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Institute for Energy and Transport  
Strategic Energies Technologies Information System



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## Key Performance Indicators for the EIBI

### Background

KPIs represent an essential toolkit for monitoring and reviewing the overall progress of the EIBI, and of the individual research, development and demonstration (RDD) activities performed in the frame of its implementation. KPIs will become instrumental for planning RDD activities, funded under the current and up-coming research and development programmes as well as other possible funding schemes that will support the EIBI. More specifically, projects supporting implementation of the EIBI will need to demonstrate the link between their objectives and the KPIs of the EIBI to which they will contribute. As such, these projects will be integrated into the *Monitoring and Review Framework* of the SET-Plan. The practicalities of this exercise and the *modus operandi*, and particularly with reference to the later stages of analysis of the data and their feeding into the technology-neutral planning tool of SETIS, are still to be defined.

Drafting of the KPIs follows the principles established in the SET-Plan Information System (SETIS), with both over-arching and specific key performance indicators adapted to fit the needs of the bioenergy value chains identified by the EIBI. The KPIs are compiled in parallel with the formulation of project eligibility criteria. It is clear that implementation of the planning, monitoring and progress review in SETIS, based on KPIs, first of all requires access to relevant and reliable data and the set-up of monitoring and data feedback procedures. These procedures will be elaborated and described in detail by the EIBI Team in the course of 2012.

Work on the development of KPIs is being carried out jointly by Commission staff that represents SETIS, representatives of the European Biofuels Technology Platform and representatives of the heat and power industrial sector. This document has been compiled through input from a small Working Group comprising the following members:

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### 1. Over-arching KPIs

In many sectors bioenergy is used in direct competition with fossil energy and transport fuels (energy carriers) and as such in most cases savings in greenhouse gas (GHG) emissions are used as a comparator to assess “how good” bioenergy is in terms of impact on the environment. Consequently, greenhouse gas (GHG) savings, and the cost of achieving the savings, are an important indicator. The cost of production of bioenergy or the energy-carrier product is also an important indicator, although price to the customer on the market is ultimately the measure of economic performance. (It is noted here that other EIIs, and the CCS EII in particular, use Levelised Cost of Electricity and Cost of Avoided CO<sub>2</sub> as KPIs, and

if the EIBI Team considers these measures appropriate, the same or similar methodologies could later be incorporated into the EIBI KPIs.) In order to provide a measure of the performance of the various bioenergy projects against the 2020 EU 20% target for renewable energy, total bioenergy production from projects within the EIBI will also be monitored. Hence, 3 over-arching KPIs are proposed:

- **Price before taxes<sup>1</sup> of bioenergy products in 2020 (€/MWh) per value chain at point of sale to customer (Annex I).**

*Targets for primary products:<sup>2 3</sup>*

1. *Synthetic liquid fuels by gasification: < 80 €/MWh*
2. *Biomethane (<= price as for natural gas) and other synthetic gaseous fuels by gasification: (depends on product, e.g. – DME <60 €/MWh), Hydrogen compressed (<80 €/MWh ), CO (<30 €/MWh )*
3. *High efficiency heat and power by thermochemical conversion: < 75€/MWh (el), <35 €/MWh (heat)*
4. *Intermediate bioenergy carriers: pyrolysis oil <50 €/MWh (to compete with Heavy Fuel Oil , but this depends on actual product), torrefied product <30 €/MWh*
5. *Ethanol and higher alcohols from ligno-cellulosic biomass by biological processes: <80 €/MWh (Note: equates to <0,50 €/litre)*
6. *Hydrocarbons by biological processes and/or chemical synthesis: < 80 €/MWh*
7. *Bioenergy carriers by micro-organisms (algae) from CO<sub>2</sub> and sunlight: < 70 €/MWh for lipids (to be competitive with vegetable oils and animal fats). Biomethane (<= price as for natural gas)*

- **GHG savings compared to fossil equivalents**

The GHG methodology and data behind the sustainability scheme in the renewables directive (2009/28/EC) will be used as a reference for biofuels and bioliquids<sup>4</sup>.

*Targets:*

*Biofuels – GHG savings from use of biofuels and bioliquids shall be at least 60% (Reference: EU directive 2009/28/EC, production started on or after 1 January 2017 GHG savings). The methodology for calculation is given in Annex V of directive 2009/28/EC.*

For other energy products, reference data will be, as far as available, obtained from recognised reference sources.

*Targets:*

*For bioenergy products, other than biofuels and bioliquids – while GHG savings are not yet defined in directive 2009/28/EC, the Commission has indicated*

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<sup>1</sup>The purpose of this KPI is to give a rating for different technologies concerning their price competitiveness, Hence this includes production, plus profit margin and relevant costs to point of sale to a customer, and excludes product related taxes applied (e.g. VAT, excise duties and strategic stockpile fee).

<sup>2</sup> Energy content based on LHV

<sup>3</sup> Reference is 2010 and based on an oil price of 86 USD/bbl: as appropriate, targets can be adjusted with changes in the price of oil according to IEA

<sup>4</sup> One option would be to request information on the GHG savings and the methodology used in obtaining the result

*that in the absence of specific targets, the targets set for biofuels and bioliquids should be used (i.e. 60% according to RED) and future agreed methodology will be adopted.*

- **Total bioenergy produced by EIBI projects (TWh/year)**

*Targets:*

*2016: Intermediate step from 2012 to 2020 reflecting maturity of first phase of demonstration projects (one fourth of 2020 target)*

*2020: 35 TWh total energy from EIBI projects contribute to the 20% renewables target; 17.5 TWh of the 10 % renewable energy target for transportation will be reached by advanced biofuels. The 17.5 TWh corresponds to 2 GW installed capacity.*

## **2. General KPIs for EIBI**

Within each of the Value Chains, specific aspects of feedstock and/or processing technologies are at different stages of development, some of them have attained the pilot scale where their technical viability has been confirmed, while a few have reached the demonstration phase and are being evaluated to ascertain their technical reliability. None of the technologies in any of the Value Chains have reached the flagship plant stage and consequently none have yet proven economic viability.

Some of the technologies that could be deployed in the 7 generic value chains are already supported by actions at industrial, local, national and EC level and the performance of those projects should be monitored. The general project KPIs are:

- Number of Final Investment Decisions (FID) (i.e. approved projects of Demonstration scale or Flagship scale) per value chain specified in the EIBI (See Bioenergy Roadmap)  
*Target: at least 1*
- Cumulative number of Final Investment Decisions (FID) (i.e. approved projects of Flagship scale) based on technologies specified in the EIBI for all value chains  
*Targets: at least 8*
- Gross installed output capacity of plants based on the EIBI value chains and supported by the EIBI projects by 2020  
*Target: >2000 MW (total thermal capacity of all products)*
- Availability<sup>5</sup> during agreed final period of project of demonstration/Flagship plants in operation  
*Target: >95%*

## **3. Project Specific KPIs:**

To assess the progress of the portfolio of European projects and follow the success of the value chains four types of KPIs are foreseen, Technology Specific, Resource Specific, Health & Safety and Socio-Economic.

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<sup>5</sup> Availability is defined as a percentage measure of the degree to which machinery and equipment is in an operable and committable state at the point in time when it is needed; measured in hours per 8760 hours.

For the purpose of setting targets for the KPIs a cost base of 2010 has been assumed. The price of oil will have a substantial impact on many costs in each of the value chains and the cost base taken is \$ 86 per barrel (IEA 2010).

It is noted that the “system boundary” for EIBI projects is defined as the plant gate as the starting point, and the point at which the bioenergy product is sold to a customer as a finished product (e.g. electricity or heat fed into a grid) or semi-finished product (e.g. bio-oil for further refining) is the end point. Using this system boundary, costs for conversion processes defined in the value chains are monitored. However, since total costs of bioenergy products will also be (strongly) influenced by feedstock costs, the latter will also be collected for policy monitoring purposes. It must be appreciated that the cost of biomass feedstock paid by the conversion plant operator will depend upon the state of the biomass delivered. The state of the biomass feedstock received, whether wet (and needing to be dried), already dry, chipped, pelleted, torrefied, or in the form of a bio-oil will have a significant effect on the cost of conversion and also on the conversion efficiency of the process employed.

### 3.1 Technology-Specific

- Plant at demonstration/flagship scale capable of achieving planned output capacity during agreed final period of project (while meeting quality specifications of products<sup>6</sup>, or meeting sales contract specifications)  
*Target: 100%*
- Plant at demonstration/flagship scale capable of product output at planned cost  
*Target: 100%*
- Greenhouse gas saving for each project compared with fossil fuel reference  
*Target: same as equivalent over-arching KPI*
- Net efficiency<sup>7</sup> (based on LHV) of conversion of biomass feedstock from plant gate to commercially marketable bioenergy product  
*Target: 75% (less than half of which is heat)*
- Capital intensity of the project (M€/MW)  
Investment cost per unit of energy capacity (with allocation for fuel, electricity, heat and co-products according to the proportion of the feedstock used)  
*Value chain specific and for data collection purposes only, therefore no targets*
- Cost per tonne of greenhouse gas saving (e.g. €/CO<sub>2</sub> equivalent)  
*Target: dependent on technology (value chain). Refer to Eligibility Criteria 4.6 and Annex III*

### 3.2 Resource-Specific

- Cost of biomass resource delivered at the bioenergy plant gate  
*For data collection purposes only, therefore no targets*

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<sup>6</sup> Quality specifications may be CEN standards, CEN Workshop Agreements and in their absence national or ISO standards

<sup>7</sup> Net efficiency is the percentage of useful (commercially marketable bioenergy product) energy output compared with the net sum of energy inputs (biomass and other energy inputs minus energy content of commercially marketable non-energy bio-products)

- Price of biomass resource at farm, forest or market gate (while not in the system boundary of the EIBI projects, this will indicate the intermediate costs when taking into account the cost at the plant gate)  
*For data collection purposes only, therefore no targets*
- Annual quantity of biomass consumption by the project  
*Project specific and for data collection purposes only, therefore no targets*
- GHG emissions of value chain 7 (algae) “resource production to plant gate” (e.g. CO<sub>2</sub> equivalent per MWh biomass feedstock delivered)  
*Target: <108 kg/MWh.*

### 3.3 Health, safety and environment

- Number of deviations, license suspensions with respect to prevailing emissions regulations along the whole value chain  
*Project specific and for data collection purposes only, therefore no targets*
- Number of accidents:  
*Targets: accidents <4; near-accidents<sup>8</sup> <10*

### 3.4 Socio-economic

- Number of permanent jobs created by demonstration/flagship project, including the plant itself and in the biomass supply and product chains (data broken down indicating the location of the jobs, local, within a radius of 150 km, elsewhere in the EU).  
*Data collection purposes only, therefore no targets*

## 4. Reporting

The practical implementation of the monitoring system requires a flow of information from the projects to the EIBI Team and to SETIS. There are several steps in the process with needs for input by various people:

- Data collection from EIBI projects and national projects - templates will be used to satisfy the monitoring requirement of each of the KPIs
- Data checking, and when necessary verification, by the KPI Monitoring Group (neutral experts) of the EIBI
- KPI Monitoring Group determines values for KPIs and reports to EIBI Team
- Approved KPI data from EIBI reported to SETIS

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<sup>8</sup> Computed as Lost Workday Injury Frequency (LWIF) of all workers (own staff and contractors), where LWIF is calculated from the number of Lost Workday Injuries (LWI) divided by the number of hours worked expressed in millions and as Total Recordable Case Frequency (TRCF). TRCF is calculated from the sum of fatalities, LWIs, RWIs (Restricted Workday Injury) and MTC divided by the number of hours worked in millions. These definitions are standard key performance indicators of the oil industry sector, ref. CONCAWE Report 7/09 September 2009.

- EIBI KPI Monitoring Group cooperation with SETIS on data aggregation and reviewing of EIBI KPI data fed into the technology-neutral planning tool of SETIS
- EIBI KPI Monitoring Group reports back to EIBI Team and the EIBI Team reports back to projects

It is envisaged that data for KPIs would be collected periodically at maximum interval of one year.

It is clearly the intention that all collected data are adequately protected and no publication is allowed without the consent of the original project organisations.

The EIBI will follow guidance from SETIS on procedures for KPI reporting and any other applicable data exchange.

The EIBI KPI Working Group will amend targets for demonstration/flagship projects and on the data to be collected according to the needs defined by the EIBI Team. All targets and methodologies need to be approved by the full EIBI Team.

## ANNEX I

Price of bioenergy products (e.g. €/litre, €/MWh) per Value Chain at point of sale to customer.

*Targets: Total price when Economic Value Added (EVA) =0*

Value Chain	Ethanol (or equivalent)	Diesel (or equivalent)	Biomethane	Heat	Electricity	Other Product
1 (2015)		<€1,05/litre		35 €/MWh	75 €/MWh	
1 (2020)		<€0,75/litre		30 €/MWh	70 €/MWh	
2 (2015)			45 €/MWh	<35 €/MWh	<75 €/MWh	
2 (2020)			30 €/MWh	<30 €/MWh	<70 €/MWh	
3 (2015)				<35 €/MWh	<75 €/MWh	
3 (2020)				<30 €/MWh	<70 €/MWh	
4 (2015)						<€60/MWh * <€50/MWh **
4 (2020)						<€50/MWh * <€30/MWh **
5 (2015)	<€0.70/litre					
5 (2020)	<€0.50/litre					
6 (2015)		<€1,05/litre				
6 (2020)		<€0.75/litre				
7 (2015)		<€1,0/litre				
7 (2020)		<€0,70/litre				

\* Pyrolysis oil \*\* Torrefied product

Economic Value Added (EVA) calculation for a project using Weighted Average Cost of Capital (WACC)-method and setting:

- EVA as 0
- Cost of equity as 15% (post tax)
- Cost of debt as 5%
- Share of equity as 45 %
- Project life time as 15y
- Residual value as 0
- Tax scheme as 30 %
- Tax depreciation Linear 15 years
- Production cost is at plant gate
- Annual Inflation 0%
- Working capital 20% of turn-over
- All by-products earnings valued in EVA calculation as quoted in the ARA (Amsterdam-Rotterdam-Antwerp)- market or in the absence of this, to be based on relevant market analysis.

WACC calculation gives a value of 10.68%.