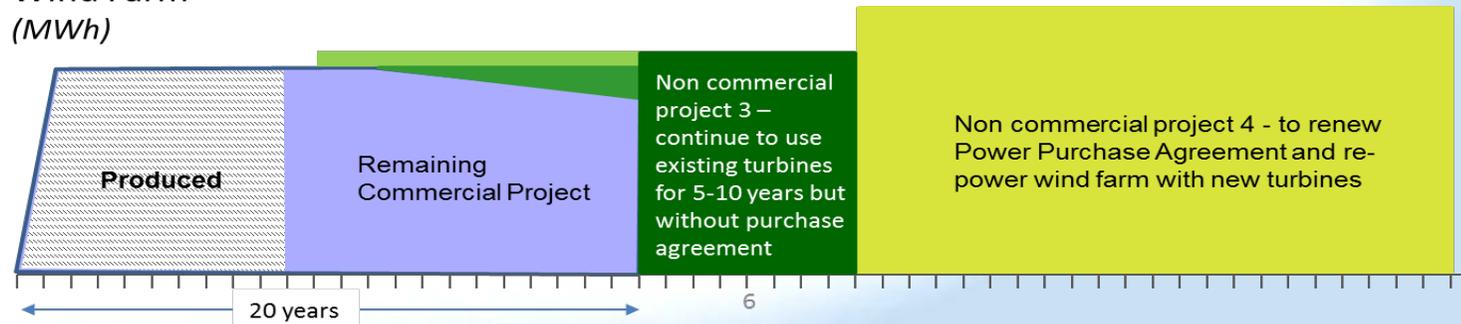
## Illustration: oil field vs wind farm



Non commercial project 1 - to invest in plant efficiency to retain same throughput over lifetime of the plant

Non commercial project 2 - to increase turbine efficiency and decrease downtime on maintenance, resulting in higher throughput

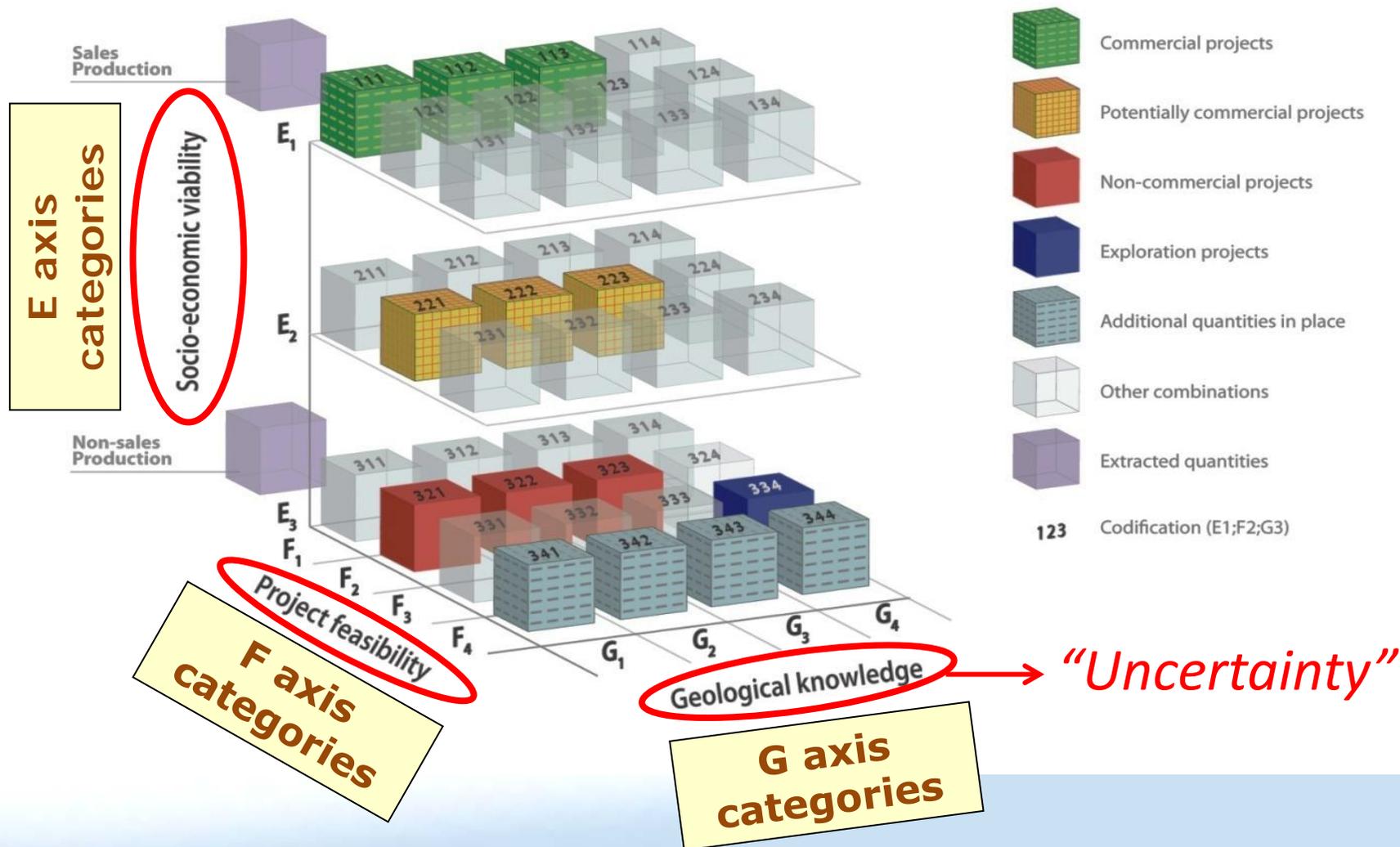
Wind Farm (MWh)



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Presented for illustrative purposes. Classification not necessarily consistent with UNFC framework

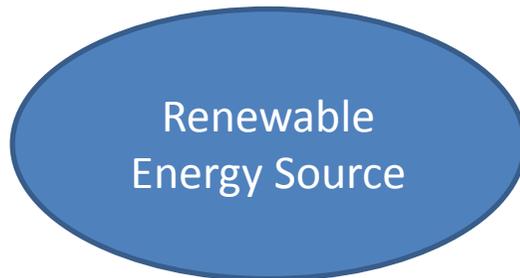
# The UNFC principles can therefore also be applied to Renewables



# What are “Renewable Energy Resources”?

## Renewable Energy Source:

The primary energy available for extraction/conversion



*Examples: sun, wind, biomass, earth heat, river flow, tides etc*

Extraction / Conversion



Process/project:  
Wind park, solar park, hydro power plant, sugar cane mill, geothermal

## Renewable Energy Resources:

cumulative quantities of extracted and marketable Energy Products from the Renewable Energy Source, measured at a Reference Point



*Examples: Electricity*

Heat

Biofuel

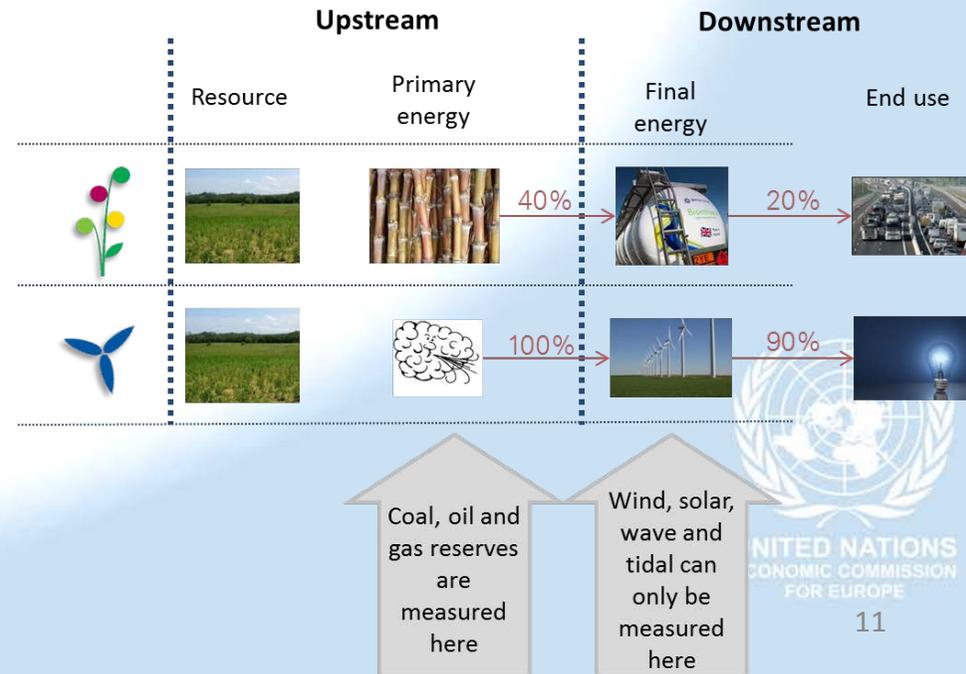
# The definition of the “Project”

- The concept of the “project” is fundamental to resource evaluation.
- A project is the link between the Resource and the and sale quantities of Energy Products and provides the basis for economic evaluation and decision-making.
- A resource evaluation is carried out at a project level, e.g.
  - A new wind farm, PV array, or biofuels plant
  - A change to an existing asset requiring major capital investment
- The assessment is done for a specific time-point e.g. at sanction or during operating life. Assumptions and classification criteria must be consistent with that time-point.



# Reference Point Definition

- Renewable Energy Resource evaluation requires the definition of a particular reference point / point of measurement (this is not linked to entitlement).
- Wind, solar, wave and tidal have effectively only one meaningful reference point. Bioenergy has potentially a number of options.
- The proposal in the Renewable Specifications is that the reference point is defined as the point in the value chain where there is a **“marketable Energy Product”**
- An Energy Product in turn is defined as a product that is directly linked to (or a direct replacement of) a fungible energy commodity and therefore has a clear market value.



# Entitlement

- A requirement to simultaneously demonstrate.

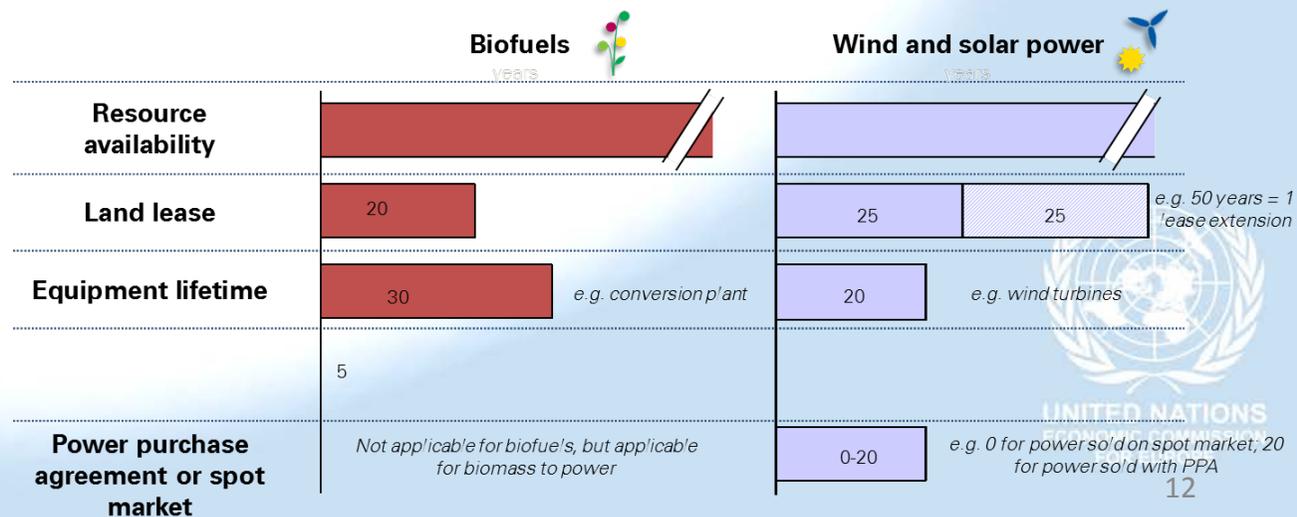
## 1. Access or entitlement to the Resource.

- E.g. Ownership of the resource (land ownership)
- Lease or another form of entitlement of the resource.

## 2. Exposure to risks in the extraction process (conversion of the resource to energy).

## 3. The opportunity for reward through the subsequent sales of the Energy Product.

- Access / entitlement to the conversion technology and infrastructure in place to produce and market the energy product.
- E.g. own or have equity in the conversion asset.



# Project Life Time

- The period of economic feasibility for a project is a key factor in bounding the renewable resource classification for a project.
- This can be defined either as:-
  1. The extraction rate (cumulative production) beyond which the remaining cumulative net operating cash flows from the Project are negative.
    - However in practice this unlikely to be appropriate for most renewable projects.
  2. The assessed project lifetime based on the design / operational characteristic of the conversion asset.
    - Assessment based on design and/or typical industry operating experience.
    - Routine maintenance does not constrain the Project lifetime.
    - Significant capital re-investment and/or future option to do so would augment the renewable resource base, but potentially as a project of lower maturity.
  3. Entitlement limit
    - E.g. Length of Lease. Options /potential to renew or extend the lease would augment the resource base, but potentially as a project of lower maturity.