

S2Biom Project Grant Agreement n°608622

**Deliverable 5.4:
Consistent Cross-Sectoral Sustainability
Criteria & Indicators**

Annex

March 2015



About S2Biom project

The S2Biom project - Delivery of sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe - supports the sustainable delivery of non-food biomass feedstock at local, regional and pan European level through developing strategies, and roadmaps that will be informed by a “computerized and easy to use” toolset (and respective databases) with updated harmonized datasets at local, regional, national and pan European level for EU28, Western Balkans, Moldova, Turkey and Ukraine. Further information about the project and the partners involved are available under www.s2biom.eu.

Project coordinator



Scientific coordinator



Project partners



About this document

This report corresponds to the annex of the main report of deliverable 5.4 – Consistent Cross-Sectoral Sustainability Criteria & Indicators - of S2Biom.

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Methodology overview

This annex provide the exact provisions for each indicator or issue of the research projects considered in deliverable 5.4. This refers to:

- Biomass Policies (Pelkmans et al. 2014)
- BEE: Biomass Energy Europe (Vis et al. 2010)
- Biomass Futures (Fritsche et al. 2012)
- Biocore: BIOCOmmodity refinery (Piotrowski et al. 2013; Rettenmaier et al. 2014)
- Global BioPact (Diaz-Chavez et al. 2012)

A benchmark against the S2Biom set of indicators was performed and it is presented in this annex. Two categories have been used to describe the extent to which each indicator performs against the S2Biom requirements:

- Indicator fully considered (symbol \surd), this means that the main issues of any indicator in the research projects against which the S2Biom indicators are meaningfully captured.
- Indicator partially considered (symbol \sim). In this case, the main message of the research project indicators against the S2Biom requirements, are partially covered.

Those indicators that are not included in the proposal under S2Biom but that are included in any of the schemes are also presented.

This serves to compile the exact requirements given in these projects and better understand these indicators in order to further elaborate the S2Biom proposal to sustainability.

In the Global Bio-Pact project (Díaz-Chavez et al. 2012), each indicator is linked to a measurement, monitoring process or unit depending of its nature and it is indicated from where the data could be accessed:

- Processing company or plantation (P)
- Government (G)
- Community (C)
- Non-Governmental Organisation (N)
- Worker (W)

1. Environmental theme

1.1 Resource Use

1.1.1. Land use efficiency

Biomass Policies (✓): Land use productivity (bioenergy and bioproducts per hectare)

Biomass Futures (✓): Land use efficiency

1.1.2. Secondary resource efficiency

Biomass Policies (✓): Secondary resource use

Biomass Futures (✓): Secondary resource efficiency

1.1.3. Energy efficiency

Biomass Policies (✓): cumulative energy demand and non-renewable energy demand

Biocore (~): Depletion of non-renewable energy resources, i.e. fossil fuels such as mineral oil, natural gas, coal and uranium ore.

1.1.4. Output service quality

Biomass Policies (✓): output service quality

1.1.5. Increase resource efficiency

BEE (✓): Resource efficiency should be increased:

- Recycle before waste is used for energy production, and
- Ensure a sustainable use of renewable resources

1.2 Climate Change

1.2.1 Life cycle-based CO₂eq including direct land use change

Biomass Policies (✓): Life cycle greenhouse gas emissions

Biomass Futures (✓): Life cycle GHG emissions incl. direct land use changes

Biocore (✓): Global warming as a consequence of the anthropogenic release of greenhouse gases. Besides carbon dioxide (CO₂), a number of other gases like methane (CH₄) and nitrous oxide (N₂O) are included.

1.2.2 Other GHG emissions

Biomass Policies (✓): greenhouse gas emissions related to indirect land use change and sustainable harvest levels (the later indicator is also related with other indicators).

Biomass Futures (✓): Inclusion of GHG effects from indirect land use changes

1.3 Biodiversity

1.3.1 Protected areas and land with significant biodiversity value

Biomass Policies (✓): conservation areas

BEE (✓): The loss of habitats of high biodiversity value (HBV) shall be prevented:

- I.1 Adapt management in Natura2000 areas (based on Birds & Habitats Directive); in states not covered by the Natura2000 network, identify high biodiversity value areas from national legislation / data sources *
- I.2 Exclude other legally protected areas - national (e.g. nature reserves, national parks) and international (e.g. Biosphere reserves (UNESCO MAB), Ramsar sites) *
- I.3 "Adapt management on areas designated for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the IUCN **"
- I.4 No drainage / use of land that was wetland (including peatlands) in January 2008 *

I.5 Buffer zones between cultivated land and areas of high biodiversity value (protected areas and wetlands)

"Protection of High Nature Value (HNV) farmland"

I.14 Adapt management practices (i.e. crop choices and yields) on areas under agroenvironmental support

I.15 Adapt management practices (i.e. crop / tree choices) on agricultural areas under organic farming and in certified forestry areas

I.16 Adapt management practices (i.e. crop choices and yields) on extensively cultivated areas

Biomass Futures (✓): Conservation of land with significant biodiversity values

Global Bio-Pact (~):

Indicator: Conservation Measures

Measurement/Monitoring Process/Unit: % of surface set-aside for conservation purposes

Guidance: e.g. protected habitat, buffer zones, ecological corridors, riparian vegetation, etc.

Data access: P

1.3.2 Biodiversity conservation and management

Biomass Policies (✓): management practices and biodiversity

BEE (✓): Support forest and agrobiodiversity

I.10 Adapt management practices (i.e. crop/tree choices and yields) to local bio-physical conditions

I.11 Restrict use of genetically modified organisms (GMO)

I.12 Maximum extraction rates for primary agricultural and forestry residues

I.13 Minimum number of crop species and varieties as well as structural diversity within the cropping area

Biomass Futures (✓): Land management without negative effects on biodiversity

Biocore (~): Biodiversity among plants on and around cultivated areas is affected e.g. by weed control measures.

Global Bio-Pact (✓):

Indicator: Reduction of biodiversity

Measurement/Monitoring Process/Unit: Non-agricultural land or pasture that has been converted towards feedstock operation within a 5- year period (ha), type of previous vegetation of converted land

Guidance: This can be check with the operation and cross checked with local or national authorities or environmental NGOs

Data access: P (G, N)

1.3.3 Fauna

Biocore (✓): Local biodiversity among animals is affected e.g. by the presence of diverse habitats

Global Bio-Pact (✓):

Indicator: Impacts on local fauna/ flora perceived by community

Measurement/Monitoring Process/Unit: Impacts on local fauna/ flora perceived by community

Guidance: Questions addressed to local community, NGO or local authority

Data access: C, N, G

Indicator: Impacts on fisheries/ other aquatic fauna

Measurement/Monitoring Process/Unit: Local perceptions on impacts on fisheries/ other aquatic fauna

Guidance: Questions addressed to local community representatives, NGO or local authority

Data access: C, N, G

1.3.4 Landscape

Biocore (✓): Characteristics and diversity of the landscape.

1.3.5 Access to ecosystem services

Only Global BioPact (✓):

Measurement/Monitoring Process/Unit: Reduction in local communities' access to hunting, fishing

Guidance: Qualitative questions to local community representatives, and NGO(s)

Data access: C, N

Measurement/Monitoring Process/Unit: Reduction in local communities' access to non-timber forest products

Guidance: Qualitative questions to local community representatives, and NGO(s)

Data access: C, N

Measurement/Monitoring Process/Unit: Reduction in local communities' access to cultural ecosystem services such as sacred and recreational sites

Guidance: Qualitative questions to local community representatives, and NGO(s)

Data access: C, N

1.4 Soil

1.4.1 Erosion

Biomass Policies (✓): soil erosion

BEE (✓): Minimise soil erosion:

I.17 Maximum slope limits for cultivation

I.18 Only perennial crops on sites susceptible to soil erosion

Biomass Futures (✓): Erosion

Biocore (✓): Soil quality is affected e.g. by erosion, compaction or organic matter content.

Global Bio-Pact (✓):

Indicator: Implement Practices

Measurement/Monitoring Process/Unit: Percentage of surface under no or reduced tillage

Guidance: Check practices on the fields

Data access: P

Indicator: Soil Erosion

Measurement/Monitoring Process/Unit: Feedstock cultivation area in flood prone region (ha)

Guidance: Maps and data from company

Data access: P

Indicator: Soil Erosion

Measurement/Monitoring Process/Unit: Feedstock cultivation area in wind prone region (ha)

Guidance: Maps and data from company

Data access: P

Indicator: Soil Erosion

Measurement/Monitoring Process/Unit: Feedstock cultivation area in slopes above 25° surface gradient

Guidance: Maps and data from company

Data access: P

Indicator: Soil Erosion

Measurement/Monitoring Process/Unit: Implemented measures to control soil erosion

Guidance: List measures implemented

Data access: P

1.4.2 Soil Organic Carbon

Biomass Policies (✓): Soil Organic Carbon

BEE (~): Protect soil quality:

I.10 Adapt management practices (i.e. crop/tree choices and yields) to local bio-physical conditions

I.11 Restrict use of genetically modified organisms (GMO)

Biomass Futures (✓): Soil Organic Carbon

Biocore (✓): Soil quality is affected e.g. by erosion, compaction or organic matter content.

Global Bio-Pact (~):

See indicators 1.4.1 and 1.4.3

1.4.3 Soil nutrient balance

Biomass Policies (✓): soil nutrient balance

BEE (~): Protect soil quality:

I. 10 Adapt management practices (i.e. crop/tree choices and yields) to local bio-physical conditions

I. 11 Restrict use of genetically modified organisms (GMO)

Biomass Futures (✓): Soil Nutrient Balance

Biocore (~): Soil quality is affected e.g. by erosion, compaction or organic matter content.

Global Bio-Pact (~):

Indicator: Soil analysis

Measurement/Monitoring Process/Unit: Frequency of carrying out soil analysis in the operation

Guidance: How often is soil analysis carried out in the operation?

Data access: P

Indicator: Implement Practices

Measurement/Monitoring Process/Unit: Fertiliser applied (type)(kg/ha/yr)

Guidance: List types of fertilizer and the annual amounts applied per hectare (5-year period)

Data access: P

Indicator: Implement Practices

Measurement/Monitoring Process/Unit: Herbicides and pesticides applied (type)(kg/ha/yr)

Guidance: List types of fertilizer and the annual amounts applied per hectare (5-year period)

Data access: P

1.5 Water

1.5.1 Water availability and regional water stress

Biomass Policies (✓): water availability and regional water stress

BEE (✓): Prevent overexploitation of water resources:

I.19 Adapt management practices (i.e. crop/tree choices and yields) to local bio-physical conditions (especially for rain fed agriculture)

I.20 For irrigation, adapt water consumption to regional resources; if no data are available, exclude irrigation as a precautionary principle

Biomass Futures (✓): Water availability and Use efficiency

Biocore (✓): Local water availability for ecosystems and its quality.

Global Bio-Pact (✓):

Indicator: Water consumption (irrigation)

Measurement/Monitoring Process/Unit: Net non-recycled water consumed through irrigation per unit mass of product (l/ton of feedstock)

Guidance: Check water balances at the company level

Data access: P

Indicator: Water Management Plan

Measurement/Monitoring Process/Unit: Implementing a water management plan

Guidance: Is there a water management plan, is it implemented?

Data access: P

Indicator: Availability of water

Measurement/Monitoring Process/Unit: Perceived change in availability of water by local communities (amount consumed)

Guidance: Questions addressed to local community representatives, NGO or local authority

Data access: C,N,G

1.5.2 Water use efficiency

Biomass Policies (✓): water use efficiency

Biomass Futures (✓): Water availability and Use efficiency

1.5.3 Water quality

Biomass Policies (✓): water quality

BEE (✓): Minimisation of harmful contamination of surface and ground water

Biomass Futures (✓): Water quality

Biocore (✓):

- Marine / freshwater eutrophication:

Input of nutrients into surface water (marine and freshwater) directly or via input into soils and gaseous emissions. E.g. nitrogen and phosphorous species contribute to this (keyword 'algal bloom').

- Water:

Local water availability for ecosystems and its quality.

Global Bio-Pact (✓):

Indicator: Quality of water

Measurement/Monitoring Process/Unit: Perceived change in quality of water by local communities

Guidance: Questions addressed to local community representatives, NGO or local authority

Data access: C,N,G

1.6 Air

1.6.1 SO₂ equivalents

Biomass Policies (✓): acidification

BEE (✓): Minimization of emissions of air pollutants

Biomass Futures (✓): SO₂ equivalents

Biocore (✓): Terrestrial acidification: Shift of the acid / base equilibrium in soils by acidifying gases like sulphur dioxide, nitrogen oxides and ammonia (keyword 'acid rain').

Global Bio-Pact (~):

Indicator: Open burning on company level

Measurement/Monitoring Process/Unit: Days open burning used in operations/year

Guidance: Annual days open burning used in operations, 5-year period

Data access: P

Indicator: Open burning area

Measurement/Monitoring Process/Unit: Percentage of surface under open burning regime

Guidance: % surface under open burning regime

Data access: P

Indicator: Use of Best Available Technologies for reducing emissions

Measurement/Monitoring Process/Unit: List of best available technologies in place

Guidance: Review technologies used at company

Data access: P

1.6.2 PM₁₀

Biomass Policies (✓): particulate matter

BEE (✓): Minimization of emissions of air pollutants

Biomass Futures (✓): Particulate Emissions PM10

Biocore (✓):

- Respiratory inorganics (particulate matter emissions):
- Damage to human health due to air pollutants such as fine, primary particles and secondary particles (mainly from NOX, NH3 and SO2, keyword 'winter smog' or 'London smog').

Global Bio-Pact (~): See indicator 1.6.1

1.6.3 Photochemical ozone formation

Biocore (✓): Formation of specific reactive substances, e.g. ozone, in presence of nitrogen oxides, volatile hydrocarbons and solar radiation in the lower atmosphere (keyword 'ozone alert' or 'summer smog').

Global Bio-Pact (~): See indicator 1.6.1

1.6.4 (Stratospheric) Ozone depletion

Biocore (✓): Loss of the protective ozone layer in the stratosphere by certain gases such as CFCs or nitrous oxide (keyword 'ozone hole').

1.7 Land use, Land Use Change and indirect Land Use Change

BEE (✓):

- Direct land cover change shall be prevented:

I.6 Avoid a massive conversion of permanent grassland to arable land; no conversion of highly biodiverse grassland *

I.7 Allow afforestation of permanent grassland if it is compatible with the environment (exclusion of highly biodiverse grassland)

I.8 Exclude continuously forested areas and wooded land from conversion into arable land*

- Indirect land cover change shall be prevented

I.9 Preference of using surplus land

Biocore (✓):

- Direct additional land use:

Occupation of agricultural land by production of dedicated crops. Extraction of residues from already cultivated land is not included.

- Indirect land use

Agricultural land that may not be cultivated anymore elsewhere (e.g. in the EU or South America, SA) because co-products of the assessed process like feed replace competing products.

Global Bio-Pact (✓):

Indicator: Expansion of land area

Measurement/Monitoring Process/Unit: Additional land area under production (ha/year)

Guidance: Additional land under feedstock production within the last 5 years. Previous land use of the land area.

Data access: P,G

2. Social theme

2.1 Participation and transparency

2.1.1 Effective participatory processes

Biocore (✓): Community participation

Global Bio-Pact (~):

Indicator: Involvement of smallholders of small suppliers

Measurement/Monitoring Process/Unit: Percentage of feedstock that originates from associated smallholders and outgrowers

Guidance: Percentage of feedstock that originates from associated smallholders outgrowers within a 5-year period. Number of associated smallholders or outgrowers.

Data access: P,C,W

2.2 Land Tenure

2.2.1 Compliance with the Voluntary Guidelines on the Responsible Governance of Tenure of Land to secure land tenure and ownership

Biomass Futures (✓): Social Use of Land: changes in land tenure and access

Biocore (✓): Land use tenure: land ownership rights

Global Bio-Pact (✓):

Indicator: Legal title of land right

Measurement/Monitoring Process/Unit: Operation has a legal title/concession for the land that is not challenged.

Guidance: Document of legal title

Data access: P,G

Indicator: Communal/public land

Measurement/Monitoring Process/Unit: Area of land cultivated by the operation that is customary, public or community land (ha)

Guidance: Report on public or community land within the project which would affect people living from subsistence agricultures, nomades, etc. Cross-check this information with the land categories listed under 'basic information'

Data access: P, C (N)

Indicator: Land conflicts

Measurement/Monitoring Process/Unit: Area of land currently under dispute, land conflict. (ha) Has the operation had any land use conflicts, if so, what caused them, how were they resolved?

Guidance: Land area currently under dispute. Qualitative description of any current or previous land use conflicts. If they were resolved, how this happened.

Data access: P,C,G (N)

2.3 *Employment and labor rights*

2.3.1 Full direct jobs equivalents along the full value chain

Biomass Policies (✓): Full direct jobs equivalents along the full value chain

Biocore (~): Job creation and wages:

- Labour involved on feedstock gathering
- Labour involved in oil production
- Wages paid according to national/regional regulation (minimum wage)
- Poverty reduction

Global Bio-Pact (~):

Indicator: Employment

Measurement/Monitoring Process/Unit: Total number of employees and person days of employment per year

Guidance: Total number of people employed each year and total number of person days per year within a 5 year period. Breakdown should be given for categories of employment for operation (management/office/processor/field labour, male/female, contract/no contract)

Data access: P, W

Indicator: Ration between local and migrant workers

Measurement/Monitoring Process/Unit: Ratio of employment from local area / outside local area per category of employment (management/ office/ processor/ field labour)

Guidance: Local area is defined as state or province (however, assessor can further adapt this to local context). Absolute annual number of workers per employment category (including temporary/ permanent) within a 5-year period

Data access: P,G

Indicator: Percentage of permanent workers

Measurement/Monitoring Process/Unit: Percentage of workers that have a fixed contract employment per category of employment

Guidance: Annual percentage permanent vs. temporary workers within a 5-year period

Data access: P,G

Indicator: Provision of worker training

Measurement/Monitoring Process/Unit: Number of workers that have received training (for skills development, education etc.) each year, number of working days spent in training provided by the operation each year, type of training

Guidance: Annual numbers should be given for a 5-year period

Data access: P,W

2.3.2 Full direct jobs equivalent in the biomass consuming region (or country)

Biomass Policies (✓): Full direct jobs equivalent in the biomass consuming region (or country).

2.3.3 Human and Labor Rights

BEE (✓): Labour rights shall be complied with:

I23. Compliance with labour standards according to the conventions of the International Labour Organisation (Nr. 29, 87, 98, 100, 105, 111, 138, 182) *

Biomass Futures (✓): Healthy livelihoods: Adherence to ILO Principles

Biocore (✓): Labour conditions. ILO conventions including:

- Child labour
- Right to organise
- Indigenous rights
- Forced labour

Global Bio-Pact (✓):

Indicator: Freedom of association

Measurement/Monitoring Process/Unit: Existence of labour unions

Guidance: Existence of labour unions and whether workers have the right to join them. This should be verified by interviewing the management and the workers: Do workers belong to a union or other type of working association?

Data access: P, W, C

2.3.4 Occupational safety and health for workers

Biocore (✓): Health and safety. Compliance with health and safety regulations at the different supply chains

Global Bio-Pact (✓):

Indicator: Work related accidents and diseases

Measurement/Monitoring Process/Unit: Number of work related accidents per person days of employment per year, number of work related diseases/person days of employment per year

Guidance: Records of any work-related accidents or diseases.

Data access: P, W

Indicator: Personal protective equipment

Measurement/Monitoring Process/Unit: Percentage of workers that use appropriate personal protective equipment

Guidance: To be calculated as a percentage of sample in a site visit

Data access: P

Indicator: OSH training

Measurement/Monitoring Process/Unit: Percentage of employees that have received OSH (Occupational Safety & Health) training

Guidance: Training records and worker interviews

Data access: P,W

2.4 Food & fuelwood

2.4.1 Measures to avoid risks for negative impacts on price and supply of national food basket and fuelwood.

BEE (~):

I.14 "Avoid competition with food production"

I.15 "Avoid competition with the production of biomaterials"

Biomass Futures (✓): Price and supply of national food basket

Biocore (~): Competition with other Sectors: Competition of residues use for biorefinery and impact on other industries and sectors that affects negatively

Global Bio-Pact (✓):

Indicator: Land that is converted from staple crops

Measurement/Monitoring Process/Unit: Land that has been converted from staple crops (ha)

Guidance: Hectares of land that has been converted from staple crops to the feedstock production (assessor should define staple crops for the country) within the last five years

Data access: P, (G,N)

Indicator: Edible feedstock diverted from food chain to bioenergy

Measurement/Monitoring Process/Unit: Amount of edible raw material diverted into bioenergy production (t)

Guidance: Annual amount of edible feedstock that was used in bioenergy production (5-year period)

Data access: P

Indicator: Availability of food

Measurement/Monitoring Process/Unit: Perceived change in availability of food after the beginning of bioenergy operations

Guidance: Check (survey) at community level about perceived change

Data access: C,W

Indicator: Time spent in subsistence agriculture

Measurement/Monitoring Process/Unit: Change in time spent in subsistence agriculture in the household

Guidance: Check (survey) at community level about perceived change

Data access: C,W

2.5 Rural development and infrastructure

2.5.1 Rural development and infrastructure

Biomass Policies (✓): contribution to rural economy

Biocore (✓):

- Road
- Water (availability and quality) for the local population
- Sanitation infrastructure
- Risk of not having bed at hospital

Global Bio-Pact (✓):

Indicator: Community investment

Measurement/Monitoring Process/Unit: Amount invested in community investment projects (e.g. CSR) (% of annual revenue) and qualitative description of investments including any projects specific for women

Guidance: Annual values should be given for a 5-year period. This should be calculated as percentage of annual revenue.

Data access: P,C

Indicator: Amount paid to smallholders and suppliers of feedstock

Measurement/Monitoring Process/Unit: Annual amount paid to smallholders and suppliers of feedstock (EUR)

Guidance: Annual value paid to associated smallholders and outgrowers per unit of product within a 5 year period

Data access: P,C,W

2.5.2 Local embedding-proximity to markets

Biomass Policies (✓)

2.6 Production of feedstock

Biocore (✓):

Incentives

Barriers

2.6.1 Identification of stakeholders along the supply chain

Biocore (✓):

Producers (farmers)

Regulators

Business

Traders

Research

Global Bio-Pact (~):

Indicator: Involvement of smallholders of small suppliers

Measurement/Monitoring Process/Unit: Percentage of feedstock that originates from associated smallholders and outgrowers

Guidance: Percentage of feedstock that originates from associated smallholders outgrowers within a 5-year period. Number of associated smallholders or outgrowers.

Data access: P,C,W

2.6.2 Policies and regulations

Biocore (✓):

National
Enforcement
International conventions and agreements

2.7 Gender equality

Biocore (✓): Inclusion of women

Global Bio-Pact (✓):

Indicator: Benefits created for women

Measurement/Monitoring Process/Unit: Employment benefits that are specific for women

Guidance: List any employment benefits that are specific for women (i.e. maternity leave, others)

Data access: P,W

3. Economic theme

3.1 Production costs

3.1.1 Production cost (levelised life cycle cost)

Biomass Policies (✓): life cycle costs

Biocore (✓):

Total capital investment

Sum of invested capital for the biorefinery facility including utilities.

NPV (5 %): The net present value is the sum of expenses and future returns discounted at a rate of 5 % per year (in this case)

Variants (no GP / incl. GP): Several economic indicators were calculated under the boundary conditions that Green Premium prices can be obtained or not.

Global Bio-Pact (✓):

Indicator: Production cost

Measurement/Monitoring Process/Unit: Breakdown of yearly production costs of the facility (incl. labour, raw material, energy, services, etc.) (EUR/t of feedstock)

Guidance: Annual production costs within a 5-year period

Data access: P

3.1.2 Future prospects of life cycle production costs

Only Biomass Policies (✓): future life cycle costs

3.2 Markets

3.2.1 Business case for biomass mobilization

Biomass Policies (✓)

3.2.2 Size of the markets to valorise the outputs

Biomass Policies (✓)

3.2.3 Technology readiness level

Biomass Policies (✓)

3.2.4 Other non-fossil alternatives in the markets

Biomass Policies (✓)

3.2.5 Competing biomass pathways / potential market distortions

Biomass Policies (✓)

3.2.6 Access to markets

Biocore (✓):

Access to markets is determined by demand for the final product and by restrictions like the adaptation of manufacturers to new chemicals.

3.3 System versatility

Only Biomass Policies (✓)

3.3.1 Flexibility and controllability

3.3.2 (energy) security

3.4 Other economic considerations

3.4.1 IRR (Internal Rate of Return)

Biocore (✓):

The Internal Rate of Return is defined as the discount rate at which the NPV is just equal to zero. The higher the IRR, the more favourable the investment project appears.

3.4.2 Price support

Biocore (✓):

Support of product prices (in %) that is necessary to reach the indicated IRR. Product price support is one option to make projects economically feasible that are considered valuable for other effects.

3.4.3 CO₂ avoidance costs

Biocore (✓):

Monetary losses (or profits if indicator result is negative) per unit of avoided greenhouse gas emissions. This indicator is not defined if no greenhouse gas emissions are avoided.

3.4.4 Energy resource savings costs

Biocore (✓):

Monetary losses per unit of saved non-renewable energy resources (analogous to CO₂ avoidance costs).

3.4.5 Value added

Global Bio-Pact (✓):

Indicator: Value added

Measurement/Monitoring Process/Unit: Value added by the operation. Annual value of sales less the price of goods, raw materials (including energy) and services purchased. (EUR/t of feedstock)

Guidance: Annual value added within a 5-year period

Data access: P

3.4.6 Taxes/royalties paid to the government

Global Bio-Pact (✓):

Indicator: Taxes/royalties paid to the government

Measurement/Monitoring Process/Unit: Breakdown of payments made to the government/year (EUR)

Guidance: Payments made to the government per year within 5 years

Data access: P, G

3.4.7 Contributions made by the operation to allied industries in the local economy

Global Bio-Pact (✓):

Indicator: Contributions made by the operation to allied industries in the local economy

Measurement/Monitoring Process/Unit: Percentage of feedstock that originates from associated smallholders and outgrowers

Guidance: Percentage of feedstock that originates from associated smallholders outgrowers within a 5-year period. Number of associated smallholders or outgrowers.

Data access: P,C, W

4. Technology

Only Biocore (✓)

4.1.1 Maturity

Technical maturity of involved processes.

4.1.2 Availability of infrastructure for logistics and storage

This indicator refers to logistics as well as short-term and seasonal storage of biomass.

4.1.3 Use of GMOs

Use of genetically modified organisms (here: microbes) in closed fermentation facilities within the biorefinery. Release of GMOs like genetically modified plants to the environment is not intended.

4.1.4 Risk of explosions and fires

Risk of explosions and fires within industrial facilities like biorefineries.

4.1.5 Development of legislative framework and bureaucratic hurdles

Potential legislative and bureaucratic hurdles for the implementation of the scenario.

4.1.6 Feedstock flexibility of conversion technologies

The capability of the core process to use several different feedstocks interchangeably or in a mixture.

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