



**ADVANCEFUEL**

# Monitoring framework and the KPIs for advanced re- newable liquid fuels (RESFuels)

## D1.2

Ayla Uslu

Energy Transition Studies

Energy research Center of the Netherlands (ECN)

Amsterdam, the Netherlands

[uslu@ecn.nl](mailto:uslu@ecn.nl) | [www.ecn.nl](http://www.ecn.nl)

ECN-E--18-016



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.° 764799.

Deliverable Information	
Grant Agreement Number	764799
Project Acronym	ADVANCEFUEL
Instrument	CSA
Start Date	1 September 2017
Duration	36 months
Website	www.ADVANCEFUEL.eu
Deliverable Number	D1.2
Deliverable Title	Monitoring framework and the KPIs for advanced renewable liquid fuels
Expected Submission	M6
Actual Submission	M6
Authors	Ayla Uslu
Reviewers	Hamid Mozaffarian, Marc Londo, Kristin Sternberg, Panoutsou Calliope
Dissemination Level <i>Public (PU), Restricted (PP), Confidential (CO)</i>	PU



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# Introduction

The overarching goal of the Horizon 2020-funded EU project **ADVANCEFUEL** is to facilitate the market roll-out of advanced liquid biofuels and other liquid renewable fuels (further jointly addressed as “RESFuels”) in the transport sector between 2020 and 2030.

This report aims to set the monitoring framework using a set of Key Performance Indicators (KPIs) for this project and for the RESFuels sector in general. The KPIs, therefore, are grouped as project monitoring and RESFuel market progress monitoring indicators.

- Project monitoring: The strategic objective of the **ADVANCEFUEL** project is to facilitate the market roll-out of advanced liquid biofuels and other liquid renewable fuels. Each work package (WP) aims to provide new knowledge to the stakeholders, particularly recommendations to remove the most prominent barriers to their commercialisation. KPIs are selected for each WP and are aligned with the main goal(s) of the WP. The ultimate aim is to measure the specific activities within a WP in terms of the extent to which they help overcoming identified barriers.
- RESFuel market progress monitoring: This is a continuous monitoring process, which will go along with the project’s progression. The aim is to systematically and continuously collect data and inform the stakeholders on the actual progress of RESFuels.

The KPIs are selected, whenever possible, following the principles below.

- Specific - The KPIs are clearly defined. There is one widely-accepted definition of the KPI to make sure the different users interpret it the same way and, as a result, come to the same and right conclusions which they can act on.
- Measurable - The KPI is measurable to make it possible to measure the progress
- Achievable - the KPI is defined in a way that it is achievable. Thus, the set norms are realisable.
- Relevant - The KPI aims to give more insight in the performance of the project.
- Time-specific - It is important to express the value of the KPI in relation to time-scale. Every KPI has a meaning only if its time dimension, in which it is realised, is known. The KPI therefore has to be time-specific.

There are, however, KPIs that don’t always follow these principles. In some cases, it is not possible to quantify and/or measure the progress as the KPI is set for information purposes.



# KPIs for ADVANCEFUEL project monitoring

There are 4 WPs, related to different steps of the RESFuels value chain. They focus on the key barriers and aim to provide new and innovative solutions to overcome them.

**WP2** seeks to compare different roadmaps for various feedstocks and proposes upgrading strategies for feedstock supply chains. The ultimate aim of these upgrading strategies is to have high quality and more commoditised feedstock<sup>1</sup> with relatively lower costs to produce advanced biofuels. The KPIs to monitor the progress in this WP are identified as follows:

- the feedstock cost/price reduction by innovations. The feedstock prices comprise about 35-45% of total cost of advanced biofuel generation based on gasification technologies. It increases to 60-67% when pyrolysis upgrading is considered. For the biochemical routes, the feedstock prices have a slightly lower share in the total production costs of cellulosic ethanol (roughly 30% (SGAB, 2017)). It is important to ensure a reliable supply of relatively cheap feedstock. The measurement is % reduction of dedicated crop feedstock costs in €/t or €/GJ through innovations in the cropping systems (for instance through productivity increase, multi-cropping, intercropping, savings related to fertilizer use etc.).

The lack of information on dedicated energy cropping has been identified as a major barrier. WP2 focuses on dedicated energy cropping and provides new knowledge. The next indicators are selected for information purposes.

- the availability of marginal land<sup>2</sup> in Member States (ha),
- the technical potential of dedicated cropping on marginal land (t or MJ) and,
- the production costs of dedicated energy cropping (€/t or €/MJ)

The challenges related to the conversion of lignocellulosic feedstock into biofuels can be grouped as techno-economic, financial-economic and regulatory. The main techno-economic challenges are

- increasing flexibility of processes with regard to used feedstock
- reducing energy intensity
- improving overall efficiency and process reliability
- overcoming economic challenges related to integration of new conversion technologies into existing processes.

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<sup>1</sup> Intermediates that are available in standardised qualities and can be traded on competitive and liquid international markets (Olsson et al., 2016).

<sup>2</sup> Marginal land is land on which cost-effective food and feed production is not possible under given site conditions and cultivation techniques (Wicke, 2011)

The financial-economic challenges relate to the investors uncertainty to invest due to high capital investment requirements coupled with the technological risks.

Regulatory challenges relate to the need for long-term, dedicated and stable policy support to advanced biofuels.

**WP3** looks into the conversion technologies and aims to provide innovative approaches to increase the overall system efficiency and increase the technology readiness levels (TRL) of different conversion technologies. Besides, this WP analyses how far the existing infrastructures can facilitate the ramp-up of advanced biofuels. The KPIs to monitor the progress in this WP are defined as:

- well-to-wheel system efficiency, through innovative approaches, for the years 2020, 2030 and 2040 ( $MJ_{output}/MJ_{input}$ )
- CAPEX investment needs to increase the TRL of certain conversion technologies (M€ and person months)
- CAPEX and OPEX reduction by existing infrastructure use (compared to the alternative of new stand-alone plants). At least three concepts in which RESFuel production can be integrated into existing fossil fuel production assets that result in CAPEX and OPEX cost reduction (%)

**WP4** analyses the sustainability aspects of RESFuels and aims to help overcoming the challenges related to sustainability criteria and sustainability certification. The proposed KPIs related to this WP are:

- A set of additional sustainability criteria (addition to the existing RED criteria) at EU level- that is reviewed and acknowledged by the key stakeholders
- A set of recommendations on the harmonisation of voluntary schemes focusing on RESFuels

**WP5** focuses on the end use sector to provide information on future market uptake. This WP presents best practices in Europe and outside. Next to that, fuel blend properties in end use to facilitate the use of RESFuels in the road and aviation is analysed.

- Best practices in Europe and at international level. The best practices are based on 'advanced biofuel programs/ strategies that facilitate policy (regulatory, financing and information provision dialogue) and market (number of plants started and in operation) development, address sustainability concerns by focusing on efficient land use and greenhouse gas (GHG) performance, allow long term smooth market operation and develop reliable databases to assist market operation and monitoring.
- Fuel performance data in comparison with fossil diesel and gasoline
  - fuel consumption of vehicle in light duty (l/100km)
  - brake specific fuel consumption of engine in heavy duty (g/kWh)

**WP 6** combines all the outputs from the aforementioned WPs and conducts an integrated assessment. It provides a systematic overview of integrated pathways for RESFuel production, and a coherent overview of the extent to which the innovations from WPs 2-5 lead to full-chain RESFuel production. Next to that this WP examines the employment and GHG emission reduction potentials.



- Gross employment effect of different advanced fuel production pathways (total fte or fte/PJ)
- Life cycle GHG emission reduction performance of different pathways (t CO<sub>2</sub>eq./MJ)

Table 1 summarises the KPIs identified for the different WPs. This table also includes some indicative targets to achieve.

*Table 1 Barriers related to feedstock supply*

Relevant WP	KPI	Aim
WP2 feedstock supply focused	Dedicated energy crop production cost reduction by deployment of innovative technologies (% reduction in costs €/t or €/GJ)	Relates to the barrier high feedstock prices. Introduces the options to reduce the costs.
	Availability of marginal land in Member States (ha)	For information purposes. Informs stakeholders on the future availability of land for dedicated energy crops (woody and grassy).
	Technical potential of dedicated cropping (t or MJ) on marginal land	Relates to the reliable supply of feedstocks. Informs stakeholders on the technical potential of dedicated energy crops (woody and grassy).
WP3 conversion focused	Well-to-wheel system efficiency due to innovative approaches (%)	Presents possible system efficiency increases in 2020, 2030 and 2040
	CAPEX needed to increase the TRL of selected technologies (M€)	For information purposes. Indicates the TRL increase possibilities
	CAPEX and OPEX reduction due to opportunities for greening the fossil fuel infrastructure (%)	Presents the opportunities related to the use of existing infrastructure. Compares the total costs of an integrated system with a stand-alone system.
WP4 sustainability performance focused	A set of additional sustainability criteria (addition to the existing RED criteria) at EU level- that is reviewed and acknowledged by the key stakeholders	Relates to safeguarding any possible negative sustainability effects of RESFuels
	A set of recommendations on the harmonisation of voluntary schemes focusing on RESFuels that is reviewed and acknowledged by the key stakeholders	Relates to implementation and verification of sustainability criteria
WP5 end use focused	3 best practices in Europe or outside.	Presents existing and well-functioning practices related to RESFuels in Europe and/or abroad.
	Fuel performance data in comparison with fossil diesel and gasoline <ul style="list-style-type: none"> <li>• fuel consumption of vehicle in light duty (l/100km)</li> </ul>	Informs on the fuel performance of RESFuels.

	<ul style="list-style-type: none"> <li>• brake specific fuel consumption of engine in heavy duty (g/kWh)</li> </ul>	
WP6 integrated assessment focused	Gross employment effect of the selected pathways (fte/PJ)	Informs on the possible employment effects of RESFuel value chains.
	The GHG emission reduction effects of the selected pathways (t CO <sub>2</sub> eq./MJ)	Presents the avoided GHG emissions and measures how far they meet the set targets in REDII proposal.





# General KPIs for RESFuels market monitoring

In this section the aim is to inform about the progress in producing RESFuels in Europe rather than monitor any specific **ADVANCEFUEL** project goal. The indicators are set to inform and update both the project partners and the key stakeholders enabling them to make well-founded decisions.

The European Industrial Bioenergy Initiative (EIBI) has defined KPIs for monitoring and reviewing the overall progress of the EIBI and of the individual research, development and demonstration activities performed in the frame of its implementation. Those KPIs are designed to feed into the Monitoring and Review Framework of the SET-plan. These indicators are reviewed to help us define the KPIs. However, we haven't used the EIBI KPIs directly as they were tailored to EIBI activities, whereas the objective in this section is to present an overview of the advanced biofuel sector in Europe.

Table 2 introduces the KPIs selected for market monitoring of RESFuels in Europe. Feedstock price related KPIs are based on the available market data. Market prices of wood pellets, wood chips and straw are selected to give insights in the price developments and the main factors behind these developments. Concerning the developments in conversion technologies the status of the operational plants in Europe will be presented. The total consumption and production of RESFuels in Europe will also be shown (depending on the data availability). Next to that, the overview of the total R&D investments to biofuels and the EU funding to RESFuels will be presented. Finally, the status of the policy support in the EU member states is included in the market monitoring.



Table 2 Selected KPIs for the market monitoring of RESFuels in Europe

Name of the KPI	measure	Means of quantification	Aim
<b>Feedstock price indications</b>			
<b>Wood pellet &amp; wood chip prices</b>	€/t	Industrial wood pellet prices (cif Ara)(Argus) Wood chip prices (cif Ara)(Argus)	High feedstock prices are defined as one of the important barriers. Feedstock prices are influenced by the amount of supply and market demand. Currently advanced biofuels sector comprise a very small amount when compared with other sectors such as electricity & heat or animal husbandry (agricultural residues such as straw). This monitoring will give insights in main factors affecting the feedstock prices. The industrial stakeholders, researchers and policy makers will be the main interest group.
<b>Straw price</b>	€/t	Eurostat publishes absolute purchase prices of wheat straw. The prices relate to sale of straw to farmers for feed purposes.	
<b>RESFuel technology status and end use</b>			
<b>Plant capacity</b>	MW <sub>installed</sub> per country	IEA task 39 Commercializing Liquid Biofuels Database For RESFuels from non-biological origin demonstration plants will also be included	The KPIs in this section will inform the relevant project partners and stakeholders on the recent developments regarding investments in conversion technologies and developments around advanced biofuel production. The main interest group, next to project partners, are policy makers, researchers and NGOs. It will also update the stakeholders on the recent developments related to national policy support.
<b>Actual production and consumption</b>	PJ/year	USDA FAS, Eurostat EC progress reports, when available	
<b>Total Investments</b>	M€ OR k€/MW <sub>installed</sub>	IEA task 39 Database (Whenever possible. This information is not always public)	
<b>Support to (advanced) biofuels</b>	M€	Total R&D to biofuels from IEA Energy Technology RD&D Statistics (data available for the two prior years)	



		Status of the EU funding to RESFuels	
Status of the policy support to advanced biofuels		RESLegal and EurObserv'ER, whenever available country progress reports	



# The monitoring timeline

KPIs, which target project monitoring, will be quantified when the corresponding WP has progressed enough to present such results whereas general biofuels market monitoring will be updated annually. Table 3 presents the timeline of the KPI monitoring.

Table 3 Timeline of the KPI presentations

Relevant WP	KPIS	March 2019 (Month 18)	March 2020 (Month 26)
<b>Project related KPIs</b>			
WP2 feedstock supply	Feedstock cost reductions due to innovative technologies	X	
	The availability of marginal land in Member states		X
	The technical potential of dedicated cropping		X
WP3 conversion technologies	Well-to-wheel system efficiency increase due to innovative approaches		X
	Time framed CAPEX need for TRL level increase of certain technologies		X
	CAPEX reduction due to opportunity for greening the fossil infrastructure		X
WP4 sustainability and certification	A set of additional sustainability criteria for RESFuels		X
	A set of recommendations on the harmonisation of voluntary schemes focusing on RESFuels		X
WP5 end use	Best practices in Europe or outside	X	
	Fuel performance data		X
WP6 integrated analysis	Gross employment effect of the selected pathways		X
	GHG emission reduction of selected pathways		X
<b>RESFuels market progress related KPIs</b>			
Resource specific	Wood pellet & wood chip prices	X	X
	Straw prices	X	X
Conversion and end use specific	Existing RESFuel plant capacity	X	X
	RESFuel production and consumption	X	X
	Total Investments	X	X
	Public support to (advanced) biofuel technologies	X	X

	- Total R&D to biofuels - EU funding research and development (R&D) to advanced biofuels		
	Status of the policy support to advanced biofuels	X	X

## Conclusion

This report sets the monitoring framework using a set of Key Performance indicators (KPIs). The defined KPIs herein are differentiated and grouped according to their purpose as project monitoring indicators and RESFuel market monitoring indicators.

Project monitoring related KPIs are aligned with the main goals of the single WPs and aim to measure the specific activities within a WP in terms of the extent to which they help overcoming identified barriers. In total 12 KPIs were selected.

- 3 KPIs focusing on feedstock supply (WP2 )
- 3 KPIs related to conversion technologies (WP3)
- 2 KPIs focusing on sustainability performance of RESFuels (WP4)
- 2 KPIs focusing on end use (WP5), and
- 2 KPIs focusing on integrated assessment (WP5).

RESFuels market monitoring aims to systematically and continuously collect data and inform the stakeholders on the actual progress of RESFuels' development – taking into account all stages of the RESFuel value chain. KPI selection is based on publically available data and information sources. In total 7 KPIs have been identified. Indicators related to feedstock supply consist of market prices of wood pellet, wood chip and straw prices. KPIs regarding the RESFuels technology and the end use monitoring consist of information related to existing demonstration and first-of-a-kind commercial demonstration plants. In addition, R&D support aiming to further develop the considered sustainable and renewable transport fuels as well as the status of policy measures in the member states have been selected as being relevant KPIs for assessing RESFuel markets.

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