BioTrade2020plus

Supporting a Sustainable European Bioenergy Trade Strategy

Intelligent Energy Europe
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Deliverable 5.2

Strategies for bioenergy in potential supply regions and regulatory SWOT analysis as trade partner to the EU

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Objectives

The main aim of BioTrade2020plus is to provide guidelines for the development of a **European Bioenergy Trade Strategy for 2020 and beyond** ensuring that imported biomass feedstock is sustainably sourced and used in an efficient way, while avoiding distortion of other (non-energy) markets. This was accomplished by analysing the potentials (technical, economical and sustainable) and assessing key sustainability risks of current and future lignocellulosic biomass and bioenergy carriers. Focus was on wood chips, pellets, torrefied biomass and pyrolysis oil from current and potential future major sourcing regions of the world (US, Latin America, Sub-Saharan Africa, Southeast Asia, Ukraine).

BioTrade2020plus will thus provide support to the use of stable, sustainable, competitively priced and resource-efficient flows of imported biomass feedstock to the EU – a necessary pre-requisite for the development of the bio-based economy in Europe.

Activities

The following main activities are implemented in the framework of the BioTrade2020plus project:

- Assessment of **sustainable potentials of lignocellulosic biomass** in the main sourcing regions outside the EU
- Definition and application of sustainability criteria and indicators
- Analysis of the **main economic and market issues of biomass/bioenergy imports** to the EU from the target regions
- Development of a dedicated and **user friendly web-based GIS-tool** on lignocellulosic biomass resources from target regions
- **Information to European industries** to identify, quantify and mobilize sustainable lignocellulosic biomass resources from export regions
- **Policy advice on long-term strategies** to include sustainable biomass imports in European bioenergy markets
- **Involvement of stakeholders** through consultations and dedicated workshops

More information is available at the BioTrade2020plus website: **www.biotrade2020plus.eu**

About this document

This report corresponds to Deliverable D5.2 of BioTrade2020+ – Report discussing strategies for bioenergy in potential supply regions to the EU, and analysing potential risks and potential impacts of policy changes. It has been prepared by VITO and CENER.

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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services):	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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2	29 April 2016	Feedback from partners & integration of bioenergy strategies; background document for survey	draft
3	20 July 2016	Feedback from stakeholders through survey and telephone conferences integrated	final

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Acronyms

B..	diesel fuel with …% (volume basis) biodiesel
BAU	Business-as-Usual scenario
BRA	Brazil
CND	Canada
CO2-eq	CO2-equivalent emissions
COL	Colombia
COP21	21st yearly session of the Conference of the Parties
E..	gasoline fuel with …% (volume basis) ethanol
EGU	electric generating unit (United States)
EPA	Environmental Protected Agency (United States)
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FRA	Forest Resources Assessment
FSC	Forest Stewardship Council
GDP	Gross domestic product
GHG	Greenhouse Gas
GW	Giga (10^9) Watt
ha	hectare
HWSD	Harmonized World Soil Database
IDN	Indonesia
IEA	International Energy Agency
IMF	International Monetary Fund
INDC	Intended nationally determined contributions
JRC	Joint Research Centre of the European Commission
KEN	Kenya
kha	thousand hectares
LCFS	Low Carbon Fuel Standard (California)
LULUCF	Land use, Land Use Change and Forestry
MAL	Malaysia
MDG	Millennium Development Goal
MOZ	Mozambique
Mtoe	million tonnes of oil equivalent
Mton/MT	Million tonnes
MW	Mega (10^6) Watt
NAMA	Nationally Appropriate Mitigation Actions to reduce greenhouse gas emissions
NREAP	National Renewable Energy Action Plan
OECD	Organisation for Economic Co-operation and Development
PEFC	Programme for the Endorsement of Forest Certification
PV	Photovoltaic
RE	Renewable Energy
REDD+	Reducing emissions from deforestation and forest degradation
RFS	Renewable Fuels Standard (United States)
RUS	Russian Federation
SDG	Sustainable Development Goal

SWOT	Strengths, Weaknesses, Opportunities and Threats
TPES	Total Primary Energy Supply
TRWR	Total Renewable Water Resources
UKR	Ukraine
UNFCCC	United Nations Framework Convention on Climate Change
UNSDSN	United Nations Sustainable Development Solutions Network
US / USA	United States of America
USDA	United States Department of Agriculture
WGI	Worldwide Governance Indicators

1. Introduction

Availability of global biomass for export to the EU will also depend on international policies and strategies on biomass and bioenergy. Countries may – for a certain time – put focus on exporting biomass to initiate local supply chains, and may shift to domestic valorisation over time. Long term climate, renewable energy or specific bioenergy strategies can indicate a shift to a higher local use of biomass; it is also important to consider the regulatory stability and how firm sustainability provisions are in terms of biomass production in sourcing regions.

The sourcing regions considered here are linked to the case studies selected in WP2 and WP3 of the BioTrade2020+ project (*US, Brazil, Colombia, Ukraine, Indonesia, Kenya*). Canada is also added as it is an important sourcing region for biomass currently. Data from some other countries - mentioned between brackets - are indicated for comparison. This is the overview of countries which were reviewed:

- North America: United States, Canada
- South America: Brazil, Colombia
- East Europe: Ukraine, (Russia)
- Southeast Asia: Indonesia, (Malaysia)
- East Africa: Kenya, (Mozambique)

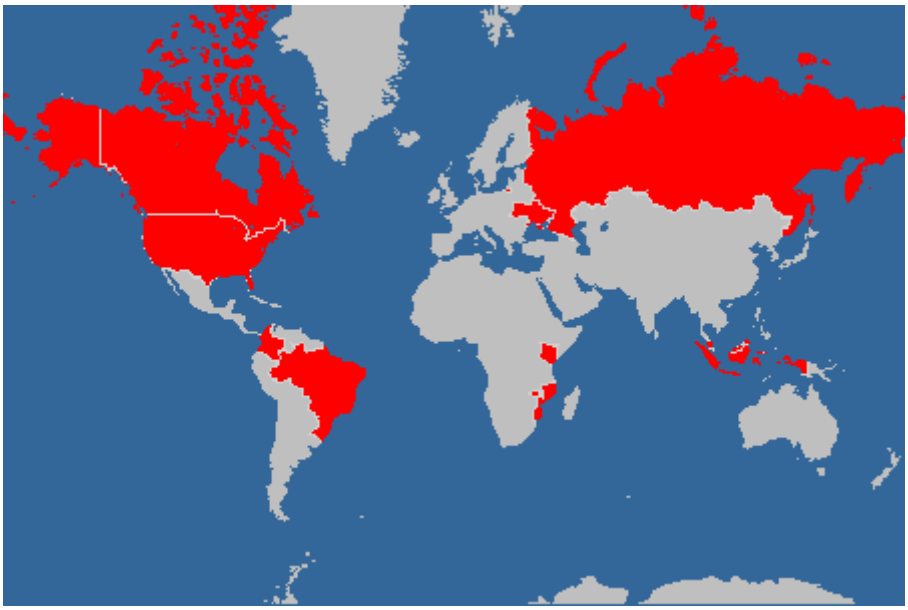

Figure 1: the considered potential sourcing regions indicated in red on the world map

Next to relevant background data, mostly based on international databases, this report includes an overview of the main bioenergy related strategy documents of the different sourcing regions. Based on all background information, a SWOT overview was developed on the biomass trade position of the sourcing regions, which has been discussed with local stakeholders (through on-line surveys and webinars). This SWOT overview will be integrated in the on-line toolset of the BioTrade2020+ website, so actors can have an overview of the pros and cons of trading with a certain region.

2. Background

2.1. Methodology

Several criteria have been considered which in some way indicate strengths and weaknesses of a certain country in terms of potential biomass trade to the EU. The below overview starts with the strength of their economy and an assessment of their governance (in general) in terms of investment climate. The second part is about local production of biomass in forestry and agriculture, and the current extraction rates. Finally we consider the current status in greenhouse gas emissions, the role of renewable energy and the strategies/actions plans presented to indicate their future directions for uptake of renewable energy. The following criteria have been considered for the different countries to develop their SWOT overview:

- Economy & governance
  - Economic strength and growth prospects
  - Governance (general)
  - Investment climate
- Current biomass extraction (for all uses)
  - Food & feed production
  - Forest biomass extraction
- Sustainable forest management
  - Share of certified forest
  - Change in forest carbon stock
- Sustainable agriculture and food provision
  - Soil conditions
  - Water use in agriculture
  - Food security
- Climate policy
  - Current greenhouse gas emissions related to fossil fuel use
  - Role of LULUCF
  - Climate action plans and their consistency with 'fair effort sharing'
- Renewable energy and the role of biomass
  - Share of renewables and bioenergy in the energy system
  - Role of traditional biomass
  - Renewable energy strategies

Below the background of these indicators is shortly described, accompanied with overview tables based on public figures from international organisations like World Bank, FAO or IEA, comparing the different countries.

2.2.Economy & governance

The **strength of an economy** can be expressed in its GDP (per capita). This is often linked with the level of total primary energy demand (TPES), see further.
Prospects of **economic growth** are also very relevant as this may induce an increase in energy demand, and potentially also other uses of biomass (food, materials).

Economic indicators are available from the International Monetary Fund (IMF)[1]. The table below shows GDP per capita in 2014 and economic growth prospects in 2020 for the different potential sourcing regions.

Table 1: GDP and economic growth figures in the different potential sourcing regions (source of the data: IMF-World Economic Outlook Database)

		GDP (2014)	Growth perspective in 2020
		US$/capita	%/yr
United States	**USA**	**54370**	2.0
Canada	**CND**	**50304**	2.0
Brazil	**BRA**	11573	2.5
Colombia	**COL**	7928	4.1
Indonesia	**IDN**	3524	**6.0**
Malaysia	**MAL**	11049	**5.0**
Mozambique	**MOZ**	630	**17.6**
Kenya	**KEN**	1420	**6.9**
Ukraine	**UKR**	3051*	4.0
Russia	**RUS**	12718	1.5

** impacted by the recent crisis in Ukraine. Ukraine GDP was 4435 US$/capita in 2013.*

There is a clear distinction between developed countries like the USA and Canada, which have high GDP and limited growth perspectives, and developing countries like Mozambique, Kenya or Indonesia, with low GDP and higher growth perspectives.

The World Bank has published **Worldwide Governance Indicators** (WGI). Governance consists of the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them.[2]
The WGI report six aggregate governance indicators for over 200 countries and territories over the period 1996-2014, covering i) Voice and Accountability, ii) Political Stability and

[1] https://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx
[2] https://www.govindicators.org

Absence of Violence/Terrorism, iii) Government Effectiveness, iv) Regulatory Quality, v) Rule of Law, and vi) Control of Corruption.

- **Voice and accountability** captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
- **Political Stability and Absence of Violence/Terrorism** measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.
- **Government effectiveness** captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
- **Regulatory quality** captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
- **Rule of law** captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
- **Control of corruption** captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

The resulting 'governance score' is a value on a scale from -2.5 to 2.5. Higher values correspond to better governance. The following table shows an overview for the selected countries.

Table 2: Worldwide Governance Indicators (source of the data: World Bank - Worldwide Governance Indicators)

2014	USA	CND	BRA	COL	IDN	MAL	MOZ	KEN	UKR	RUS
Voice & accountability	1.05	1.43	0.41	-0.10	0.13	-0.33	-0.23	-0.16	-0.08	-1.04
Political stability & absence of violence/terrorism	0.62	1.18	-0.01	-1.12	-0.37	0.34	-0.25	-1.27	-1.93 *	-0.84
Government effectiveness	1.46	1.76	-0.15	-0.11	-0.01	1.14	-0.73	-0.30	-0.38	-0.08
Regulatory quality	1.27	1.83	-0.07	0.50	-0.10	0.84	-0.39	-0.34	-0.63	-0.40
Rule of law	1.62	1.89	-0.08	-0.34	-0.35	0.64	-0.84	-0.45	-0.79	-0.71
Control of corruption	1.32	1.82	-0.38	-0.39	-0.58	0.48	-0.70	-0.94	-1.00	-0.87

(-2.5 weak; 2.5 strong)

** impacted by the recent crisis in Ukraine. In 2012 this value was -0.10.*

The figures in red indicate that the situation is rather poor. This is particularly the case in African countries and in Ukraine and Russia, and for some aspects in Indonesia, Colombia and Brazil. USA and Canada score highest in terms of governance. Countries with better governance structures would logically be more stable and reliable trade partners.

The **Investment climate** is closely linked to the governance structures. The World Bank Group measures business regulations in different countries towards the 'Ease of doing business'[3], according to 10 underlying topics. The following table shows an overview of a combined indicator, showing how far a country is from the 'best performer'. In general terms the conclusions of this table are similar as in Table 2.

Table 3: Investment Climate according to the World Bank Group

2016	USA	CND	BRA	COL	IDN	MAL	MOZ	KEN	UKR	RUS
Doing business indicator*	82.1	79.9	57.7	69.9	56.7	79.1	53.7	53.6	62.3	69.3

* The distance to frontier score shows how far on average an economy is at a point in time from the best performance achieved by any economy on each Doing Business indicator since 2005 or the third year in which data for the indicator were collected. The measure is normalized to range between 0 and 100, with 100 representing the frontier.

2.3.Current biomass extraction (for all uses)

On www.materialflows.net[4], data are provided on national based extraction of different materials, including fossil fuels, industrial and construction materials, ore, and also biomass. For biomass, distinction is made between feed, food, forestry biomass, animal biomass and other biomass,
Feed and food biomass are closely linked to agricultural land use, while forestry biomass is related to the use of forests. Mind that extraction also includes quantities destined for export.

Extraction from agricultural land

Table 4: Extraction from agricultural land (materialflows.net)

2013	Biomass feed & food extraction			
	Mton* (absolute value)	ton/capita	ton/ha**	% unused***
EU27	1824	3.6	11.4	35%
USA	1878	5,9	4.6	32%
CND	238	6,7	3.6	24%
BRA	2477	12,1	8.9	14%
COL	207	4,4	4.9	13%
IDN	565	2,2	9.9	28%
MAL	158	5,4	20.2	13%
MOZ	39	1,5	0.8	33%
KEN	120	2,7	4.3	12%
UKR	225	5,0	5.5	40%
RUS	299	2,1	1.4	28%

* mass data are transformed to a standard of 15% water content

[3] http://www.doingbusiness.org/
[4] http://www.materialflows.net/data/datadownload/

** in relation to the total agricultural area in the country[5]
*** Unused extraction refers to materials that never enter the economic system and comprises agricultural harvesting losses.

Highest extraction rates per hectare can be found in Southeast Asia (mostly related to palm oil plantations) and Brazil. Mind that climatic circumstances in these regions also influence yield rates. Brazil has a high extraction per capita, which is in part also related to products destined for exports.
Russia and Mozambique have very low extraction rates.
Residues can be as high as 40% of extraction rates, showing some potential for agricultural residues.

Extraction from forestry

Table 5: Extraction from forestry (materialflows.net)

2013	Forestry biomass extraction		
	Mton* (absolute value)	ton/capita	ton/ha**
EU27	318	0.64	2.0
USA	287	0.91	0.93
CND	105	2.99	0.30
BRA	217	1.06	0.44
COL	10	0.21	0.17
IDN	99	0.39	1.09
MAL	18	0.62	0.82
MOZ	16	0.59	0.41
KEN	23	0.53	5.2
UKR	13	0.28	1.33
RUS	287	0.91	0.93

* mass data are transformed to a standard of 15% water content
** in relation to the total forestry area in the country[6]

In terms of forestry biomass, high extraction rates are reached in Kenya, which is likely linked to traditional biomass use. Extraction rates (per ha) in Colombia and even Canada are on the low side, so there could be ways to increase there. Mind that growth rates of forest biomass also depend on climatic circumstances and forest management practices.

[5] http://data.worldbank.org/indicator/AG.LND.FRST.K2/countries
[6] http://data.worldbank.org/indicator/AG.LND.FRST.K2/countries

2.4.Sustainable forest management

As an indication of how forests are managed, the area of forest with sustainable management certification (FSC, PEFC) is considered. We do realize that also non-certified forest may be managed in a sustainable way.
A certified forest area indicates responsibly managed forests, including natural or semi-natural forests that are used to produce timber and non-timber forest products, and forest plantations. It generally does not contain protection areas as these are not used for timber production. An increase in the area of PEFC and FSC certified forest represents an increase in the area for which evidence of sustainable forest management is available in terms of forest managed responsibly with respect to biodiversity conservation, including the protection of critical ecosystems, in addition to promoting the social and economic, cultural and ethical dimensions of sustainable forest management (Biodiversity Indicators Partnership).
The area of FSC and PEFC certified forest has increased from 53 million hectares in 2000 to 460 million hectares in 2015. The following figure shows the distribution between boreal, temperate and tropical regions.

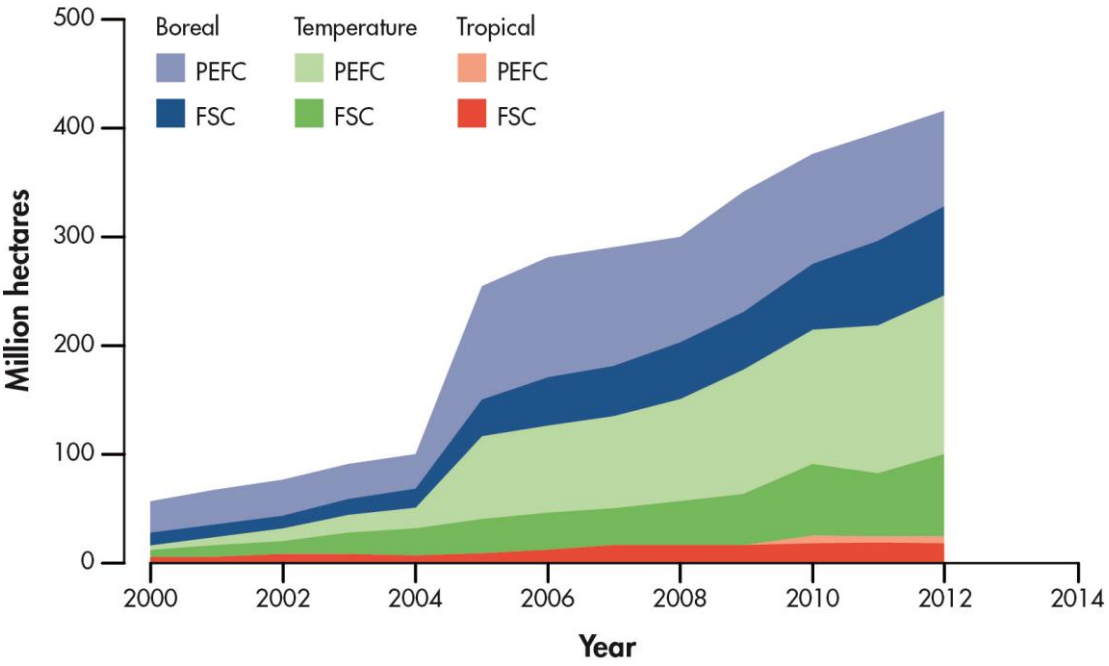

Figure 2: total area of forestry under FSC and PEFC certification in boreal, temperate and tropical regions (source: Biodiversity Indicators Partnership[7])

The following tables show an overview of total forest area in the considered regions, the distribution between public and private ownership, the share of forest in protected areas and forest with a management plan, and the amount of forest certified under FSC and PEFC. Data in the first table are from the FAO Global Forest Resources Assessment 2015 (FRA 2015)[8]; FSC and PEFC data in the second table are data derived from the FSC and PEFC websites (situation early 2016).

[7] http://www.bipindicators.net/forestcertification
[8] http://www.fao.org/3/a-i4808e.pdf

Table 6: Total forest area, public vs private ownership and amount in protected areas or with management plan (source of the data: FRA2015)

2015	Total forest Area (kha)	% public ownership	*Of which business mgt**	% private ownership	% forest in protected areas	% forest with management plan
USA	310095	43%	-	57%	11%	**66%**
CND	347069	92%	-	8%	7%	59%
BRA	493538	81%	-	19%	42%	12%
COL	58502	22%	-	67%	18%	14%
IDN	91010	91%	*57%*	9%	35%	95%
MAL	22195	98%	*10%*	2%	23%	**61%**
MOZ	37940	100%	*2%*	-	25%	75%
KEN	4413	39%	-	61%	13%	20%
UKR	9657	100%	-	-	12%	**89%**
RUS	814931	100%	*17%*	-	2%	**100%**
Global	*4033060*					

** share of public forest managed by business entities and institutions*

Table 7: Amount of forest area certified under FSC and PEFC (source of the data: FSC, PEFC)

	Total forest area (kha)	FSC[9] (kha)	FSC (%)	PEFC[10] (kha)	PEFC (%)
USA	310095	13873	4.6%	33413	10.8%
CND	347069	52339	**16.9%**	130317	**37.5%**
BRA	493538	6186	1.2%	2906	0.6%
COL	58502	137	0.2%	-	-
IDN	91010	2186	2.2%	1053	1.2%
MAL	22195	673	3.3%	3893	**17.5%**
MOZ	37940	57	0.2%	-	-
KEN	4413	-	-	-	-
UKR	9657	2625	**27.0%**	-	-
RUS	814931	40710	5.0%	-	-
Global		*187172*	*4.6%*	*275282*	*6.7%*

Mind that in some places the same stand is certified by the two schemes so the total of certified forest in a country is not the sum of the area certified by the two schemes.

Considering forest management, the situation is very different in the countries considered. Canada, Malaysia and Ukraine have a relatively high share of certified forest (>20%), in the US the share is around 15%, while in the other regions the share is 5% or lower.
On the other hand, the forest may be managed through local management plans, which are not necessarily endorsed by the certification schemes. This is mainly the case in Russia, Ukraine, Malaysia, the US and Kenya (for the public forests). It is not fully clear to what extent these local management plans compare to each other.

[9] https://ic.fsc.org/en/facts-figures (Feb 2016)
[10] http://www.pefc.org/images/documents/PEFC_Global_Certificates_-_March_2016.pdf

The distribution between public and private ownership is also relevant. In particular in Colombia, Kenya and the US, the majority of forests are in private ownership, mostly smallholders. In Indonesia, 92% of forest is in public ownership; however most are managed by businesses.

The following table shows an overview of **changes in forest area and carbon stock** in living forest biomass (source: FRA2015), in the period 2000-2015.

Table 8: Changes in forest area and carbon stock in living forest biomass (source: FRA2015)

	Annual change rate forest area 2000-2015		Forest affected by forest fires (avg 2003-2007)	Forest affected by insects / diseases (avg 2003-2007)	Carbon stock in living forest biomass 2015	Annual change 2000-2015	
	kha/yr	%/year	kha/yr	kha/yr	MT	MT/yr	%/year
USA	+437	0,1%	2169	5640	17330	+108	0,6%
CND	-49	0,0%	1230	17273	13992	-28	-0,2%
BRA	-1849	-0,4%	-	-	59222	-173	-0,3%
COL	-220	-0,4%	-	-	8867	-31	-0,3%
IDN	-560	-0,6%	5	-	12488	-244	-2,0%
MAL	+40	0,2%	2	-	2787	+12	0,4%
MOZ	-217	-0,6%	-	-	1641	-9	-0,6%
KEN	+57	1,3%	-	-	634	+10	1,6%
UKR	+10	0,1%	5	272	783	+8	1,0%
RUS	+377	0,0%	991	4152	32800	+43	0,1%

In absolute figures, Brazil lost most forest area in this period, with almost two million hectares per year on average – in relative terms the loss in Indonesia and Mozambique was bigger. Mind that deforestation rates in Brazil have seriously decreased in the past ten years.
The US, Kenya, Malaysia, Ukraine and Russia had an increase of forest area and forest carbon stock in the same period. Kenya had a very high reduction of forest area in the period 1990-2000, which is still not totally recovered.
Mind that the amount of forests affected by fires or insects/diseases is substantial in Canada (6%), Ukraine (2.9%), the US (2.6%) and Russia (0.6%). This could be mitigated through better forest management, which may open up opportunities for bioenergy.

Forestry governance:
FRA2015 contained a survey to countries to indicate if they have policies supporting sustainable forest management. All mentioned countries confirmed they have such policies, either at national or regional/provincial level.

2.5.Sustainable agriculture: soil quality, water stress and food security

Agriculture – supplying nutrition as a basic human need – is the world's largest user of land, occupying more than one third of the Earth's terrestrial surface and also using vast amounts of water. Agriculture is expected to supply sufficient nutrients, economically and culturally valued foods, fibres and other products. Agriculture must also provide employment and optimized land use and productivity in relation to limiting resources.
Meeting world food demand conflicts with current trends of increasing competition for land, water and other natural resources by non-agricultural sectors, and needs to be accomplished under a more extreme and also more uncertain future climate in many parts of the world.[11]
Management of population growth, food losses and waste will be important for reducing the pressure on agricultural land, water and natural ecosystems, in addition to increases in agricultural productivity and efficiency and measures to protect natural resources from unsustainable exploitation, degradation or pollution.

Some indicators have been defined to measure different issues of sustainability in agriculture. We will focus here on soil quality and water stress on the one hand, and food security on the other hand.

Soil quality can be defined as "the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation" (Karlen et al., 1997).
Soil quality is defined according to the soil functions (e.g. bearing function, production function, habitat function, resources function, reactor function) and cannot be measured by a single parameter. However, **soil organic carbon** has been defined by EUROSTAT as the more appropriate indicator for soil quality. High organic carbon content corresponds to good conditions from an agro-environmental point of view. Soils with organic carbon content less than 1% in weight are generally affected by soil degradation processes and erosion. On the other hand, soils with 1-10% organic carbon content have high agricultural value[12].
The data used for the production of this indicator are geo-spatial raster data contained in the **Harmonized World Soil Database** (HWSD) released by FAO, IIASA, ISRIC, ISSCAS, and JRC in 2008 with a spatial resolution of 30 by 30 arc seconds (approximately 1 km).

Table 9: Average carbon content in topsoil (FAOSTAT)

2008	Average carbon content in the topsoil		
	% of weight		% of weight
USA	1.52	MAL	3.48
CND	4.28	MOZ	0.84
BRA	1.21	KEN	0.90
COL	3.82	UKR	2.33
IDN	5.21	RUS	3.89

[11] http://unsdsn.org/wp-content/uploads/2014/02/130919-TG07-Agriculture-Report-WEB.pdf
[12] http://faostat3.fao.org/download/G2/GI/E

This indicator indicates the condition of the soils and adequacy of soil management in the different sourcing regions. Mind that it includes both forest and agricultural soils. The quality of soils in African countries is problematic; Brazilian and US soils are also relatively low in carbon content.

Total **freshwater withdrawn** in a given year, expressed in percentage of the total renewable water resources (TRWR), gives an indication of the pressure on the renewable water resources. It is the Millennium Development Goal (MDG) Indicator 7.5 and the Sustainable Development Goal (SDG) indicator 6.4.2. Countries could be defined as water-stressed if they withdraw more than 25 percent of their renewable freshwater resources.
Mind that national level data may hide large disparities within a country, which especially can be the case for large countries.
Worldwide around 9 percent of the renewable freshwater resources are withdrawn and at continental level it is less than 5 percent for each of them except Asia, where it is 20 percent. However, these continental figures hide large differences between regions as well as within large countries, such as China and India. China is facing severe water shortage in the dry north, while the humid south still has abundant water resources.

Agriculture is by far the largest **water use** at global level, with about 70 percent of water withdrawal and 90 percent of water consumption. In several developing countries, irrigation represents up to 95 percent of all water uses, and plays a major role in food production and food security. Future agricultural development strategies of most of these countries depend on the possibility to maintain, improve and expand irrigated agriculture. On the other hand, the increasing pressure on water resources by agriculture faces competition from other water use sectors and represents a threat to the environment in an increasing number of regions.[13]

The importance of agricultural water withdrawal is highly dependent on both climate and the place of agriculture in the economy. Water withdrawal ratios vary by continent, where the agricultural part (including irrigation, livestock and aquaculture) varies from more than 80 percent in Africa and Asia to just over 20 percent in Europe. The following table shows the share of agriculture in total water withdrawal, as well as what this means in terms of total renewable water resources.

Table 10: Average water withdrawal in agriculture and pressure on renewable water resources (FAO-AQUASTAT[14])

	Water withdrawal for agricultural		Arable land equipped for irrigation	Total freshwater withdrawal
	% of total water withdrawal	% of total renewable water resources	% of total arable land (2011-2013)	% of total renewable water resources
USA	40.2 (2005)	6.27 (2005)	17.1	15.5 (2005)
CND	12.2 (2010)	0.16 (2010)	2.5	1.34 (2009)
BRA	60.0 (2010)	0.52 (2010)	7.3	0.96 (2010)
COL	54.3 (2008)	0.27 (2008)	67.4	0.50 (2008)
IDN	81.9 (2000)	4.59 (2000)	28.6	5.61 (2000)

[13] http://www.fao.org/nr/water/aquastat/irrigationmap/index50.stm
[14] http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

MAL	22.4 (2005)	0.43 (2005)	39.9	1.93 (2005)
MOZ	78.0 (2001)	0.32 (2001)	2.1	0.41 (2001)
KEN	59.3 (2010)	6.21 (2010)	2.6	10.48 (2010)
UKR	30.0 (2010)	2.54 (2010)	6.7	8.47 (2010)
RUS	19.9 (2001)	0.29 (2001)	3.6	0.29 (2001)

The share of total renewable water resources used for agriculture is one of the parameters to check if local agriculture is not putting too much stress on water supply. The highest figures are measured in the US, Kenya, Indonesia and Ukraine.

- Food security

The prevalence of undernourishment expresses the probability that a randomly selected individual from the population consumes an amount of calories that is insufficient to cover her/his energy requirement for an active and healthy life. This is the traditional FAO hunger indicator, adopted as official Millennium Development Goal indicator for Goal 1, Target 1.9.
The prevalence of food inadequacy indicator measures the percentage of the population that is at risk of not covering the food requirements associated with normal physical activity, and therefore including also those who, even though cannot be considered chronically undernourished, are likely being conditioned in their economic activity by insufficient food.
The cereal imports dependency ratio tells how much of the available domestic food supply of cereals has been imported and how much comes from the country's own production. This indicator provides a measure of the dependence of a country or region from cereal imports. The greater the indicator, the higher the dependence.

Table 11: Food security indicators (FAOSTAT)

	Prevalence of undernourishment	**Prevalence of food inadequacy**	**Cereal import dependency ratio**
	% (2014-2016)	% (2014-2016)	% (2009-2011)
USA	<5.0	<5.0	-24.0
CND	<5.0	<5.0	-81.0
BRA	<5.0	<5.0	-3.0
COL	8.8	15.5	63.3
IDN	7.6	13.9	12.7
MAL	<5.0	5.5	76.0
MOZ	25.3	32.3	27.3
KEN	21.2	32.1	36.4
UKR	<5.0	<5.0	-60.3
RUS	<5.0	<5.0	-27.5

In the case a region faces substantial undernourishment or food inadequacy, the main aim of its agriculture should be to increase food provision. This is certainly the case for the African countries, to a lower extent also for Colombia and Indonesia.
Several countries rely on imports of cereals for domestic food provision, which would question their ability to produce crops for exports (for bioenergy) on their arable land. This is certainly the case for Malaysia, Colombia, Indonesia, Kenya, Mozambique and Indonesia. The other countries are net cereal exporters.

2.6. Climate policy

In terms of climate policy, two aspects will be considered:

1. What is the actual level of GHG emissions per capita, including efforts made in the frame of the Kyoto agreement?
2. What is the commitment of the country towards the future (connected to the Paris Climate Agreement achieved after COP21[15])?

The following table shows total primary energy consumption (TPES) and CO_2 emissions related to **combustion of fossil fuels** in 2013 (source: IEA[16]) for the different potential sourcing regions. The EU28 is also mentioned for comparison. The last column expresses the figures per capita, which will serve as comparison between the countries. The US, Canada and Russia have very high levels of CO_2 emissions from combustion of fossil fuels, while African and South American countries have much lower CO_2 emissions, mostly in relation to their lower energy use.

Table 12: Total primary energy consumption (TPES) and CO2 emissions related to combustion of fossil fuels (source of the data: IEA)

2013	Population	TPES		CO2 emissions*	
	million	Mtoe	toe/capita	Mt CO2	t CO2/capita
EU28	508	1625.6	3.2	3340.1	6.57
USA	316	2188.4	6.91	5119.7	16.18
CND	35	253.2	7.2	536.3	15.26
BRA	200	293.7	1.47	452.4	2.26
COL	48	31.7	0.66	68.3	1.41
IDN	250	213.6	0.85	424.6	1.70
MAL	30	89.0	2.99	207.2	6.97
MOZ	26	10.8	0.42	2.9	0.11
KEN	44	21.5	0.48	11.7	0.26
UKR	45	116.1	2.55	265.0	5.83
RUS	143	730.9	5.11	1543.1	10.79

** CO_2 emissions linked to fossil fuel combustion; non-CO2 GHG emissions or LULUCF are excluded*

Considering their high CO_2 emissions, the US, Canada and Russia in principle will need to make extra efforts to reduce their GHG emissions in energy production, through energy savings and renewable energy, which may induce a higher use of domestic biomass and may reduce their availability of biomass for international markets over time.
On the other hand, some of the developing countries may experience much higher energy consumption levels when their economies grow further, which may also result in a higher domestic claim on their resources (see also category economy).

[15] http://www.cop21.gouv.fr/en/
[16] http://www.iea.org/statistics/ieaenergyatlas/

LULUCF (land use, land use change and forestry) emissions are part of the reporting for climate agreements (Kyoto agreement in the past, Paris agreement in future). The following overview shows UNFCCC figures of greenhouse gas emissions, with a distinction between LULUCF and other GHG emissions[17] and the evolution between 1990 and 2012. Annex I parties reported to UNFCCC, emissions of non-Annex I parties are estimated with different time frames (indicated in the table).
In comparison to table 3, the GHG figures also include GHG emissions not related to fossil fuel combustion (like methane and nitrous oxides emissions).

Table 13: Evolution of greenhouse gas emissions, split up in LULUCF and other GHG emissions; 2012 data also expressed per capita (source of the data: UNFCCC)

	GHG emissions, excl. LULUCF			LULUCF emissions		
	Mt CO2-eq		t CO2-eq /capita	Mt CO2-eq		t CO2-eq /capita
	1990	2012	2012	1990	2012	2012
EU28	5626	4544	8,9	-258	-304	-0,6
USA	6220	6488	20,5	-817	-942	-3,0
CND	591	699	19,9	-71	41	1,2
BRA*	576	863 *(2005)*	4,3 *(2005)*	813	1329 (2005)	6,6 (2005)
COL*	119	154 *(2004)*	3,2 *(2004)*	11	26 (2004)	0,5 (2004)
IDN*	267	554 (2000)	2,2 (2000)	198	821 (2000)	3,3 (2000)
MAL*	137 (1994)	193 (2000)	6,5 (2000)	-61 (1994)	-220 (2000)	-7,4 (2000)
MOZ*	6,8	8,2 (1994)	0,3 (1994)	2	8 (1994)	0,3 (1994)
KEN*	21,5 (1994)	21,5 (1994)	0,5 (1994)	-28 (1994)	-28 (1994)	-0,6 (1994)
UKR	944	403	8,9	-70	-27	-0,6
RUS	3368	2297	16,1	165	-542	-3,8

** Non-Annex I parties*

Very high GHG emissions are reported in the US, Canada and Russia (as was already clear in the previous table on CO_2 emissions). In terms of LULUCF emissions the highest figures are reached in Brazil and Indonesia, although these figures need to be updated with more recent figures.

Future climate action plans:
In preparation of the Paris Agreement, most countries have submitted "INDCs" (Intended nationally determined contributions) to indicate their plans to reduce greenhouse gas

[17] http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3814.php Other GHG emissions include CO_2, CH_4 and N_2O emissions.

emissions. Climate ActionTracker[18] has evaluated most of these plans and checked if these were consistent with the target of maximum 2°C global warming.

- The plans of Brazil, EU, and the US were rated as 'medium', meaning '*not consistent with limiting warming below 2°C as it would require many other countries to make a comparably greater effort and much deeper reductions*'.
- The plans of Canada, Indonesia, Russian Federation, and Ukraine were rated as 'inadequate', meaning '*if all governments put forward inadequate positions warming likely to exceed 3–4°C*'.
- The INDCs of Colombia, Malaysia, Mozambique and Kenya are not assessed (yet) by Climate Action Tracker.

2.7. Renewable Energy

The following table gives an overview of the share of renewable energy – and specifically energy from biomass and waste – in total primary energy supply (TPES). Data are derived from the IEA database.

Table 14: overview of the role of renewables and biomass in the energy system (source of the data: IEA)

2013	Renewables in TPES		Biomass & waste in TPES		Biomass in residential
	Mtoe	%	Mtoe	%	toe/capita
EU28	208,8	12,8%	140,1	8,6%	0,08
USA	146,8	6,7%	97,4	4,4%	0,03
CND	47,9	18,9%	13,2	5,2%	0,10
BRA	116	39,5%	81,2	27,7%	0,03
COL	7,8	24,6%	4,0	12,5%	0,04
IDN	72,5	34,0%	54,9	25,7%	0,18
MAL	4,6	5,2%	3,7	4,1%	0,05
MOZ	9,9	91,4%	8,6	**79,8%**	0,24
KEN	17,6	81,8%	15,5	**72,2%**	0,17
UKR	3,2	2,7%	1,9	1,6%	0,02
RUS	23,3	3,2%	7,2	1,0%	0,01

The role of biomass in the energy system in Ukraine, Russia, Malaysia, the US and Canada is very low, despite substantial domestic biomass potential. In Mozambique, Kenya and Indonesia, the role of biomass is already very important, however, most of it is traditional biomass in residential applications. Brazil also has a high share of biomass in its energy system, but more focused at non-residential applications (industry and transport fuel).

Renewable energy strategies and targets

Most countries expressed certain targets on renewable energy implementation, also in the frame of the climate negotiations (INDC) – some also mention the role of bioenergy.[19] Most

[18] http://climateactiontracker.org/countries.html

focus is on renewable electricity (where non-biomass renewable energy forms like wind and solar may have a more prominent role in the strategies), and transport, where biofuel blending mandates are common practice.

[19] http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf

Table 15: Renewable energy targets (REN21, 2015)

2013	Renewable Energy Target (%)			
	overall	**Electricity**	**Heating & Cooling**	**Transport**
EU28	20% by 2020 27% by 2030	- -	- -	10% by 2020 -
USA	-	State level renewable portfolio standards	-	National: The Renewable Fuels Standard 2 (RFS2) requires 136 billion litres (36 billion gallons) of renewable fuel to be blended annually with transport fuel by 2022. States: specific blend mandates
CND	-	Provincial level targets	-	Biofuel blend mandates National: E5 and B2 Specific provincial blend mandates
BRA	-	Target of 45% of renewables in the energy mix by 2030	-	Blend mandates: E27.5 and B7 Target of 18% sustainable biofuels by 2030
COL	-	Electricity (grid-connected) 3.5% of generation by 2015; 6.5% by 2020 Electricity (off-grid) 20% of generation by 2015; 30% by 2020	-	Blend mandate: E8
IDN	25% by 2025	26% by 2025	-	Blend mandates: E3 and B5 Biofuels 10.2% share of primary energy by 2025
MAL	-	5% by 2015 9% by 2020 11% by 2030 15% by 2050	-	Blend mandate: B5
MOZ	-	Bio-digesters for biogas 1,000 systems installed (no date)	Targets for Solar water and space heating:	Blend mandates: E10 in 2012–2015; E15 in 2016–2020; E20 from 2021

		Hydropower, solar PV, wind 2 GW each (no date) Solar PV 82,000 solar home systems installed (no date) Wind turbines for water pumping 3,000 stations installed (no date) Renewable energy-based productive systems 5,000 installed (no date)	(no date)	
KEN	-	Geothermal power 1.9 GW by 2016; 5 GW by 2030 Hydropower 794 MW by 2016 Solar PV 423 MW by 2016 Wind power 635 MW by 2016	Targets for Solar water and space heating: (no date)	-
UKR	11% by 2020 18% by 2030	12.4% by 2020 20% by 2030	11% by 2020	Blend mandates: E5; E7 by 2017 10% target by 2020
RUS	-	2.5% by 2015 4.5% by 2020	-	-

3. Stakeholder consultations on SWOT statements

On the basis of the collected background data described in Chapter 2 a number of SWOT statements were produced for the different sourcing regions (6 to 10 statements per region) divided in general conditions, export conditions for biomass from forestry and export conditions for agricultural biomass. The statements were discussed in an Advisory Board meeting, in two webinars and through an on-line survey.

Survey

The draft statements were entered into an on-line SurveyGizmo survey (http://www.surveygizmo.com/s3/2807987/67e19fea8229).

The survey was distributed to several stakeholders on 3 June 2016 and it was kept open until 8 July 2016. 46 valid responses were received.
Most of the respondents classified themselves as 'expert', but different sectors were also represented (people could indicate multiple selections).

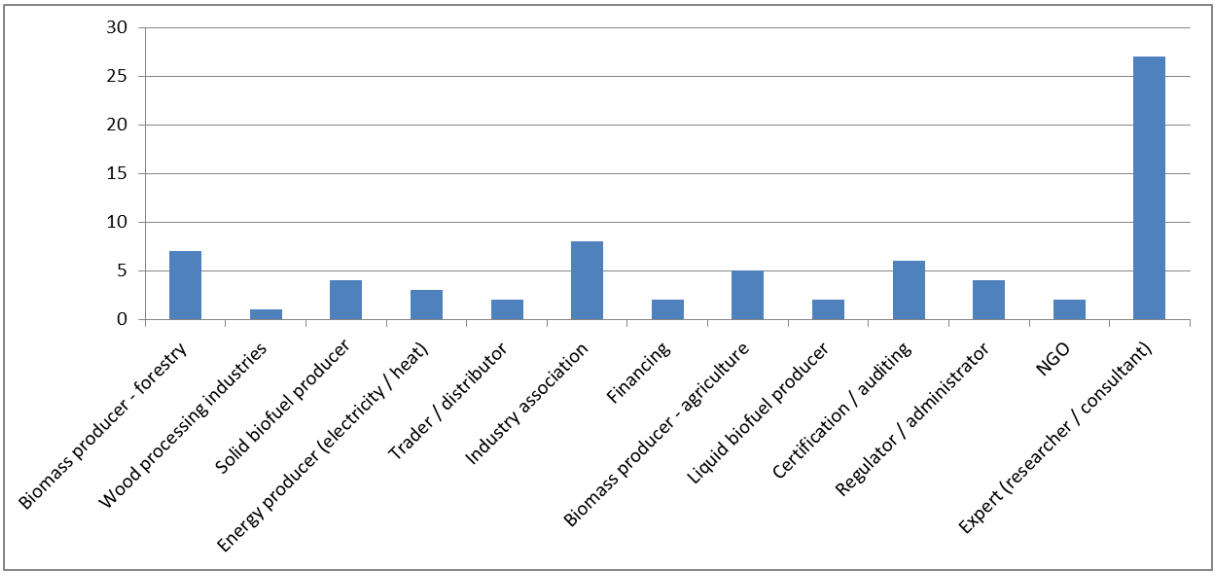

Figure 3: overview of replies in the on-line survey concerning type of organisation/expertise

Figure 4 shows how many of the responses were received for each sourcing region. Responses related to Kenya, Colombia and Indonesia are limited, indicating a relatively low interest from these regions in trade of lignocellulosic biomass with Europe.

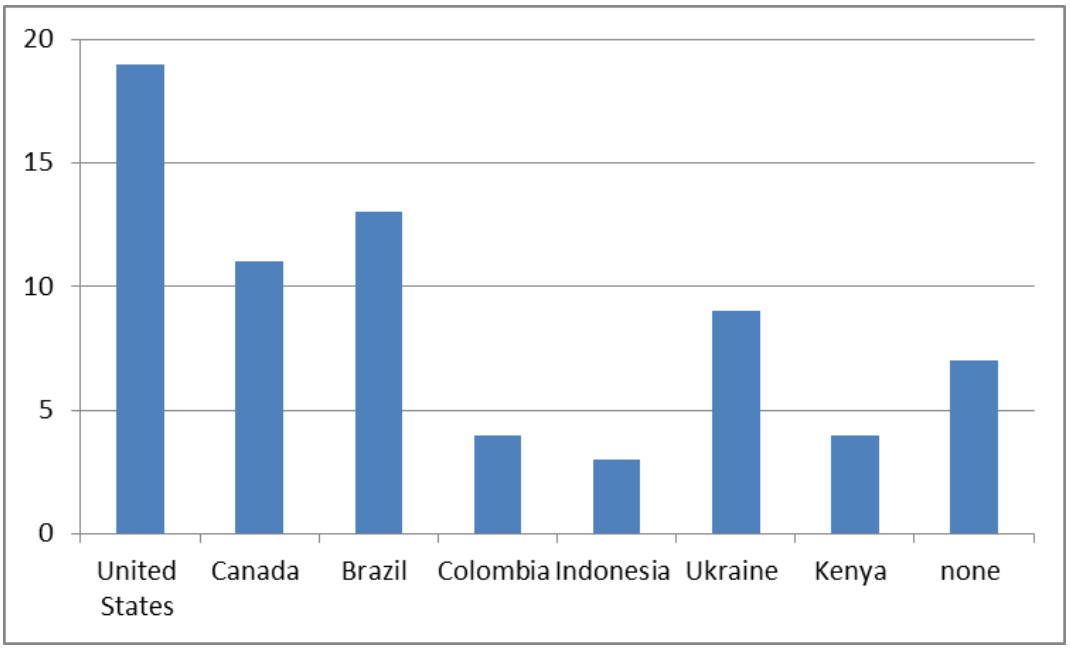

Figure 4: amount of replies related to the different sourcing regions in the on-line survey

The concrete results per sourcing region and the reactions to the SWOT statements (also from the advisory board meeting and the webinars) will be discussed in the separate chapters of the sourcing regions.

4. Strategies and SWOT for the United States

4.1.Bioenergy strategies in the United States

The United States has put relatively high attention to transport biofuels in the past, mostly in relation to air quality and energy security concerns. In recent years there is growing attention to renewable electricity and biorefineries, also in the frame of climate change mitigation. The following is an overview of the most important documents determining the strategies of the US in terms of bioenergy and/or renewable energy, in general up to 2030.

Energy Independence and Security Act of 2007[20]
This legislation seeks to expand the production of renewable transport fuels, reduce US dependence on oil, increase energy security and address climate change. Key provisions include:

1) Increasing the supply of alternative fuel sources by setting a mandatory **Renewable Fuel Standard** (RFS) requiring fuel producers to use at least 36 billion gallons of biofuel in 2022, and by providing for further incentives for the development of renewable energy technologies;
2) Reducing US demand for oil by setting a national fuel economy standard of 35 miles per gallon by 2020. The act also allows the Transportation Department to issue "attribute-based standards".
3) provisions to improve energy efficiency in lighting
4) provisions to improve energy efficiency in appliances
5) provisions to improve energy efficiency in buildings

The **Renewable Fuel Standard** (RFS) program was authorized under the Energy Policy Act of 2005 and expanded under the Energy Independence and Security Act of 2007 (to RFS2). [21]

The RFS program is a national policy that requires a certain volume of renewable fuel to replace or reduce the quantity of petroleum-based transportation fuel, heating oil or jet fuel. The four renewable fuel categories under the RFS are: Biomass-based diesel; Cellulosic biofuel; Advanced biofuel; Total renewable fuel. RFS2 required the use of 9 billion gallons in 2008 and scheduled a requirement for 36 billion gallons in 2022. The quota for 2022 was to allow no more than a maximum of 15 billion gallons from corn-starch ethanol and a minimum of 16 billion gallons from cellulosic biofuels. In recent years EPA reduced advanced biofuels targets. Considering the low uptake of cellulosic biofuel, the EPA has consistently lowered targets for cellulosic biofuel in the past years.

The Californian **Low Carbon Fuel Standard (LCFS) Program** is the most prominent example of a parallel State level initiative. This standard promotes the use of greenhouse-gas-reducing transportation fuels (such as liquid biofuels, renewable natural gas, electricity, and hydrogen) through a fuel-neutral declining carbon intensity standard. Carbon intensity is a measure of the GHG emissions associated with the production, distribution, and consumption steps in the "life cycle" of a transportation fuel. The target is to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020.

[20] https://www.epa.gov/laws-regulations/summary-energy-independence-and-security-act
[21] https://www.epa.gov/renewable-fuel-standard-program/program-overview-renewable-fuel-standard-program

In parallel to the RFS, various support programmes exist on Federal and State level to support advanced biofuels production and biorefineries.

The 2008 **Farm Bill** established new energy programs, including the **Biorefinery Assistance Program**, the Biobased Marketing Program and the Biomass Crop Assistance Program. The Biorefinery Assistance Program was expanded in the 2014 Farm Bill to include biobased product and renewable chemical manufacturing. The 2014 Farm Bill also expanded the **BioPreferred program** to include forestry products.[22]

The **Biorefinery Assistance Program** (which was recently renamed to 'Biorefinery, Renewable Chemical, and Biobased Product Manufacturing Assistance Program'[23]) assists in the development, construction, and retrofitting of new and emerging technologies for the development of Advanced Biofuels, Renewable Chemicals, and Biobased Product Manufacturing by providing loan guarantees for up to $250 million.

The goal of the **BioPreferred Program**[24] is to increase the purchase and use of biobased products. The BioPreferred program was created by the 2002 Farm Bill and reauthorized and expanded as part of the 2014 Farm Bill to include forest products. The program's purpose is to spur economic development, create new jobs and provide new markets for farm commodities. The two major parts of the program are:

- mandatory purchasing requirements for federal agencies and their contractors,
- a voluntary labelling initiative for biobased products.

Strategies towards climate change

The United States is not a Party to the Kyoto Protocol. While a target of a 7% reduction below 1990 until 2008–2012 was originally negotiated and agreed, the US never ratified the Protocol and the target therefore never came into force.

In June 2013, President Obama put forward a broad-based **Climate Action Plan** to cut the carbon pollution in the US[25]. The plan, which consists of a wide variety of executive actions, has three key pillars:

1. Cut Carbon Pollution in America
2. Prepare the United States for the Impacts of Climate Change
3. Lead International Efforts to Combat Global Climate Change and Prepare for its Impacts

Some focus points:

- Cutting carbon pollution from power plants
- Developing and deploying advanced transportation technologies (incl. Renewable Fuels Standard)

[22] http://www.usda.gov/documents/usda-2014-farm-bill-highlights.pdf
[23] http://www.rd.usda.gov/programs-services/biorefinery-renewable-chemical-and-biobased-product-manufacturing-assistance
[24] http://www.biopreferred.gov/BioPreferred/faces/pages/AboutBioPreferred.xhtml
[25] https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

- Preserving the role of forests in mitigating climate change (Conservation and sustainable management)

On 31 March 2015, the US submitted its **Intended Nationally Determined Contribution** (INDC) to reduce net GHG emissions by 26–28% below 2005 in 2025, including land use, land use change and forestry (LULUCF) (equivalent to 24-31% below 2005 or 12–19% below 1990 levels of GHG emissions excluding LULUCF).

On August 3, 2015, President Obama and the EPA announced the **Clean Power Plan**[26] to reduce carbon pollution from power plants. The Clean Power Plan sets standards to reduce CO_2 emissions by 32% from 2005 levels by 2030. EPA is establishing interim and final CO_2 emission performance rates for two subcategories of fossil fuel-fired electric generating units (EGUs):

- Fossil fuel-fired electric steam generating units (generally, coal- and oil-fired power plants),
- Natural gas-fired combined cycle generating units.

Interim CO_2 performance rates are prescribed for the period between 2022 and 2029, and the final emission performance rates by 2030.

In the final Clean Power Plan, EPA determined that BSER (best system of emissions reduction) consists of three building blocks:

- Reducing the carbon intensity of electricity generation by improving the heat rate of existing coal-fired power plants;
- Substituting increased electricity generation from lower-emitting existing natural gas plants for reduced generation from higher-emitting coal-fired power plants;
- Substituting increased electricity generation from new zero-emitting renewable energy sources (like wind and solar) for reduced generation from existing coal-fired power plants.

The final Clean Power Plan provides guidelines for the development, submittal and implementation of **state plans** that establish standards of performance or other measures for affected EGUs in order to implement the interim and final CO_2 emission performance rates.
States must develop and implement plans that ensure the power plants in their state – either individually, together, or in combination with other measures – achieve the equivalent, in terms of either or rate or mass, of the interim CO_2 performance rates between 2022 and 2029, and the final CO_2 emission performance rates for their state by 2030.

States may choose between two plan types to meet their goals:

- Emission standards plan– includes source-specific requirements ensuring all affected power plants within the state meet their required emissions performance rates or state-specific rate-based or mass-based goal.
- State measures plan– includes a mixture of measures implemented by the state, such as renewable energy standards and programs to improve residential energy efficiency that are not included as federally enforceable components of the plan.

[26] https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants

States have been active in adopting or increasing **renewable portfolio standards**, and 29 States now have them (see figure). These standards require utilities to sell a specified percentage or amount of renewable electricity. The requirement can apply only to investor-owned utilities but many states also include municipalities and electric cooperatives, though their requirements are equivalent or lower. [27]

In June 2015, the US and Brazil committed their countries to sourcing 20% of their electricity from non-hydro renewables by 2030[28].

[27] http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx
[28] https://www.whitehouse.gov/the-press-office/2015/06/30/fact-sheet-united-states-and-brazil-mature-and-multi-faceted-partnership

States and territories with Renewable Portfolio Standards	States and territories with a voluntary renewable energy standard or target	States and territories with no standard or target

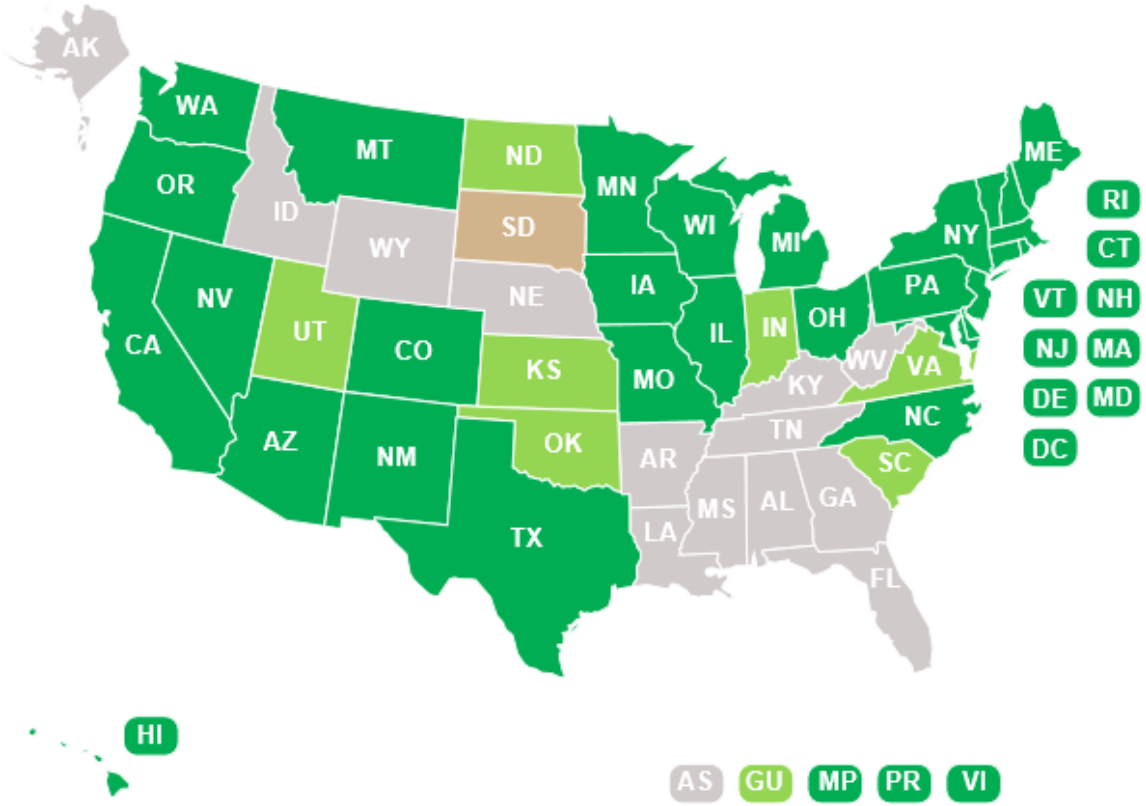

Figure 5: Renewable Portfolio Standards or Voluntary Targets in US States (status March 2016)

4.2.Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for the US, and the reactions in the on-line survey. Statements with relatively large disagreement are indicated in red.

Table 16: Draft SWOT statements for the US and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	The US has a strong economy and regulatory stability, with a positive investment climate and a high trade orientation. This makes the US a stable trade market for the EU.	15	4	-
2	The US has very high energy consumption per capita, with high greenhouse gas emissions related to fossil fuel consumption. Considering the global climate targets, substantial efforts will be needed in energy savings and renewable energy and a major growth in domestic use of lignocellulosic biomass can be anticipated (for transport fuels, renewable energy, biobased products). This reduces the room for biomass export in the medium term.	2	9	8
Export conditions for biomass from forestry				
3	The highly forested area in the US Southeast is easily accessible for trade with the EU through its Atlantic harbours.	12	5	2
4	The uptake of sustainable forest management (SFM) certification in the US is relatively low, so the sustainability of forest biomass from the US is difficult to demonstrate.	3	6	10
5	While SFM is not very common, a relatively high share of US forests is managed with a forest management plan and national regulations address aspects in terms of biodiversity, water and soil.	14	1	3
6	Forest area and carbon stock in forests in the US has continued to grow in the past decades, resulting in a net greenhouse gas sink from LULUCF, so US forest biomass (residues) is not associated with a loss of forest carbon.	13	4	1
Export conditions for biomass from agriculture				
7	Agriculture is relatively intensive in the US, with reduced carbon content in the topsoil and high irrigation needs. Further intensification of harvesting in agriculture may induce sustainability risks.	3	3	8

8	The US has sufficient area to supply domestic food and feed demand through its own agriculture and there is room for diversification to include non-food crops.	10	2	2
9	Considering the stimulation of domestic biofuels from agricultural residues or energy crops (corn stover, switchgrass) through the RFS2, there will be little room for exporting agricultural biomass to the EU.	-	7	6

Apart from the 19 responses through the on-line survey, a webinar was organized to discuss these statements. The webinar had 15 participants, of which 11 from the US.

General conditions

Most participants of the webinar did not agree with statement 2, in particular the 'major growth' of domestic use of biomass was questioned:

- The US EIA does not anticipate biomass playing an increasing role in US energy usage in their 2016 reference case projections. In fact it believes that "*Biomass, which includes wood as well as liquid biofuels like ethanol and biodiesel, remain relatively flat, as wood use declines and biofuel use increases slightly. In contrast, wind and solar (for electricity) are among the fastest-growing energy sources in the projection, ultimately surpassing biomass and nuclear, and nearly exceeding coal consumption in the Reference case projection by 2040*".
- Fossil fuels are inexpensive in the US, which makes domestic use of biomass difficult.
- The bioeconomy focus is on biobased products and biofuels, particularly, drop-in biofuels for aviation and military fuels, since light duty transport can move towards electric or hybrid systems.

Similar comments were received in the survey.

- The US is only using a small portion of its domestic biomass. Domestic and import markets can continue to grow and not affect the sustainability of US biomass.
- There is tremendous, untapped, sustainable production potential in the US, exceeding 1 billion dry tons of biomass annually (see July 2016 Biomass Assessment from US DOE). We need markets to provide incentives to manage the resources for beneficial use.
- Many policy issues related to energy and environment are handled at state, even municipal levels. Thus, one may expect variations in policy.
- Many US states are considering their own use of biomass under the Clean Power Plan which could create a growing domestic market for the feedstock.
- No carbon pricing (carbon tax or cap-and-trade) is foreseen in the short term, while prices on fossil fuels are low. This makes it hard for biomass to compete on the internal market. There is also a lot of NGO resistance to large-scale use of biomass.

Export conditions for biomass from forestry

Statements 4 and 5 are clearly linked and most of the webinar participants had a problem with statement 4. There were many comments on the apparent reliance on SFM certification in the statements presented, especially given the US rank in the trends in forest stocks and

land area in the analysis reported; it was frequently brought up that consideration should be given to equivalent mechanisms/methodologies that satisfy sufficient proof of sustainability.

- There are intensive monitoring programmes of US forests. Certification is a piece of paper, most important is action on the ground. The evolution of US forest land and carbon stocks show the ability of the US system to have sustainable forest and fibre production. We need adaptive systems with strong monitoring, not a fully prescriptive approach.
- Most important is a rigorous monitoring system and analysis of the data, rather than relying on specific anecdotal findings.
- The basis for forest management in the US are Federal and State legislation, e.g. Endangered Species Act, Clean Water Act, and Best Management Practices (BMPs). BMPs are either required or voluntary depending on the State, but in practice there is over 90% implementation rate. There is a lot of focus on sector education, including loggers and procurement foresters.
- Certification will only be applied if it pays off (higher price or access to a certain market). It puts the reporting responsibility at the forest land owner, but this is too expensive for small land owners.
- Fibre sourcing standards (at procurement level) are commonly applied - all pellet producers apply this. This includes logging practices, also on smaller land (family land owners).
- There was some reference to a statement for Canada on the threat of insects and forest fires, which could also apply to the US. Sustainable forestry moved away from restricting harvests. In many settings, thinnings and active forest management actually improve forest growth, biodiversity and resilience to fire and insects.
- Available markets for what is otherwise unmerchantable material provides incentives/opportunities for restoration and management activities that can increase the resilience of systems.

Similar comments were received in the survey. Some additional comments:

- Estimates of GHG sink due to LULUCF need ongoing validation.
- Large amounts of biomass are available in areas with plantations originally aimed for pulp production. Productivity is high, and these forests have low value for biodiversity.
- Sustainable forest management certification (SFM) in the US occurs for corporately owned land (about 20% of the timberland in the southeast US is owned by timber corporations). However sustainability of forest biomass from the US can be (and is being) demonstrated by the USDA Forest Inventory Analysis data. Biomass producers in the US demonstrate sustainability to their customers every day with third-party process-level certifications for fibre sourcing and chain of custody, as well as GHG calculations from processing and transport.
- US forests are managed according to a mix of federal, state, and local requirements that insure their sustainability even without SFM systems.
- Independent data from the US Forest Service (US Department of Agriculture) confirms that growth continues to exceed harvests and demonstrates continued sustainability regardless of formal certification.
- An NGO representative stated: “While the overall size of US forests may have grown, the demand for biomass has resulted in an increasing demand and increased harvesting rates. This means that the forests have not grown by as much as they otherwise might have done, resulting in a carbon debt and a loss of potential carbon sequestration.

Furthermore, in many Southeast states, where most biomass exported to the EU is sourced from, there is little to no regulation of forests in order to protect biodiversity. Harmful practices such as clearcutting of wetland forests are permitted and existing sustainability criteria for bioenergy are not sufficient to prevent these practices. This puts wildlife and habitats at severe risk in the future and has already had significant impacts in many places."

- Another thing to consider is the vitality of forests, the ability of forest to absorb carbon. Young forests are efficient in that respect, but the function declines rapidly with time.
- Residues will rot quickly in hot, damp Southeast US climate, or be burned intentionally or via wildfires (increasingly an issue with climate change). Further, due to dwindling markets for other forest products, if there are no other options the US will continue to have excess supply of commercial timber and residues which creates a disincentive to replant trees after harvest. Lack of markets could lead to a change in 40 year trend, since the single largest threat to forests in the Southeast is the conversion to non-forest use. Not only has no threat been identified due to wood pellets, but to the contrary, among the other major threats to US forest areas in the Southeast identified by USDA Forest Futures analysis, is the lack of markets for forest products.
- There is a big potential for trade of biomass from forestry for the EU. Possible problems:
  1) the high percentage of small(er) forest owners with limited means and knowledge on sustainable forestry.
  2) The need to prove the conformity of the material with the sustainability criteria from European buyers is not fully acknowledged by the US forest owners/traders.
  3) US forestry operators need to improve transparency in the way they manage forests with the other American stakeholders (excl. nature conservationists) and European buyers/users in mind.

Export conditions for biomass from agriculture

Agricultural biomass is clearly less in focus for the United States to trade with Europe compared to forest biomass. Most participants of the webinar had their focus expertise in forestry. Regarding agricultural biomass, mainly statement 7 and 9 were debated in the webinar.

On statement 7 it was stated that energy crops and the use of agricultural residues can actually enhance sustainability of agricultural land.

- Agricultural systems in the US also have BMPs to maintain carbon on the site and in soils. The monitoring system is different than forestry.
- Soil loss and water quality are in focus for agricultural practices. There are BMPs stimulating no till farming; this also includes limited stover removal.
- Yields of traditional crops may increase through crop improvement. This also leads to a higher production of residues (e.g. corn stover).
- Practices involving perennial crops may enhance sustainability, including improved water quality.

Regarding statement 9, webinar participants mentioned that the stimulation of advanced biofuels through RFS has not been as successful as anticipated in the law. EPA reduced lignocellulose biofuels targets consistently based on projections of volumes from operation of pioneer plants.

Similar comments were received in the survey. Some additional:

- The lower density of agricultural residue type feedstocks versus woody feedstocks means that the economic challenge will be greater for such feedstocks. So while there may be "room" to export such materials in the short to midterm, it is unlikely economically viable to do so.
- Irrigation is intensive in some parts of the US -- generally west of the 100th Meridian. But this is not the area where bioenergy crops will generally come from. East of the 100th Meridian, there is little agriculture land that is regularly irrigated or irrigated at all.
- Much of the US south is forested and the harvesting and replanting of this woody biomass does not affect domestic food and feed supply. There is no link between the RFS and the supply of woody biomass used to produce pellets for export.
- There is certainly a large potential to produce lignocellulosic biomass in US agriculture, but with the current policies and price relations to fossil fuels it is unlikely to happen. The only possible demand would be if RFS will stimulate production of cellulosic ethanol in large volumes, and in that case it will be corn stover first.
- There is plenty of room for exporting agricultural biomass to the EU. However, this is unlikely to occur due to logistics and costs.

4.3.Final SWOT table for the United States

Table 17: SWOT of the United States as a sourcing region for biomass to the EU, in relation to regulations and governance

United States	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general	Strong economy and regulatory stability Positive investment climate and a high trade orientation. ⇨ stable trade market for the EU.		
Forestry biomass	High potential in highly forested area in the US Southeast, with high growth rates. Demand for pellets can compensate declining markets for pulp in this area. This demand can be an incentive to replant trees after harvest. Existing logistics & the US Southeast is easily accessible for trade with the EU through its Atlantic harbours. Thinning and active forest management improves forest growth, biodiversity and resilience to fire and insects. Forest area and carbon stock in US forests have continued to grow in the past decades, resulting in a net greenhouse gas sink from LULUCF. Strong monitoring systems	Relatively low uptake of sustainable forest management Certification, but US forests are managed according to a mix of federal, state and local requirements; 90% implementation rate of ‚Best Management Practices' (BMPs)	High share of private, family ownership of forests (fragmented) with limited means and knowledge on sustainable forestry

Agricultural biomass	The US has sufficient area to supply domestic food and feed demand through its own agriculture and there is room for diversification to include non-food crops. There are BMPs to maintain carbon on the site and in soils and protect water quality. Perennial crops on certain lands may enhance sustainability, including improved water quality.	Relatively high freshwater withdrawal for agriculture in some regions; relatively high share of arable land needs irrigation (although mostly situated towards the West which is less interesting for trade with the EU). Relatively low average carbon content in the topsoil, so care should be taken with extraction of residues.	Low density of agricultural residue type feedstocks and disperse availability ⇨ costly to trade
Climate policy & renewable energy	Climate action plan backed by the president Different tools at federal and state level for green power production.	Ongoing program (RFS) on the promotion of liquid biofuels, but its impact remains below expectation	Very high energy consumption per capita / high CO_2 emissions related to fossil fuel consumption The role of renewables and biomass in energy provision is limited. Efforts in the past to reduce GHG emissions have been limited.

5. Strategies and SWOT for Canada

5.1.Bioenergy strategies in Canada

While Canadian government policies and incentives were initially focused on biofuels, there has been increased focus on policy development supporting bio-heat and power. Bioheat and biopower are supported by provincial goals.

The **Canadian renewable fuel standards** (RFS) fulfil commitments made by the government in 2006, through amendments made to the Canadian Environmental Protection Act 1999, more commonly known as the Clean Air Act. As of December 2010, the amendments require an annual average renewable content of 5% in gasoline, and a 2% requirement for renewable content in diesel and heating oil as of July 2011.

There are provincial renewable fuel mandates in effect in the provinces of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario. British Columbia also has a Low Carbon Fuel Standard in place.

The **Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations (SOR/2012-167)**[29] set a performance standard for new coal-fired electricity generation units and those that have reached the end of their useful life (at 50 years of age). This came into force on July 1, 2015. The level of performance standard is set at 420 t CO_2/GWh. The stated aim of this approach is that it will implement a permanent shift to lower- or non-emitting types of generation, such as high-efficiency natural gas, renewable energy, or fossil fuel-fired power with CCS.

The **Canadian Energy Strategy** (July 2015)[30] is built on the collaboration of provinces and territories through the Council of the Federation. In conjunction with provincial and territorial Energy Ministers, Premiers identified three themes to inform the future of energy in Canada: sustainability and conservation (a.o. transition to a lower carbon economy), technology and innovation (a.o. facilitate the development of renewable, green and/or cleaner energy sources to meet future demand and contribute to environmental goals and priorities) and delivering energy to people.

The **Canadian Biomass Innovation Network (CBIN)** is a network of federal researchers, program managers, policy makers, and expert advisors partnered with industry, academia, non-governmental organizations, other government levels and the international community. The Network's goal is to continually ensure the availability of knowledge, technology and enabling policy required to support the development of a sustainable Canadian bioeconomy.

The **Investments in Forest Industry Transformation** (IFIT)[31] program was created in 2010 to support Canada's forest sector in becoming more economically competitive and

[29] http://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=209
[30] http://www.canadaspremiers.ca/phocadownload/publications/canadian_energy_strategy_eng_fnl.pdf
[31] http://www.nrcan.gc.ca/forests/federal-programs/13139

environmentally sustainable. The initial four-year $100-million initiative supported forest industry transformation by accelerating the deployment of highly innovative, first-in-kind technologies at Canadian forest industry facilities. These projects included bioenergy, biomaterials, biochemicals and next-generation building products. IFIT was renewed in February 2014, with an additional $90.4 million provided for the program over four years.

State-level initiatives: some examples

Alberta Bioenergy Strategy Framework: In 2006, an industry and Government of Alberta collaboration resulted in the 9-Point Bioenergy Plan framework. From 2007 to 2014, industry expanded bioenergy production capacity. The Bioenergy Producer Credit Program (BPCP) was the key catalyst to industry growth from 2011 to 2014. This program expired March 2016.[32]
Alberta government recently announced plans to phase out coal power by 2030 and move up to 30% of renewable energy in the electricity grid by 2030.[33]

The **2007 British Columbia Energy** Plan calls for provincial energy self-sufficiency by 2016, and for a clean and renewable energy standard of greater than 90%.The subsequent **2008 British Columbia Bioenergy Strategy** identified the following action items for the province[34]:

- $25 million in funding to establish the Bioenergy Network.
- $10 million over the course of three years for biodiesel production
- Meeting 50% or more of B.C.'s renewable fuel requirements by 2020 with biofuels produced in B.C.
- Establishing at least 10 community energy projects that convert local biomass into energy by 2020.
- Establishment of one of Canada's most comprehensive provincial biomass inventories that creates waste-to-energy opportunities.

Ontario's Green Energy Act (GEA) was created to expand renewable energy generation, encourage energy conservation and promote the creation of clean energy jobs.[35] Ontario's updated Long-Term Energy Plan of December 2013 mentions that by 2025 about half of Ontario's installed generating capacity will come from renewable sources.

In February 2016 the Government of Yukon has announced the adoption of the **Yukon Biomass Energy Strategy** which is part of the Renewable Energy priority action to "develop a wood based bio-energy industry in Yukon by building a local market for wood energy technologies and wood fuel products[36].

[32] http://westerncanadabiodiesel.org/wp-content/uploads/2015/11/Alberta-Bioenergy-Strategy-Framework-FINAL-11-09-15.pdf
[33] http://www.alberta.ca/release.cfm?xID=389297B6E1245-F2DD-D96D-329E36A4573C598B
[34] http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/bc_bioenergy_strategy.pdf
[35] http://www.energy.gov.on.ca/en/green-energy-act/
[36] http://www.energy.gov.yk.ca/pdf/Yukon-Biomass-Energy-Strategy-Feb2016.pdf

Climate change mitigation actions

In 1997 Canada signed the Kyoto Protocol, committing itself to reducing its greenhouse gas emissions to 6% below 1990 levels by 2012. However, in December 2011, Canada withdrew from the Kyoto Protocol. In 2012, Canada subsequently reported an emissions increase of 18% above 1990 levels. In particular, Canada's extraction of oil from tar sands is expected to contribute to a significant emissions increase.

On 15 May 2015 the Government of Canada has submitted its **intended nationally determined contribution (INDC**) to the UNFCCC Secretariat. Canada intends to reduce greenhouse gas emissions economy-wide by 30% below 2005 levels by 2030. Climate Action Tracker rated Canada's INDC as inadequate, meaning that it is not consistent with interpretations of an equitable approach to reach a 2°C pathway,

5.2.Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for Canada, and the reactions in the on-line survey. Statements with relatively large disagreement are indicated in red.

Table 18: Draft SWOT statements for Canada and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	Canada has a **strong economy** and **regulatory stability**, with a **positive investment climate** and **high export orientation**. This makes Canada a **stable trade market** for the EU.	8	3	-
2	Canada has very **high energy consumption** per capita, with **high greenhouse gas emissions** related to fossil fuel consumption. Considering the global climate targets, Canada will need to do much more (current plans are inadequate); substantial efforts will be needed in energy savings and renewable energy and a **major growth in domestic use of lignocellulosic biomass** can be anticipated (for transport fuels, renewable energy, biobased products). This reduces the room for biomass export in the medium term.	1	4	6
Export conditions for biomass from forestry				
3	The highly forested area in Canada is **easily accessible** for trade with the EU - particularly in the East - through its harbours. Infrastructure is available.	7	3	1
4	The uptake of sustainable forest management (SFM) **certification** in Canada is high, also in relation to the high share of public forest (92%). This facilitates the demonstration of the sustainability of forest biomass	8	3	-

	from Canada.			
5	Forest area and forest carbon stocks in Canada have slightly decreased in past years. This is mostly due to **forest fires and forests infected by insects**. Managing forests against these risks can provide a lot of resource which can be used for energy.	6	3	2
Export conditions for biomass from agriculture				
6	Canada has high average carbon content in the topsoil and low freshwater withdrawal, which are **good conditions for agriculture**.	7	1	1
7	Canada has sufficient area to supply domestic food and feed demand through its own agriculture – it is actually a major exporter of cereals. There is room to use **agricultural residues**, or for **diversification to include non-food crops**.	10	1	-

Apart from the 11 responses through the on-line survey, also a webinar was organized to discuss the North American statements (US and Canada). However, all participants in the webinar were from the US. One written reaction was received from Canada.

General conditions

The main disagreement expressed by the participants of the survey was about statement 2, i.e. if the room for biomass export could be limited in the medium term.
Comments received:

- Canada is a cold place and requires substantial energy for heating. It is also a large country with dispersed populations, adding to transportation costs. But it has large amounts of biomass per capita and some should be available for export.
- Canada has indeed high per capita emissions, but Canada has a huge potential of biomass (80 million ha forest land) and in relation a small population.
- There is enough potential both for domestic use and for export. Canada has very large untapped biomass resources. The population is small, and there is little infrastructure, e.g. for district heating, so the internal demand will be limited in the medium term. Better incentives may be forthcoming, e.g. by carbon pricing.
- The major problem for bioenergy in and from Canada is her extremely rigid rules and regulations for biomass allocation (including preservation of forests). Changes would mean new legislation both on provincial and federal levels. Not even the enormous disasters caused by insect attacks caused any changes in that structure.
- National and provincial governments have been very slow to react. Biomass producers are signing long term export contracts. It is very difficult to convince governments, power utilities, and the public of the benefits of biomass. Solar, wind, and geothermal have a distinct advantage.
- With a new federal government, Canada has put a new focus on climate change. However, there is enough biomass to serve both ourselves and Europe.

Export conditions for biomass from forestry

Most people agreed with the statements regarding forestry biomass.
Some comments:

- Natural disasters are unpredictable on when happening and their duration and damage caused. Allocation of resources to reduce or eliminated results of natural disasters, protection of local economies and interests (local, federal, etc.) should and will come first with trade agreements compliance following. Allocation of funds, mainly public/federal, that are used for private or particular reasons in specific areas may be difficult to achieve, if they are happening often or if damages are high. Biomass surplus of Canada, if any or decided as such a policy, could also be used as a marketing tool to distort prices in EU, eliminate competition, affect agreements and pressure other topics. It would not be prudent to only rely on one source of biomass, however attractive it may seem at moments or spot conditions. More a global policy should be implemented.
- With the Swedish carbon tax formerly applied, also biomass from the west coast was imported (through the Panama canal) with profit. However, first priority should be that Canadians use it themselves.
- Forest area has not decreased. Forest fires and insects are a natural part of the lifecycle of many Canadian forests.
- Canada clearly demonstrates the risks of not managing forests - very large amounts of carbon are lost in large-scale disturbances. Dead trees from insect infested areas should be recovered and used as fuel.
- It is better to manage and use the biomass from forests than let it be destroyed by fires and insects!

Export conditions for biomass from agriculture

Also here most people agreed with the statements regarding agriculture biomass.
Some comments:

- Canada has an export-oriented agricultural economy. Some of these exports can be bioenergy-related.
- What is really needed to avoid starving or high food prices relative income is improved social welfare in all countries. → Provided through an international system for countries with low GNP.
- Why "non-food crops" - energy crops can be planted regardless if they can be eaten by humans, animals or used for ethanol or biodiesel production. The important factor is that the land is used in a productive and economic way. Why use cellulosic crops (non-food) if starch, sugar or oil crops are more productive or more economical??

5.3.Final SWOT table for Canada

Table 19: SWOT of Canada as a sourcing region for biomass to the EU, in relation to regulations and governance

Canada	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general	Strong economy and regulatory stability; overall high governance scores Positive investment climate and high trade orientation. ⇨ Stable trade market for the EU.		
Forestry biomass	The highly forested area in Canada is easily accessible for trade with the EU - particularly in the East - through its harbours. Infrastructure is available. Canada has sufficient forestry biomass potential to cover both domestic and international demand. The uptake of sustainable forest management (SFM) certification in Canada is high, also in relation to the high share of public forest (92%). This facilitates the demonstration of the sustainability of forest biomass from Canada. Forest area and forest carbon stocks in Canada have slightly decreased in past years. This is mostly due to forest fires and forests infected by insects. Managing forests against these risks can provide a lot of resource which can be used for energy.		
Agricultural biomass	Canada has high average carbon content in the topsoil and low freshwater withdrawal, which are good conditions for		Low density of agricultural residue type feedstocks and disperse availability

	agriculture. Canada has sufficient area to supply domestic food and feed demand through its own agriculture – it is actually a major exporter of cereals. There is room to use agricultural residues, or for diversification to include non-food crops.		⇨ costly to trade
Climate policy & renewable energy			The Canadian climate action plan (INDC) is classified as 'inadequate', meaning 'if all governments put forward inadequate positions warming is likely to exceed 3–4°C' Very high energy consumption per capita / high CO_2 emissions related to fossil fuel consumption Efforts in the past to reduce GHG emissions have been limited. The role of biomass in energy provision is limited.

6. Strategies and SWOT for Brazil

6.1.Bioenergy strategies in Brazil

Brazil consumes 40% of the energy used in South America. Favourable climatic conditions and the availability of much potentially usable land make the cultivation of energy crops, especially sugar cane, particularly attractive in Brazil. Biomass can therefore make a significant contribution towards meeting Brazil's increasing energy requirements. There is a high production of ethanol, which can be attributed to the long-term targeted promotion of ethanol production and use by the Brazilian government since 1975. The oil price rise of 1973 and the fall in sugar prices led the government to subsidize ethanol production through the **ProAlcool** program. In 1979, with the second oil chock, Brazilian Government decided to enlarge the Program, supporting large-scale production of hydrated ethanol to be used as neat fuel in modified engines.[37]
End 2004 the Brazilian government launched a wide-ranging programme, the **National Program of Biodiesel Production and Use** (PNPB), intended to promote the development of a competitive biodiesel sector, in particular targeted at the poorest regions of the country.
The **Brazilian Agroenergy Plan** (2006-2011)[38] aimed to organize and develop a technology research, development, innovation, and transfer proposal with a view to guaranteeing the sustainability and competitiveness of the agroenergy chains. The plan was to make greater use not only of biofuels, but also of electricity generation from biomass. CHP from sugar cane bagasse has great potential in this area.

In December 2008 Brazil's president signed the **National Climate Change Plan** (PNMC)[39]. The Plan largely focuses on reducing greenhouse gas emissions from deforestation, and contains targets for cutting deforestation, and establishing funding mechanisms and financial incentives to achieve the aim of reducing Amazon deforestation by over half by 2017. The Plan also contains provisions regarding energy efficiency and renewable energy. It seeks to increase energy efficiency across various sectors of the economy in line with best practice and to maintain the high renewable energy mix in Brazils transport and electricity sectors. In terms of renewable energy, the Plan seeks to increase the share of electricity generated from wind and sugarcane bagasse plants, add a number of hydroelectric projects to the electricity network, expand the solar PV industry and exploit it for rural electrification. Electricity produced from cogeneration, mainly from sugarcane bagasse, is to make up 11.4% of the country's electricity supply by 2030. The National Climate Change Plan also foresees an increase in the use of biofuels. It encourages industrial users to increase their average annual consumption of ethanol by 11% in the next ten years, and envisages implementing a 5% biodiesel blending requirement from 2010 rather than 2013 as previously planned.

[37] R. Schubert (ed), 2009: Future Bioenergy and Sustainable Land Use
[38] http://www.agricultura.gov.br/arq_editor/file/Ministerio/planos%20e%20programas/plano%20nacional%20de%20agroenergia%202006%202011%20ingles.pdf
[39] http://www.mma.gov.br/estruturas/smcq_climaticas/_publicacao/141_publicacao07122009030757.pdf

Brazil is not an Annex I country in the Kyoto Protocol and, thus, does not have commitments regarding emission reductions up to 2020. In the past emissions due to land use change and deforestation were the main reason for high emission levels. Deforestation rate in the Brazilian Amazonia has been reduced by 82% between 2004 and 2014.
In its INDC[40] submitted for the Paris Climate Agreement, Brazil expressed it intend to reduce GHG emissions by 37% below 2005 levels in 2025. The following measures are announced:

i) increasing the share of sustainable biofuels in the Brazilian energy mix to approximately 18% by 2030, by expanding biofuel consumption, increasing ethanol supply, including by increasing the share of advanced biofuels (second generation), and increasing the share of biodiesel in the diesel mix;

ii) in land use change and forests:
   - strengthening and enforcing the implementation of the **Forest Code**, at federal, state and municipal levels;
   - strengthening policies and measures with a view to achieve, in the Brazilian Amazonia, **zero illegal deforestation** by 2030 and compensating for greenhouse gas emissions from legal suppression of vegetation by 2030;
   - **restoring and reforesting** 12 million hectares of forests by 2030, for multiple purposes;
   - enhancing sustainable native forest management systems, through georeferencing and tracking systems applicable to native forest management, with a view to curbing illegal and unsustainable practices;

iii) in the **energy sector**, achieving 45% of renewables in the energy mix by 2030, including:
   - expanding the use of renewable energy sources other than hydropower in the total energy mix to between 28% and 33% by 2030;
   - expanding the use of non-fossil fuel energy sources domestically, increasing the share of renewables (other than hydropower) in the power supply to at least 23% by 2030, including by raising the share of wind, biomass and solar;
   - achieving 10% efficiency gains in the electricity sector by 2030.

In addition, Brazil also intends to:

iv) in the agriculture sector, strengthen the **Low Carbon Emission Agriculture Program** (ABC) as the main strategy for sustainable agriculture development, including by restoring an additional 15 million hectares of degraded pasturelands by 2030 and enhancing 5 million hectares of integrated cropland-livestock-forestry systems (ICLFS) by 2030;

Brazil's INDC was rated by Climate Action Tracker as 'medium', indicating that Brazil's climate plans are at the lower ambitious end of what would be a fair contribution.

40 http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20iNDC%20english%20FINAL.pdf

6.2.Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for Brazil, and the reactions in the on-line survey. Statements with relatively large disagreement are indicated in red.

Table 20: Draft SWOT statements for Brazil and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	Although there are potential issues related to **corruption control**, Brazilian **modest economic growth** projections and average levels of **country governance**, make Brazil a **relatively stable trade market** for the EU.	9	4	-
2	Brazilian **energy consumption** per capita is relatively low, with **low greenhouse gas emissions** related to fossil fuel consumption. There is a high share of renewable energy, with an important role of biomass, through a **consistent policy focus in renewable energy**. So no abrupt changes in biomass use (just a consistent growth) are projected to fulfil climate targets.	7	3	2
3	The decrease of **hydro-power production** due to several years of droughts might increase biomass power production, inducing a higher use of domestic biomass and **reducing the availability for export**.	3	5	4
Export conditions for biomass from agriculture				
4	The agricultural area in Brazil Southeast and South is **easily accessible** for trade with the EU through its Atlantic harbours.	6	5	2
5	Brazil has low average **carbon content** in its topsoil. Further intensification of harvesting in agriculture may induce sustainability risks.	5	4	4
6	Brazil has sufficient area to supply domestic food and feed demand through its own agriculture and there is **room for diversification to include non-food crops**.	10	2	1
7	There are prospects of **increasing productivity** of extensively managed grasslands (higher yields, but also increasing soil carbon content).	8	4	-
8	Brazil is investing in **advanced ethanol** from lignocellulose, and will prefer trade of ethanol instead of biomass.	6	4	2
Export conditions for biomass from forestry				
9	Both the uptake of sustainable forest management (SFM) **certification** and share of **forest management plans** are very low, so the sustainability of forest biomass from Brazil is difficult to demonstrate.	5	3	3

10	Although at lower rates in the past decades, forest area and carbon stock in forests in Brazil have continued to decline, resulting in elevated levels of **greenhouse gas emissions from LULUCF.** So Brazilian forest biomass (residues) are still associated with a loss of forest carbon.	4	5	2

Apart from the 13 responses through the on-line survey, also a webinar was organized on 30 June 2016 to discuss the statements for the south American countries, with 2 participants from Brazil. There were also two Brazilian participants in the Advisory Board Meeting of 13 June 2016 who provided their feedback on the statements.

General conditions

The main disputed point was statement 3. The following comments were made in the survey and the discussions with the stakeholders:

- It is true that energy from hydro-power is decreasing and the focus is on biomass but it is not true that this will decrease the availability for export. Bio-electricity depends on public policy (tenders and prices); today there is already more capacity than can be sold to the grid. In particular straw is still underused. For electricity production, probably solar and wind power will take larger market shares than biomass (not much need of heat for combined heat and power).
- There are major political problems and an economic crisis in Brazil. Nevertheless agriculture is going well and the condition for sugar cane is very stable, providing residues which can be available for domestic use or trade. On the longer term Brazil has proved to be a stable trading partner for the EU.
- The use of domestic biomass is more related to the rules on public tenders to purchase bioelectricity from sugarcane and the underdeveloped supply chain. However, even if there is an increase in domestic usage, it would not compete with exports given the amount of sustainable bagasse available and the new possibilities to use sugarcane straw. However, a substantial move to bioeconomy (e.g. for chemicals) may decrease availability of biomass for trade.
- It was suggested to include an extra statement on the huge potential of biomass in comparison with other countries (see case study).
- Brazil has 105 million hectares of degraded areas available for agricultural and/or forest production. Currently the Brazilian Government does not encourage the use of biomass for energy, the only sector that produces energy from biomass is the sugar cane industry with bagasse that being a residue presents economic viability. It is necessary also to point out the productive potential of short rotation wood among others that could meet local demand for electricity.
- The Brazilian INDC is ambitious compared to other developing countries.

Export conditions for biomass from agriculture

The participants mostly agreed with the statements about the agriculture biomass. Only statement 5 was contested, regarding the risk to reduce carbon content in the topsoil.
Some comments:

- In fact, sugar cane is a semi-perennial crop, which leads to more carbon in the soil. The majority of the sugar cane expansion is on deteriorated, low quality land, where soil conditions will improve. Of course, good management techniques are needed.
- In terms of soil carbon, farmers must apply methods which are sustainable in the short and medium term or they will ruin their land capital. Nutrient balancing will ensure a decent topsoil carbon content for the intended production system. It is more important to take a closer look at national legislation on run-off water quality (and irrigation). Are there enough rivers that allow a natural flora/fauna biodiversity? Do farmers lower water tables so that surrounding flora/fauna/humans suffer?
- Agro-ecological zoning is important to be mentioned in the frame of sustainable agriculture. Part can be used for wood plantations (from extensive cattle grazing). Plantations into grassland areas can also lead to land use change emissions.
- Statement 7: Brazil is indeed investing in intensification of crops and higher land yields. Brazil has high potential to generate cellulosic residues. There is in Brazil, at this moment, an increasing interest in alternatives for land use considering food ánd fuel. Research studies are carried out to understand which share of agricultural residues should be left in the field.
- Statement 8: the balance between advanced ethanol, pellets or producing domestic bio-electricity depends on national legislation, which is very unstable. In fact, lignocellulosic ethanol is very expensive, so ethanol from sugar cane is favourable. Additionally, biogas production from agricultural residues is an option. Currently, advanced ethanol is more promise than reality. There are two mills producing lignocellulosic ethanol but they have several technical problems. The use of sugarcane straw can be intensified since it is not burned anymore.
- Although Brazil would rather export advanced ethanol to the EU, this would not necessarily imply that biomass could not be exported as well. Given the amount of sustainable biomass from sugarcane available in Brazil, both products could be exported, but decisions will depend on the policies in place in exporting markets, market conditions and prices. The possibility to also export biomass may offer producers flexibility to face uncertainties or price volatility.

Export conditions for biomass from forestry

Most people agreed with the statements related to forestry biomass.
Some comments:

- Distinction should be made between natural forests and plantations, as their conditions are different. There is a huge difference between the forest industry in the north and the south of Brazil. In the north it is mostly primeval forest clearings/burnings and in the south it is mostly about forest plantations. So deforestation is only related to two out of ten Brazilian states; states with human induced deforestation could be "black-listed" or be given tougher standards to meet.
- Brazil is increasing initiatives to improve the management and recovering of marginal lands. Several studies are looking for scenarios in (sustainably managed) wood plantations (e.g. Eucalyptus). In fact Brazil has the best productive and sustainable conditions for timber production. Brazilian production of woody material paper, plywood and others is derived from eucalyptus and pine. Besides, several industries in Southeast/South Brazil produce pellets from wood.

6.3.Final SWOT table for Brazil

Table 21: SWOT of Brazil as a sourcing region for biomass to the EU, in relation to regulations and governance

Brazil	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general	Experience with international trading of biofuels	Modest economic growth projections and average levels of country governance	Potential issue related to control of corruption Current political problems and economic crisis
Agricultural biomass	The agricultural area in Brazil Southeast and South is easily accessible for trade with the EU through its Atlantic harbours. Brazil has sufficient area to supply domestic food and feed demand through its own agriculture and there is room for diversification to include non-food crops. Agro-ecological zoning in the frame of sustainable agriculture There are prospects of increasing productivity of extensively managed grasslands (higher yields, but also increasing soil carbon content). Large amount of degraded areas are available for agricultural and/or forest production. The use of sugarcane straw can be intensified since it is not allowed to burn it in the field anymore.	The balance between 2G ethanol, pellets or producing domestic bio-electricity depends on the national legislation, which is quite unstable. Brazil is investing in advanced ethanol from lignocellulose, and may prefer trade of ethanol instead of biomass (although it remains to be seen how successful lignocellulosic ethanol will be).	

Forestry biomass	High focus on reducing deforestation Good conditions for growing forest plantations, particularly in the South	Majority of forests in public ownership	Share of forest with management plan is limited Very low uptake of sustainable forest management Certification (FSC or PEFC) Still a substantial loss in forest area and carbon stocks in natural forests (through deforestation) in the North, although this decreased in past years
Climate policy & renewable energy	Relatively low energy consumption and low GHG emissions related to fossil fuel consumption High share of renewable energy, with an important role of biomass. Consistent policy focus in renewable energy. Low share of traditional (unsustainable) biomass use (use of biomass is focused on industry and transport fuels) National Climate Change Plan (PNMC) largely focuses on reducing greenhouse gas emissions from deforestation, and contains targets for cutting deforestation, and establishing funding mechanisms and financial incentives to achieve the aim of reducing Amazon deforestation by over half by 2017. The Brazilian INDC is ambitious compared to other developing countries		Still elevated levels of LULUCF emissions related to deforestation (although LULUCF emissions have been reduced dramatically in recent years)

7. Strategies and SWOT for Colombia

7.1.Bioenergy strategies in Colombia

Colombia is the third largest economy in South America. The main export products are fossil fuels and agricultural products like coffee and bananas. Primary and secondary energy demand doubled between 1975 and 2009, which required a rapid growth of the energy conversion capacity. New coal- and gas-fired power plants were built to reduce the overdependence on hydropower, which has proven vulnerable to droughts. Deforestation ate up 6.2 million hectares of tropical forest between 1990 and 2010, which has been mostly replaced by extensive cattle farms.
Biomass plays an important role in the energy mix of the country, as it is today the second largest renewable energy source after hydroelectricity. Colombia is also characterized by a vast bioenergy potential that remains untapped.[41]

The Colombia **National Energy Plan 2006-2025**[42] intends to

- ensure supply by means of diverse types of energies at competitive prices,
- increase energy coverage,
- decrease energy poverty,
- contribute to the growth of developing economies and populations and regions;
- facilitate the introduction of new energy sources and technologies, control, information and telecommunications;
- and minimize negative environmental impacts by means of a sustainable energy system.

In particular it is seeking inclusion of wind power plants, photovoltaic solar, geothermal and generation from biomass in the electricity mix in the country. In terms of biofuels for transport, tax exemptions and blending obligations (for ethanol) were established.

In its **INDC**[43] Colombia commits to reduce its greenhouse gas emissions by 20% with respect to the projected Business-as-Usual Scenario (BAU) by 2030. Subject to the provision of international support, Colombia could increase its ambition to 30%.
To fulfil its mitigation goal, Colombia has prioritized mitigation measures through eight **Sectorial Mitigation Action Plans** (SMAPs) that aim to maximize the carbon efficiency of economic activities. Mitigation measures have also been identified in the land use change sector, with processes under the REDD+ strategy and the Amazon Vision program, among others.

The Colombian INDC was not (yet) assessed by Climate Action Tracker.

[41] http://eprints.unife.it/774/1/Bioenergy_technology_roadmap_for_Colombia.pdf
[42] http://www.upme.gov.co/English/Docs/PLAN_ENERGETICO_NAL_EN.pdf
[43] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Colombia/1/Colombia%20iNDC%20Unofficial%20translation%20Eng.pdf

7.2.Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for Colombia, and the reactions in the on-line survey. There were only 4 reactions, so it is difficult to draw conclusions.

Table 22: Draft SWOT statements for Colombia and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	In terms of governance Colombia has issues related to political stability & absence of violence/terrorism, rule of law and control of corruption. On the other hand, regulatory quality is positive, and overall the investment climate is rated positive.	2	2	-
2	Colombia shows relatively low energy consumption that may increase with economic growth. Besides, biomass is starting to play an important role in the energy mix of the country. Furthermore, a higher share of biomass in the electricity mix is envisaged in long term plans. This may reduce the room for biomass export in the medium term.	2	2	-
3	The accessibility of some sourcing areas in Colombia makes it difficult to transport biomass to the ocean harbours.	2	1	1
Export conditions for biomass from forestry				
4	Colombia has a high share of private ownership of forests. No uptake of sustainable forest management certification (FSC or PEFC) is reported, nor is there reporting of forests with a management plan. So the sustainability of forest biomass from Colombia is difficult to demonstrate.	4	-	-
5	There has been some reduction of forest area (net deforestation) and forest carbon in the past years in Colombia, resulting in net LULUCF emissions.	3	-	1
Export conditions for biomass from agriculture				
6	Agriculture in Colombia shows quite high yields, with high average carbon content in the topsoil and low freshwater withdrawal, which are very good circumstances for agriculture.	3	1	-
7	In Colombia, sugarcane mills play an important role in agriculture residues management. Currently the bagasse is the main residue used to generate power in sugarcane mills, but starting to use thrash (leaves) could increase biomass availability for export.	3	1	-

8	The level of undernourishment and food inadequacy in Colombia is relatively high, as well as the cereals import dependency, meaning that Colombia should prioritize domestic production of food and feed in its agriculture, with little room for diversification to include non-food crops. Potential trade should focus on agricultural residues.	2	1	1

Apart from the 4 responses through the on-line survey, also a webinar was organized on 30 June 2016 to discuss the statements for the south American countries. There was one participant from Colombia; because of connection problems he provided his comments via email.

General conditions:

The following comments were received:

- Regarding statement 1 it is remarked that the transformation in security, political and economic stability of Colombia has been instrumental, together with its geographical position, so that several companies are filed and use it as a special place to expand their markets at low costs. The 'Doing Business' World Bank report argues that Colombia is the third in Latin America and the Caribbean in terms of business environment; and a study by J.P. Morgan states that it is the second most promising country in terms of investment in Latin America.
- Regarding the role of biomass in the country, recent studies suggest that the production of bagasse (estimated at 1.5 million tons), rice husks (with 457,000 tons per year) and oil palm fruit have great potential in the development of biomass in Colombia. Although much remains to be done.
- Regarding improving transport infrastructures, in the near future, the most suitable areas to generate biomass for energy are the Santanderes, the Eastern Plains and the Atlantic Coast. There is a road infrastructure program in Colombia that proposes the construction and operation concession of highways, dual carriageways, and tunnels. Its main objective is to improve the country's competitiveness, reducing the cost and time of transporting people and especially cargo to export manufactured goods through ports.

Export conditions for biomass from forestry

Most participants agreed with the statements concerning forest biomass. Some comments were made:

- Only a small share of the forestry potential of Colombia is used. Commercial forest plantations span over 350,000 ha, while there is a potential for the development of forestry projects of 24 million hectares.
- Although forest management certification is not widespread yet, some companies do have an FSC label in Colombia, e.g. Smurfit Kappa Cartón de Colombia (67,000 ha) and Monterrey Forestal Pizano (20,000 ha).

Export conditions for biomass from agriculture

Most participants agreed with the statements concerning agriculture biomass. The following comments were made:

- Bagasse from sugarcane can be used for cogeneration. There is a potential to expand the production area of sugar cane with more than one million hectares. This would mean that cogeneration can increase at least 5 times compared to current levels, resulting in a high increase of domestic renewable energy production.
- Regarding food security, the National Government of Colombia has developed a plan to grow an extra one million hectares in crops to ensure adequate food security over time. This is done on the basis of agricultural maps indicating which products are suitable for planting and in what areas. An atlas of the energy potential of residual biomass in Colombia has been developed, as well as policies to support unconventional sources of energy.

7.3.Final SWOT table for Colombia

Table 23: SWOT of Colombia as a sourcing region for biomass to the EU, in relation to regulations and governance

Colombia	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general	Road infrastructure program to improve accessibility for trade Regulatory quality is positive, and overall the investment climate is rated positive	Average GDP, modest growth projections Governance: average in terms of voice & accountability, government effectiveness and regulatory quality	Governance: issues in terms of political stability & absence of violence/terrorism, rule of law and control of corruption
Forestry biomass	Only a small share of the forestry potential of Colombia is used	There has been some reduction of forest area (net deforestation) and forest carbon in the past years in Colombia, resulting in net LULUCF emissions.	High share of private ownership of forests. Low uptake of sustainable forest management certification (FSC or PEFC)
Agricultural biomass	Agriculture in Colombia shows quite high yields, with high average carbon content in the topsoil and low freshwater withdrawal, which are very good circumstances for agriculture.	Possible expansion of sugar cane production in the short future and then more bagasse would be available for energy use. Atlas of the energy potential of residual biomass in Colombia has been developed,	Substantial levels of undernourishment or food inadequacy, high dependency on cereal imports. The main aim of its agriculture should be to increase food provision.
Climate policy & renewable energy	Substantial share of renewable energy, with an important role of biomass. National Energy Plan 2006-2025 is seeking inclusion from biomass in the electricity mix in the country and encourage development and	Relatively low energy consumption and low GHG emissions related to fossil fuel consumption (which may increase with economic growth) Limited share of traditional (unsustainable) biomass use	

	use of biomass	Modest LULUCF emissions	

8. Strategies and SWOT for Indonesia

8.1.Bioenergy strategies in Indonesia

The strategy for bioenergy development in Indonesia contains the following items:[44]

- Increase the use of biofuel as a fossil fuel substitution
- Developing bioenergy based power plants (as base load)
- Increase the sustainable supply of bioenergy feedstock through development of energy farms/forests
- Utilization of organic waste as a source of energy
- Increase contribution of national economy through development of bioenergy industries

The main strategies for further implementation of bioenergy in Indonesia include[45]:

- Increase the mandatory implementation of biofuel in all sectors (transportation, industry and power generation) (reg. 25 yr 2013, reg 20 yr 2014, reg 12 yr 2015)
- Feed-in tariff for bioenergy based power plants (biomass, biogas, MSW) (reg. 4 yr 2012, reg 19 yr 2013, reg 27 yr 2014)
- Regulate waste/biomass for export purposes.
- Utilisation of biomass wastes in agroindustry, for example regulation on palm oil mill effluent in palm oil industry.
- Allocate special fund for implementation by local government as energy access program.

Indonesia's ambition is to increase renewable energy to 23% of primary energy supply (excluding the traditional use of biomass) by 2025, from a share of 6% early 2014. This target was anchored in the **National Energy Policy** in 2014 and is supported by a feed-in tariff. However, Indonesia is also working on the construction of new coal-fired power plants to meet rapidly increasing electricity demand, a development which is likely to bind the country to this carbon-intensive technology for many decades.

The Government of Indonesia enacted a **National Plan for GHG emission reduction** (RAN-GRK) in September 2011. Indonesia committed to achieve the target of 26% reduction in carbon emissions from a Business As Usual (BAU) scenario by 2020, and up to 41% with international support. Indonesia has also actively engaged in REDD+ negotiations and development since 2007. A number of REDD+ initiatives have been launched, accompanied by proclaimed changes in national policies and legislation in favour of REDD+. Indonesia also signed an agreement with the Government of Norway to address emissions from deforestation and forest degradation. As a follow up, Indonesia formulated a REDD+ national strategy and action plan.[46]

[44] https://www.iea.org/media/technologyplatform/workshops/southeastasiabioenergy2014/Indonesia.pdf
[45] http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/2015_events/3rd_Bioenergy_Week_25-29_May_Indonesia/25_5_3_WIBOWO.pdf
[46] http://www.nama-database.org/index.php/Indonesia

The **Community Forest Partnership for Wood Biomass Based Energy** (CFFBE NAMA) started in August 2015 and is one of the initiatives supported by the Indonesia Climate Change Trust Fund (ICCTF).
In September 2015 Indonesia released its **INDC**, including an unconditional 2030 GHG emissions reduction target (including land-use, land-use change and forestry (LULUCF)-emissions) of 29% below business-as-usual (BAU) and a conditional 41% reduction below BAU by 2030 (with sufficient international support). Climate Action Tracker assessed this INDC as inadequate due to the lack of detailing in the area of LULUCF emissions.
Indonesia's INDC targets include deforestation emissions due to deforestation and peatland destruction, which at present account for the largest source of the country's emissions, an average of 60% of total emissions over the last ten years (based on national data). Indonesia's deforestation already contributes to a large share of global deforestation emissions: around 30-40% for the period 2000-2010. Despite the fact that Indonesia has, temporarily (2010–2016), prohibited the clearing of primary forest and the conversion of peat lands, different sources indicate a strong increase of deforestation in this period[47].

8.2.Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for Indonesia, and the reactions in the on-line survey. There were only 3 reactions (from non-Indonesian people), so it is difficult to draw conclusions.

Table 24: Draft SWOT statements for Indonesia and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	Indonesia has issues in terms of political stability, rule of law and control of corruption and its investment climate is considered poor. This makes Indonesia an **unstable trade market** for the EU.	1	2	-
2	Indonesia's GDP is relatively low, presenting low **energy consumption** per capita. However, relatively high growth perspectives will increase energy demand (including biomass for energy) and other biomass uses. Considering the global climate targets, Indonesia will need to do much more (current plans are inadequate). Therefore, **major growth in domestic use of biomass** can be anticipated. This reduces the room for biomass export in the medium term.	1	1	1
Export conditions for biomass from forestry				
4	The uptake of sustainable forest management (SFM) **certification** in Indonesia is low, so the sustainability of	2	1	-

[47] http://climateactiontracker.org/countries/indonesia.html

	forest biomass from Indonesia is difficult to demonstrate.			
5	While SFM certification is not very common in Indonesia, most forests have a **management plan**, also in relation to the high share of public forest (91%).	2	1	-
6	Indonesia has serious issues with deforestation. Indonesia represented around 30 to 40% of global deforestation emissions for the period 2000-2010. Forest area and carbon stock in forests in Indonesia have continued to decline, resulting in elevated levels of **greenhouse gas emissions from LULUCF.** So Indonesian forest biomass (residues) can be associated with a loss of forest carbon.	2	-	1
Export conditions for biomass from agriculture/plantations				
7	Indonesia shows high average **carbon content in the topsoil**, but also relatively high **water withdrawal** for agriculture. Yields are high due to climatic conditions.	2	1	-
8	Indonesia's palm oil production – which is primarily for food purposes - is associated with deforestation rates and peatland draining.	3	-	-
9	Palm oil production in Indonesia produces **high amounts of residues** which can be available for energy production.	2	1	-

Considering the low interest from Indonesian stakeholders, no dedicated webinar was organized for this region. The following shows the comments made in the survey – mind that none of the three people who filled the survey in relation to Indonesia were from Indonesia.

General conditions:

There were some comments on parts of statement 2, that a major growth in domestic use of biomass can be anticipated.
The following comments were received:

- It is likely that export markets rather than domestic demand would trigger large scale investments, ample production conditions and available land in certain areas. But not in densely populated islands like Java and Bali, and in areas covered by pristine rain forests.
- The inability to stop new harvesting of such large areas of valuable forest for biodiversity and the burning of peat layers should disqualify Indonesia from EU export until things have improved a bit.

Export conditions for biomass from forestry

Most survey participants agree with the statements about forest biomass. Some comments:

- Plans in Indonesia are not always compatible with reality or respected. However, also for Indonesia, being such a large country, states could be treated separately.

- Biomass is and will not be a main driver or cause for deforestation and loss of carbon. It would be much easier to develop biomass plantations on abundant barren "unused" land.

Export conditions for biomass from agriculture

Almost all participants agree with the statements regarding agricultural biomass. Only one comment is pointed out:

- Areas drained after 2008 should be banned for EU import. Before the Indonesian states have clear plans for what land areas should be protected to meet the Nagoya Protocol, all agricultural import should be banned. Moreover, EU itself must do a fast work to show how the treaty should be met.

8.3.Final SWOT table for Indonesia

Table 25: SWOT of Indonesia as a sourcing region for biomass to the EU, in relation to regulations and governance

Indonesia	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general	The country has a big export activities in agricultural commodities.		Indonesia has issues in terms of political stability, rule of law and control of corruption and its investment climate is considered poor. This makes Indonesia an unstable trade market for the EU.
Forestry biomass		While SFM certification is not very common in Indonesia, most forests have a management plan, also in relation to the high share of public forest (91%) (although most (57%) are managed by businesses) .	Indonesia has serious issues with deforestation. Indonesia represented around 30 to 40% of global deforestation emissions for the period 2000-2010. Forest area and carbon stock in forests in Indonesia have continued to decline, resulting in elevated levels of greenhouse gas emissions from LULUCF**.** So Indonesian forest biomass (residues) can be associated with a loss of forest carbon. High pressure on forest area remains to convert to palm plantations, considering the growing demand of palm oil at global level (for food).
Agricultural biomass / plantations	High average levels of carbon content in the topsoil High agricultural yields due to climatic conditions Palm oil production in Indonesia produces high amounts of residues which		Indonesia's palm oil production – which is primarily for food purposes - is associated with deforestation rates and peatland draining. Relatively high freshwater withdrawal for agriculture / relatively high share of arable land needs irrigation. Substantial levels of undernourishment or food inadequacy; 13% dependency on cereal imports. The

	can be available for energy production.		main aim of its agriculture should be to increase food provision.
Climate policy & renewable energy	Green Energy Policy identifies Indonesia's strategy to maximise the utilisation of its renewable energy potential.	Relatively low energy consumption and low GHG emissions related to fossil fuel consumption (which will increase with economic growth) Government policy for the power sector specifies that the use of domestic energy sources will be prioritised in the national interest.	High share of traditional (unsustainable) biomass use High LULUCF emissions. The Indonesian climate action plan (INDC) is classified as 'inadequate', meaning 'if all governments put forward inadequate positions warming is likely to exceed 3–4°C'. The country may need to focus more on using domestic resources for renewable energy.

9. Strategies and SWOT for Kenya

9.1.Bioenergy strategies in Kenya

The **Kenya Vision 2030** is the national long-term development policy that aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment. The Vision comprises of three key pillars: Economic; Social; and Political. The Economic Pillar aims to achieve an average economic growth rate of 10 per cent per annum and sustaining the same until 2030. Agriculture is one of the six priority sectors.[48]
The National Energy policy is in its 5th draft as at August 2011. This Policy sets out the national policies and strategies for the energy sector that are aligned to the new Constitution and are in tandem with the Vision 2030.

The latest **draft National Energy Policy** was presented in February 2014. The vision is affordable quality energy for all Kenyans, with a mission to facilitate provision of clean, sustainable, affordable, competitive, reliable and secure energy services at least cost while protecting the environment.[49] It is expected that wood fuel will continue to be the primary source of energy for the majority of the rural population and urban poor for as long as it takes to transform the rural economy from subsistence to a highly productive economy. Wood fuel supply management is crucial to ensure sustainable supply to meet the growing demand. Key issues here include: competing land use activities, the growing imbalance between supply and demand and the attendant adverse environmental as well as related land and tree tenure issues, among others. The Government has promoted Agro forestry and social forestry programmes to increase the stock of woody biomass on farms to make up for the loss of forest trees as forestland is converted into agricultural and settlement land.

Kenya has developed a National Climate Change Response Strategy in 2010 and a National Climate Change Action Plan (NCCAP) in 2013. The country published an **Intended Nationally Determined Contribution** (INDC) in July 2015, indicating that Kenya seeks to abate its GHG emissions by 30% by 2030 relative to the BAU scenario of 143 MtCO2eq; and in line with its sustainable development agenda[50] Kenya's total greenhouse gas (GHG) emissions are relatively low, standing at 73 MtCO2eq in 2010, out of which 75% are from the land use, land-use change and forestry (LULUCF) and agriculture sectors. This may be explained by the reliance on wood fuel by a large proportion of the population coupled with the increasing demand for agricultural land and urban development. Kenya strives to be a newly industrialised middle income country by 2030. This development is expected to increase emissions from the energy sector.

[48] http://www.vision2030.go.ke/
[49] http://www.ketraco.co.ke/opencms/export/sites/ketraco/news/Downloads/National_Energy_Policy_-_Final_Draft_-_27_Feb_2014.pdf
[50] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Kenya/1/Kenya_INDC_20150723.pdf

9.2.Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for Kenya, and the reactions in the on-line survey. There were only 4 reactions, so it is difficult to draw conclusions. Statements with relatively large disagreement are indicated in red.

Table 26: Draft SWOT statements for Kenya and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	Kenya has issues in terms of political stability, violence, terrorism, government effectiveness, regulatory quality and corruption control, which make Kenya an unstable trade market for the EU.	1	3	-
2	Kenya's GDP is low, presenting low energy consumption per capita. However, relatively high growth perspectives will increase energy demand (including biomass for energy) and other biomass uses. Therefore, major growth in domestic use of lignocellulosic biomass can be anticipated. This reduces the room for biomass export in the medium term.	2	-	2
Export conditions for biomass from forestry				
3	No uptake of sustainable forest management certification (SFM) is reported in Kenya, and the share of forest management plans is still quite low, so the sustainability of forest biomass from Kenya will be difficult to demonstrate.	2	2	-
4	Forest area and carbon stock in forests in Kenya are quite limited, but there is no loss of forest or forest carbon in recent years, resulting in stable greenhouse gas emissions from LULUCF. So Kenya forest biomass (residues) is not associated with a loss of forest carbon.	1	1	1
5	Considering that wood fuel is and will continue to be the primary source of energy for the majority of rural and urban poor population, there will be little room for exporting forest residues to the EU.	3	-	1
Export conditions for biomass from agriculture				
6	Kenya shows very low carbon content in the topsoil, and high irrigation needs. Further intensification of harvesting in agriculture may induce sustainability risks.	-	2	2
7	Kenya presents high levels of undernourishment and food inadequacy and shows high dependency on cereals imports. Therefore, the main aim of its agriculture should be to increase food provision.	2	1	1

Considering the low interest from Kenyan stakeholders, no dedicated webinar was organized for this region. The Advisory Board Meeting on 13th June had two African representatives. The comments below are a summary of their reactions and the comments received in the survey.

General conditions:

People had issues with parts of statement 2, particularly that a major growth in domestic use of lignocellulosic biomass can be anticipated.
Some more comments:

- Kenya is a developing country and its population is expanding in a fast way. A biomass policy will shape the domestic use and export of this commodity as the demand increases. Besides, there is a decline in forest cover limiting the potential of biomass for export.
- It is expected that solar power will take a larger share for electricity production. Transport biofuels will have an international market.
- Export would be needed to support the development of the first commercial Projects.

Export conditions for biomass from forestry

Contrary to the figures from FRA2015 which indicate rather stable carbon stocks in forests (statement 4), people indicated that deforestation is still a major issue in Kenya, mostly related to illegal charcoal production.
Comments related to forest biomass:

- Forest biomass is currently an important source of energy in the country, mostly through traditional uses. Deforestation is a big issue in Kenya, it should try to control illegal charcoal production. The production process is very inefficient and needs huge amounts of forest biomass. Efforts should focus on improving the biomass management in the country and not to export biomass.
- On the contrary, there is a high potential to increase productivity, logistics and refinement efficiency. Export income, e.g,. for refined transport fuels, could make a difference to Kenya.
- Similar to many other countries with good growing potentials for biomass, the most reasonable export opportunity for Kenya is biomass (products) from plantations.

Export conditions for biomass from agriculture

People didn't agree that intensification of agriculture would be a negative point (statement 6).
Some comments related to agricultural biomass:

- The main aim should be to introduce a social welfare system. If people have money to buy food, food production will come first.
- An increase in agricultural production will lead to an increase in agricultural waste for energy. Improving biochar application efficiency can increase food production and yields.

9.3.Final SWOT table for Kenya

Table 27: SWOT of Kenya as a sourcing region for biomass to the EU, in relation to regulations and governance

Kenya	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general			Kenya has issues in terms of political stability, violence, terrorism, government effectiveness, regulatory quality and corruption control, which make Kenya an unstable trade market for the EU. Low GDP and relatively high growth perspectives, which may induce an increase in energy demand, and potentially also other uses of biomass (food, materials).
Forestry biomass			Serious loss in forest area and forest carbon stocks in the 1990s. There are issues with illegal charcoal production. Growing population increases pressure to forest. Considering that wood fuel is and will continue to be the primary source of energy for the majority of rural and urban poor population, there will be little room for exporting forest biomass to the EU. High share of private ownership of forests No uptake of sustainable forest management certification (SFM) is reported in Kenya, and the share of forest management plans is still quite low, so the sustainability of forest biomass from Kenya will be difficult to demonstrate.
Agricultural biomass	High opportunities to increase productivity, which also bring along residues (that can be		Very low average carbon content in the topsoil Relatively high freshwater withdrawal in agriculture High levels of undernourishment or food inadequacy; 36%

	used for energy); trade opportunities could be a trigger.		dependency on cereal imports. The main aim of its agriculture should be to increase food provision.
Climate policy & renewable energy		Clear attention for biomass in National Energy Policy document Very low energy consumption and low GHG emissions related to fossil fuel consumption, which are likely to increase with economic growth	High level of traditional (unsustainable) biomass use (wood fuel)

10. Strategies and SWOT for Ukraine

10.1. Bioenergy strategies in Ukraine

Renewable sources of energy can play an important role in meeting Ukraine's energy needs and generating green growth. First, the country currently has a high level of energy intensity, almost three times the average of industrialised countries.
Second, the natural gas price is expected to increase, therefore creating an incentive to switch to cheaper sources of energy.
Ukraine has significant natural endowments in the field of renewable energy. In particular, the country's abundant agricultural and forestry waste is a key asset for developing heat and power generation based on biomass. Ukraine's substantial potential for producing energy from renewable sources remains largely untapped. [51]

In cooperation with the European Union, Ukraine joined the Energy Community in 2011, in that way committing to binding renewable energy targets by 2020. The **Ukraine National Renewable Energy Action Plan** (NREAP)[52] is the document setting the targets of use of renewable energy sources until 2020, as well as the manner of their achievement. Amongst other things, its aim is to enhance investments into the field of renewable energy sources.

Ukraine's renewable energy 2020 targets:

- Overall target: 11% of share of energy generated from renewable sources in gross final energy consumption;
- Heating and Cooling: 12.4% of demand met by renewable energy sources;
- Electricity: 11% of electricity demand met by electricity generated from renewable energy sources;
- Transport: 10% of energy demand met by renewable energy sources.

The development of Ukraine's renewable energy production is supported by the following measures:

- Green feed-in tariff;
- Land tax reduction for renewable energy enterprises;
- Number of tax exemptions: (1) operating profits of the energy companies producing electricity from renewable sources; (2) biofuel producers' profits earned from biofuel sales; (3) company profits earned from combined electricity and heat production; (4) profits of producers of machines, equipment and devices for the manufacture and reconstruction of technical and transport means consuming biological fuel types; (5) value-added tax exemption for the transactions related to importation to Ukraine's customs territory of equipment working on renewable energy sources.

The support for the renewable energy producers has undergone significant changes at the beginning of 2015. The framework is currently not attractive anymore for the development of

[51] https://www.oecd.org/countries/ukraine/UkraineRenewableEnergy.pdf
[52] https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3430146/067A653E3AF24F62E053C92FA8C06D31.PDF

new renewable projects. Almost all new investment decisions for new projects have been postponed. The legislative inconsistencies (namely unexpected reduction of feed-in tariffs, cancellation of tax exemptions, etc.) are detrimental to the investment climate. This is jeopardizing the fulfilment of the 11% renewable energy target in 2020. [53]

In 2013 an updated '**Energy Strategy of Ukraine till 2030'** was adopted. The strategy sets new targets for different energy carriers such as electricity generation from renewable energy sources and nuclear power. The possibilities of bioenergy are basically ignored in this document.[54]

On 30 September 2015, Ukraine submitted an **INDC** for the Paris Climate Agreement, including the target to reduce GHG emissions including land use, land use change and forestry (LULUCF) by at least 40% below 1990 levels by 2030[55]. However, the most recent historical data shows that emissions excl. LULUCF have already declined by 57% below 1990 levels, while LULUCF sinks remain rather stable. This means that under Ukraine's INDC, emissions will grow by up to 39% of 2012 levels excl. LULUCF. Climate Action Tracker assessed this INDC as inadequate indicating that Ukraine's commitment is not in line with interpretations of a "fair" approach to reach a 2°C pathway.

[53] https://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Implementation/Ukraine/Renewable_Energy
[54] http://iet.jrc.ec.europa.eu/remea/sites/remea/files/files/documents/events/geletukha.pdf
[55] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Ukraine/1/150930_Ukraine_INDC.pdf

10.2. Draft SWOT statements and results of the stakeholder consultations

The following table shows the draft SWOT statements for Ukraine, and the reactions in the on-line survey. There were only 9 reactions. Statements with relative large disagreement are indicated in red.

Table 28: Draft SWOT statements for Ukraine and survey results

	Statement	Agree	Partially agree	Dis-agree
General conditions				
1	Ukraine has large issues at the moment in terms of political stability, rule of law and control of corruption, which make Ukraine an unstable trade market for the EU.	4	3	2
2	Ukraine's GDP is relatively low, with average energy consumption per capita. There is high reliance on fossil fuels; uptake of renewable energy (including biomass) is very low. Considering the global climate targets, Ukraine will need to do much more (current plans are inadequate); substantial efforts will be needed in renewable energy and a major growth in domestic use of lignocellulosic biomass can be anticipated. This reduces the room for biomass export in the medium term.	3	2	4
Export conditions for biomass from forestry				
3	The uptake of sustainable forest management certification (SFM) in Ukraine is relatively high, also related to the fact that all forests are in public hands. This facilitates the demonstration of the sustainability of forest biomass from Ukraine.	3	2	2
4	Forest area and carbon stock in forests in Ukraine has continued to grow in the past decades, resulting in a net greenhouse gas sink from LULUCF, so Ukraine forest biomass (residues) is not associated with a loss of forest carbon.	5	1	1
Export conditions for biomass from agriculture				
5	Ukraine has relatively high average carbon content in the topsoil and modest freshwater withdrawal, which are good conditions for agriculture.	6	-	-
6	Ukraine has sufficient area to supply domestic food and feed demand through its own agriculture – it is actually a major exporter of cereals. There is room to use agricultural residues, or for diversification to include non-food crops.	6	-	-

No webinar was organized for Ukraine. One participant from Ukraine provided extensive comments, which he entered into the survey.

General conditions:

Regarding the general condition for biomass trade, the survey participants didn´t agree the potential of biomass for export is limited when domestic use picks up. Although there are issues with political stability, new policy measures improve the use of biomass for energy in the short term and this creates an opportunity for export due the great biomass potential of Ukraine.
Some specific comments from survey participants:

- There is room both for increased domestic use of bioenergy and export of biomass. The situation may be unstable, but bioenergy is one big chance for the Ukrainian economy to improve, earning badly needed export income.
- Use of biomass for heat is taking off fast, also due to new legislation
- Western regions of Ukraine (Carpathians and North-West) considerably differ from the rest of the country and thus are way more attractive for investments. Different kinds of investment start-ups have been observed there since 2015, even on biomass. All of those regions are geographically located at the boarders of the EU and can be attractive for exports.
- After the government changed early 2014, the former widely established corruption system is changing. The remnants of that system are still there unfortunately. There are new investments since 2015 even though the war goes on in the country. Most significant investments are observed in the agrarian sector and sea ports logistics (Black Sea region).
- Ukraine's GDP is very low because of the national currency devaluation in 2014 and 2015. Before that, exports from Ukraine to EU became very attractive (more feasible than in 2012 and 2013 when national currency value was manually controlled by government). On the other hand, because of low average income per capita only the cheapest biomass will be used for domestic use. More valuable commodities like wood pellets and briquettes (especially of better quality) are traded to the EU. Ukraine may reach its climate change targets if low quality forestry residues and agricultural residues are managed and utilised.

Export conditions for biomass from forestry

Regarding this issue, the survey participants generally agreed with the proposed statements.
Additionally some comments were given:

- The question is how to collect and export forest residues, which may be a big challenge in Ukraine.
- Forestry certification was introduced mostly through grant projects or other ways of external support. These days a number of companies had their certificates expired because they were not willing to pay for certification costs themselves. The very fact that most forests are public had unfortunately made those subject to corruption. Last year Ukraine tried to introduce rules to reduce illegal logging. Most of the corruption was focused to export as much timber and fuel wood as possible. Early 2016 it became publicly clear that regardless of the new rules there is ongoing destruction of forests.

Huge areas inside forests were deforested. This led to wide protests to force the government to take effective protective measures. Even the government from the Transcarpatia region was involved in protests and claimed that too much of timber exported through customs is of illegal origin. At this moment the government (ministry of environment and forestry agency) must come up with the steps to address concerns of corruption and deforestation more effectively. More than half of fuel wood export from Ukraine to EU27 was supplied to one single country, Romania. Therefore sustainability of forestry biomass in Ukraine can't be taken for granted. In every business case, one must make sure that the source of the biomass is 100% legal. These days it is possible to build up transparent biomass business if one is determined to operate sustainably and avoid the risks. Before the change of government in 2014 it was almost impossible.

Export conditions for biomass from agriculture

Survey participants fully agree with the statements on agricultural biomass:
Additional comments:

- Low quality of agricultural residues is a very large issue making export for energy generation a challenge.
- Ukraine has large areas (millions of hectares) of abandoned and badly used farmland that can be used either for cellulosic biomass production or for production of biofuel crops like corn, wheat, rape, sunflower, willows, poplars etc. Therefore, the main potentials can be developed in form of energy plantations on the very large areas of abandoned former agricultural land. No restrictions should be made if these energy crops are "food" or "non-food" crops.

10.3. Final SWOT table for Ukraine

Table 29: SWOT of Ukraine as a sourcing region for biomass to the EU, in relation to regulations and governance

Ukraine	Strengths / Opportunities	Neutral	Weaknesses / Threats
Economy & governance in general		Relatively low GDP and relatively high growth perspectives, which may induce an increase in energy demand, and potentially also other uses of biomass (food, materials).	Ukraine has issues at the moment in terms of political stability (current crisis), violence/terrorism, government effectiveness, regulatory quality, rule of law and corruption, which was institutional in the past. The system is changing, but the remnants of the old system are still there.
Forestry biomass	High potential of forest biomass 27% of forests are FSC certified. Substantial amount of forests affected by insects/diseases. This opens up volumes for energy use. The State Target Program 'Forests of Ukraine for the period of 2010 – 2015 foresees the annual construction of more than 1.500 km of forest roads to provide access to wood resources and to increase the logging/felling/collection of wood residues	Most forests are in public ownership; 92% of forests have a forest management plan. Moderate increase in forest area and forest carbon stocks	Illegal logging of forest biomass is an issue, which puts into question the adequacy of forest management plans for public forests.
Agricultural biomass	Ukraine has sufficient area to supply domestic food and feed demand through its	Low quality of agricultural residues is a very large issue	

	own agriculture – it is actually a major exporter of cereals. There is room to use agricultural residues, or for diversification to include non-food crops. Ukraine has relatively high average carbon content in the topsoil and modest freshwater withdrawal, which are good conditions for agriculture. Ukraine has large areas (millions of hectares) of abandoned and badly used farmland that can be used either for cellulosic biomass production or for production of biofuel crops like corn, wheat, rape, sunflower, willows, poplars etc.	making export for energy generation a challenge.	
Climate policy & renewable energy		Limited role of traditional biomass New policy measures improve the use of biomass for energy in the short term and this creates an opportunity for export due the great biomass potential of Ukraine.	The Ukraine climate action plan (INDC) is classified as 'inadequate', meaning 'if all governments put forward inadequate positions warming is likely to exceed 3–4°C' Efforts in the past to introduce renewable energy have been limited, so current energy provision has a limited role for renewables and biomass.

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