Technical and Economic Model to Asses Energy Projects

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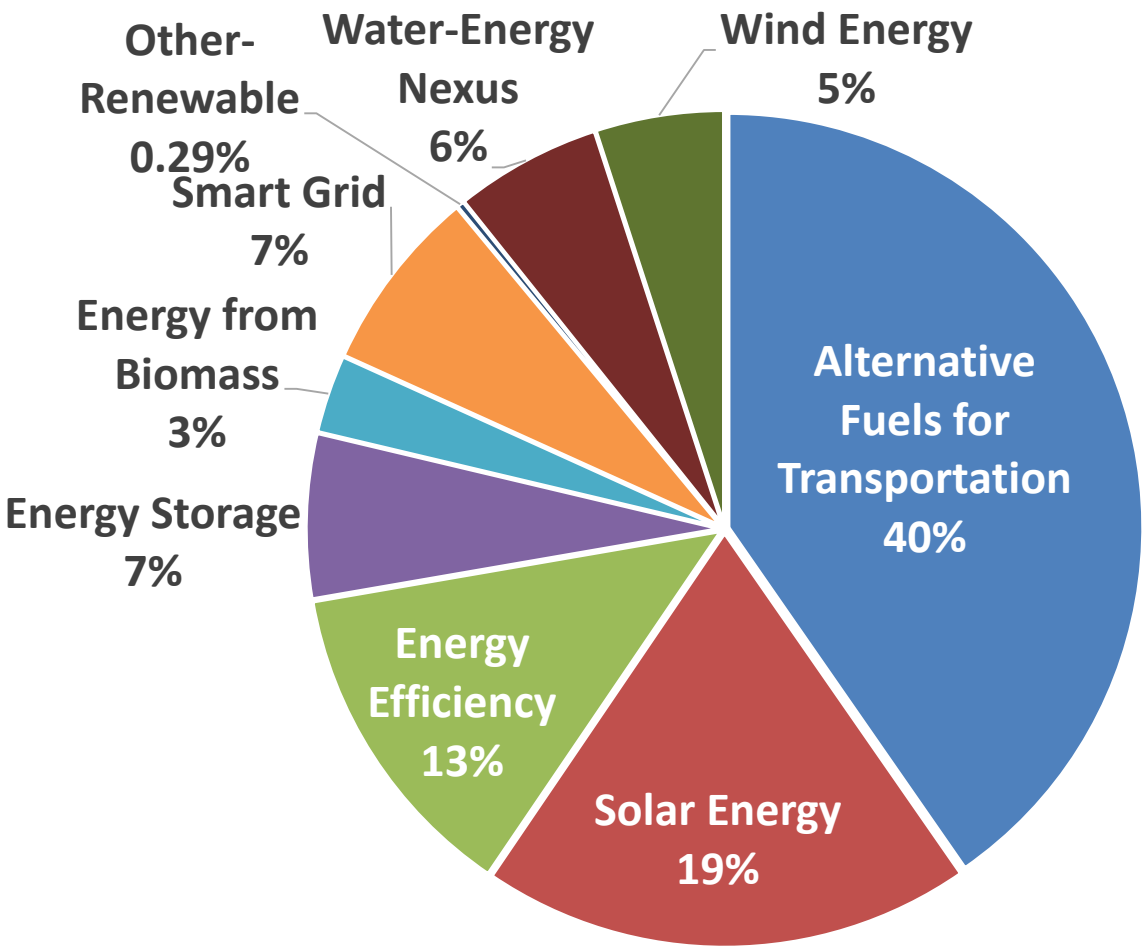
The CSO- R&D support programs

- Academic research projects
- The STARTERGY fund for early stage start-up companies
- Pilot and Demonstration Projects
- Students and Post-Doc Scholarships
- BIRD ENERGY

For further information on CSO activities please refer to our booklet

Clean Energy R&D grants 2012-2016



% of 50 Million USD

Model Objective

Creating a uniform formula for rating innovative R&D and demonstrative biofuel production projects- quantitative/objective

$$Score = a*A + b*B + c*C$$

A. **The Technology Readiness Level – TRL**
B. **The environmental contribution – according to the expected reduction of GHG emission**
C. **The weighted techno – economic improvement**

a, b, c- attributed weight factors (e.g: 0.3, 0.2, 0.5)

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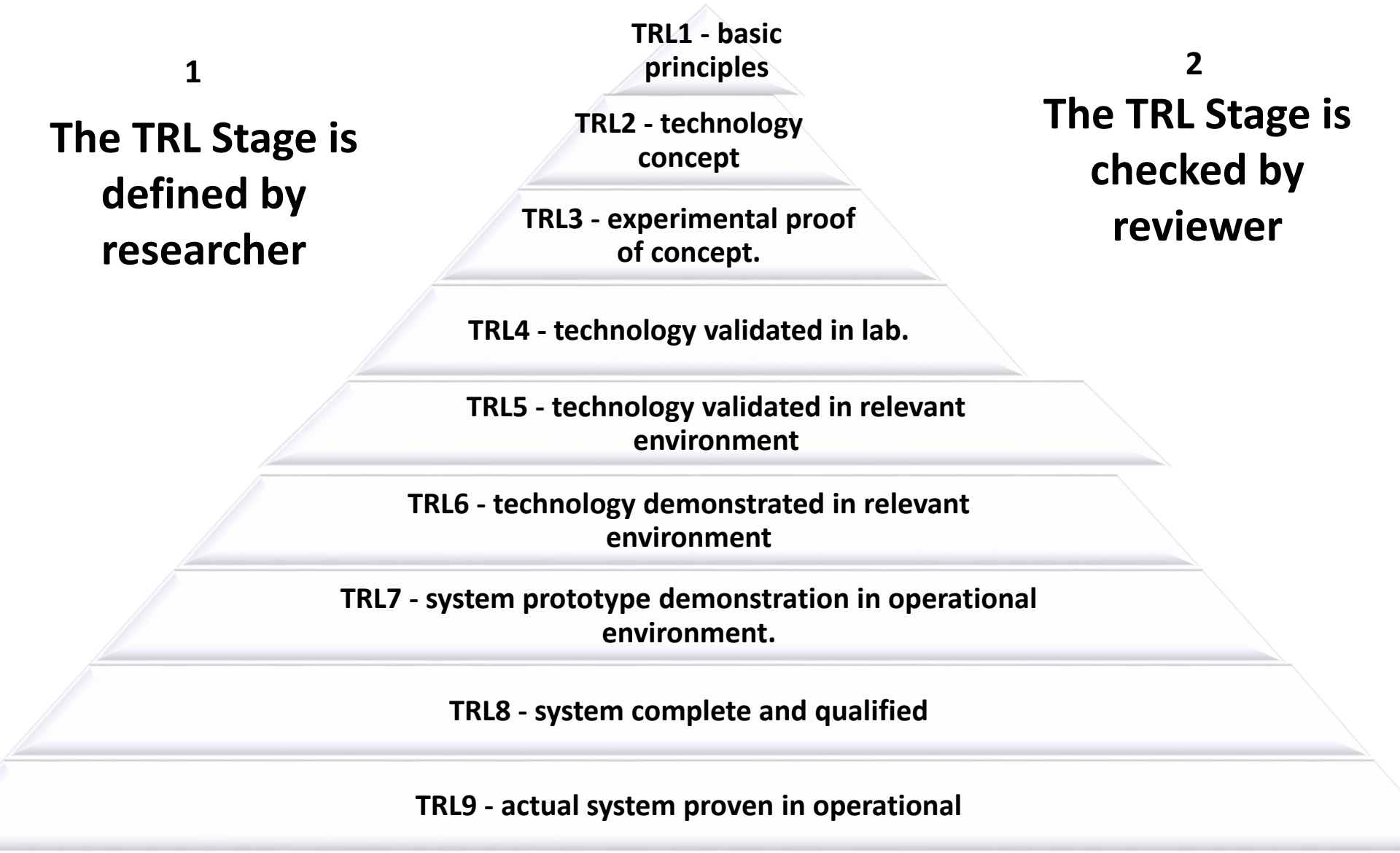
Definitions – TRL – Technology Readiness Level

1

The TRL Stage is defined by researcher



2

The TRL Stage is checked by reviewer

Weighted Coefficients Technology Readiness Level

Ordinal TRL Values	AHP Estimated, TRL Values	AHP Estimated TRL Values Adjusted to 9.0 (TRL 9)
1	0.01	0.26
2	0.02	0.53
3	0.03	0.71
4	0.04	1.14
5	0.07	1.97
6	0.10	2.74
7	0.16	4.26
8	0.25	6.81
9	0.33	9.00

AHP - The analytic hierarchy process is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology.

The AHP defines the TRL parameters according to their implied dominance as shown by their ordinal TRL values.

Parameter B – Grading According to GHG emissions

Types of technologies and Bio-Fuels	GHG emission, for algae to Bio-Fuels processes (Kg CO2 e / GJ) (*)	Grade
Fossil fuel - for reference	85	0
Biogas – thermal process – condensed/clean	25	71
Biogas – biological process – from WWT	15	82
Biogas – biological process – from dedicated raw material	20	76
Biodiesel – FT process	8	91
Biodiesel from oil	45	47
Bioethanol – biological from sugar	25	71
Bioethanol – biological from hydrolysis products	40	53

Parameter C – Techno-Economic Considerations in the Grading of Bio-Fuel Projects

Details for grading technologies, according to the relevant cost component(*) and sub-section in the major cost components of the production process of bio-fuels from biomass

The main cost components	Sub-sections of the main cost components
Infrastructure and Facilities	Road, fence, buildings e.g. service structures, process management, etc.
Land	Price of land - including the pond area production, development costs
Equipment	Algae growing equipment - Reactor / Pond, raw material production equipment, production equipment of bio-fuels, filtration equipment, drying and grinding, storage
Overheads and other costs	Searching / licenses, insurance, design and engineering, management, laboratory equipment, vehicles
Capitalized production expenses	NPV calculated according to the expected production costs for - 20-year of production, and according to the prevailing interest rate in the market and by sub-sections of the main expected current expenses of: personnel, energy, chemicals and other (maintenance, etc.)

Grading of the Techno-Economic Improvement Expected from the Implementation of Proposed Energy Projects (for Algae derived bio-fuels = BF)

The cost components in the process of BF production from Algae	Reduction percentage value – estimated by the technology submitting body	Reduction percentage value – estimated by the referent	Weight (%) of the cost component, for various types of scored bio-fuels and technologies			
			Bio-Diesel + BG in a process including WWT	Biogas in a process including WWT	Bio-Diesel + BG in a BF Prodn. process from BM	Bio-diesel in a BF prodn. Process from TG
			%	%	%	%
Infrastructure & Constructions			2.92	3.84	%	4.24
Land			6.48	8.98	3.12	5.19
Equipment			24.76	26.51	3.58	27.73
Other			15.01	17.42	25.65	16.57
NPV of the CPE			50.83	43.25	14.26	46.27
Total			100.00	3.84	53.39	100.00

Model's weaknesses

- **Requires constant data updating**
- **Requires integrative analysis to identify critical barriers and evaluate impacts on overall yield to developments in biology, cultivation, and processing**
- **The data differs from one country to the other**
- **No Scientific consensus on bioenergy sustainability**
- **The data in the model is applicable for certain technologies. If a proposed new technology is based on fundamentally different principles, the model may be less accurate**
- **A need for fundamental understanding and robust measurements of commercially relevant conditions**
- **The error might be too large for such a quantitative/objective model – difficult to differentiate between proposals**
- **Cost/effort>>>benefit**