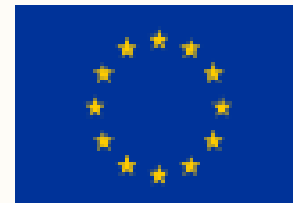




S2Biom

Ukraine

**Outlook of lignocellulosic biomass and
relevant policies for a bio-based economy
in 2030**



What types of lignocellulosic biomass are included in the analysis?

Lignocellulosic biomass in this analysis includes:

- Forest biomass from primary forestry productions (fellings), primary field residues and secondary forest industry residues;
- Agricultural biomass from primary field activities;
- Biowastes and post consumer wood;
- Dedicated perennial crops.

Context

S2Biom provides data and evidence relating to:

- indigenous, sustainable lignocellulosic biomass feedstock potentials at national/regional/local levels;
- resource and energy efficient value chains which are expected to be implemented at scale by 2030;
- policies that can facilitate uptake of indigenous lignocellulosic biomass.

Key questions, addressed by S2Biom

- Where is biomass found?
- What is estimated sustainable potential by 2030?
- What are the sustainable potentials by biomass type and where can they be found?
- Which value chains have high resource and energy efficiency?
- What is the national policy landscape?
- What future policy interventions can be considered based on good practice?

Where is biomass found?

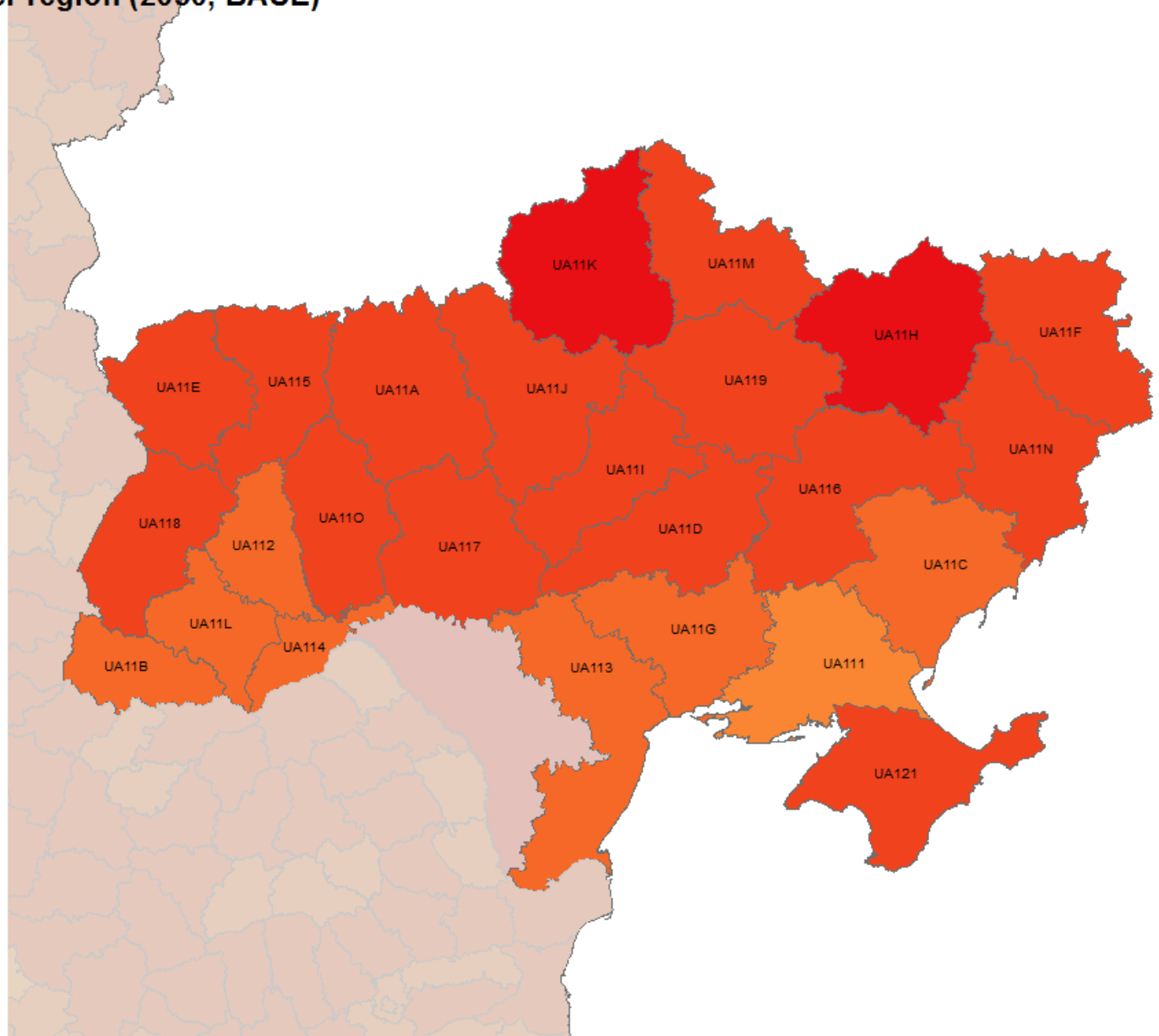
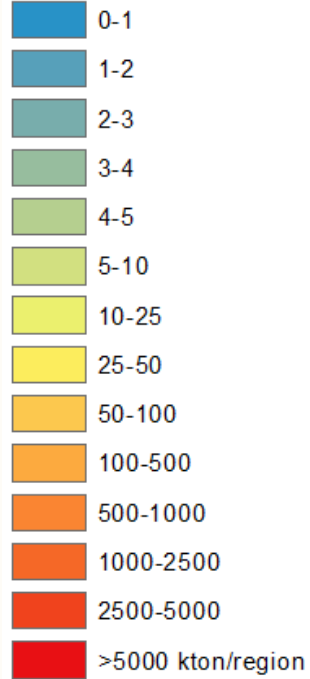
- The following slide presents a map with total sustainable* occurrence of lignocellulosic biomass by region, measured in '000 dry tonnes per year

* The estimated potentials include sustainability criteria as required by the Renewable Energy Directive.

Total lignocellulosic biomass by region

Supply in kton DM per region (2030, BASE)

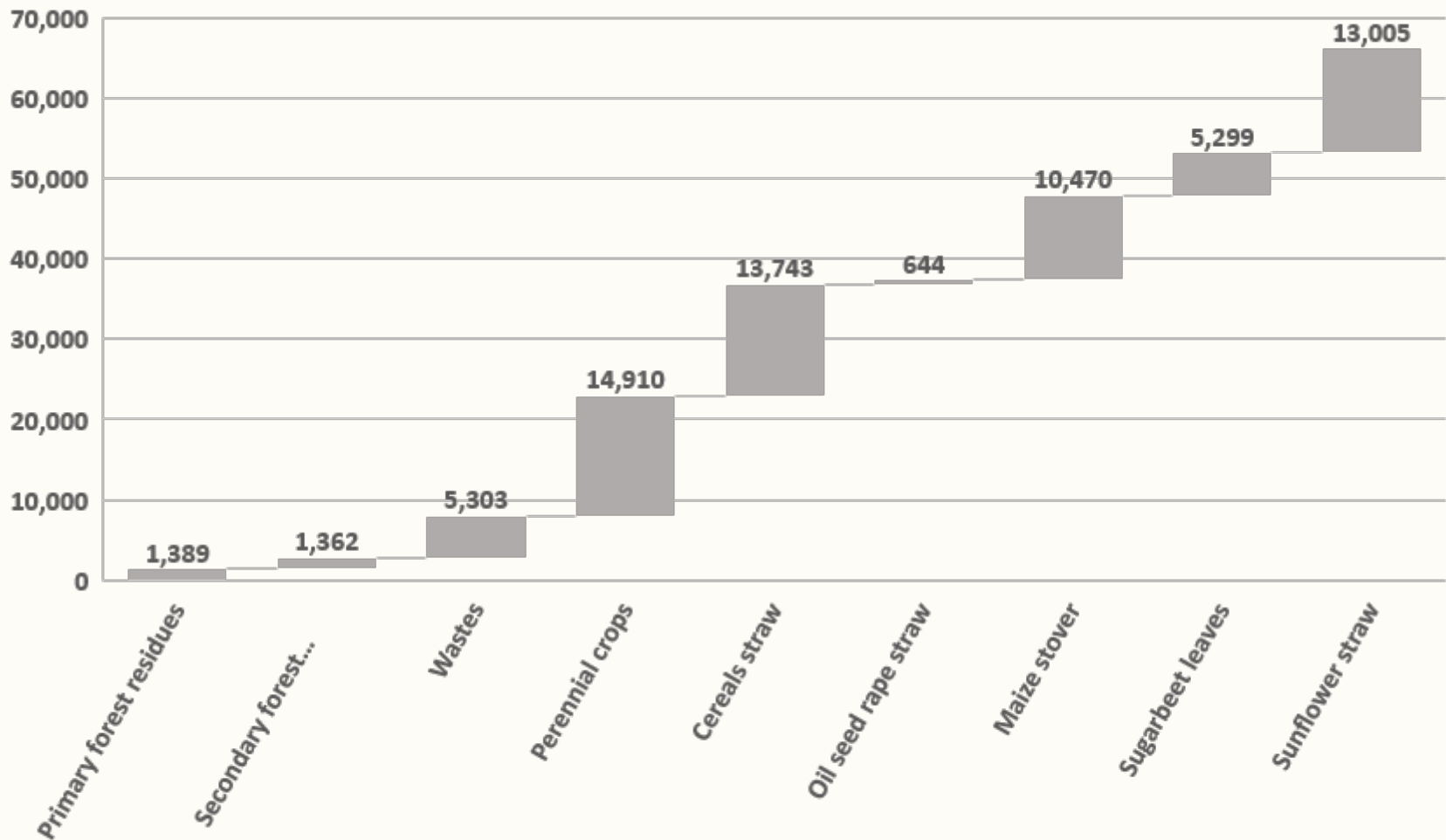
total_all



What is the availability per biomass type?

- Sustainable potential from residues, dedicated perennial crops, biowastes and post consumer wood totals 66.13m dry tonnes / year.
- Primary forestry production accounts for an additional 13.8m dry tonnes / year.
- The following slide presents a graph of potential available lignocellulosic biomass by source, excluding primary forestry production.

Lignocellulosic biomass availability by source by 2030 ('000 dry tonnes)

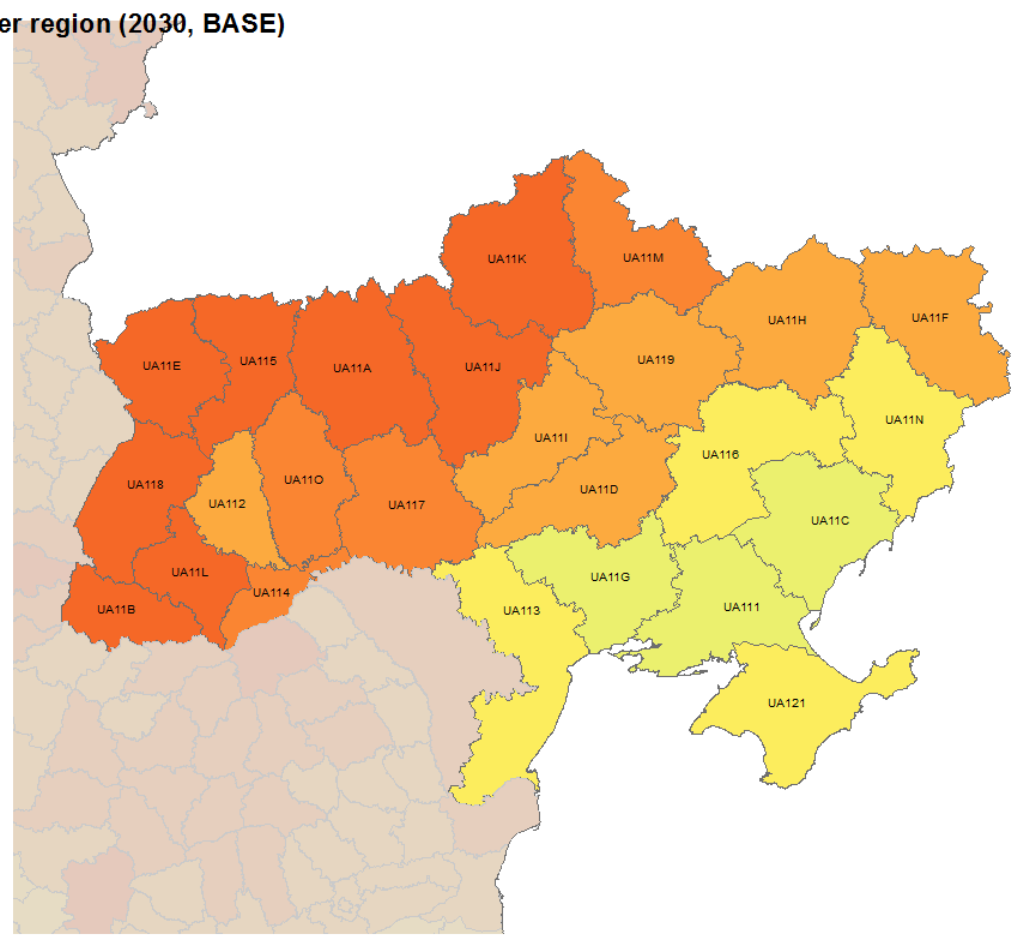
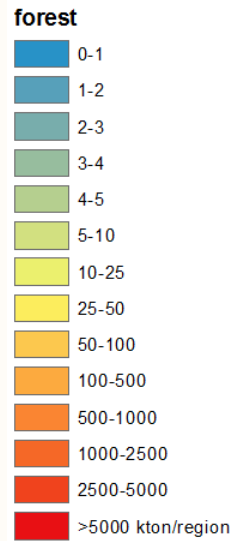


What are the sustainable potentials by biomass type and where can they be found?

- The following slides present maps of estimated sustainable potential lignocellulosic biomass by region and by main source, namely:
 - Forest (primary forestry production, field residues and secondary agricultural residues)
 - Agriculture (primary field residues and tree prunings)
 - Biowastes and post consumer wood
 - Dedicated perennial crops

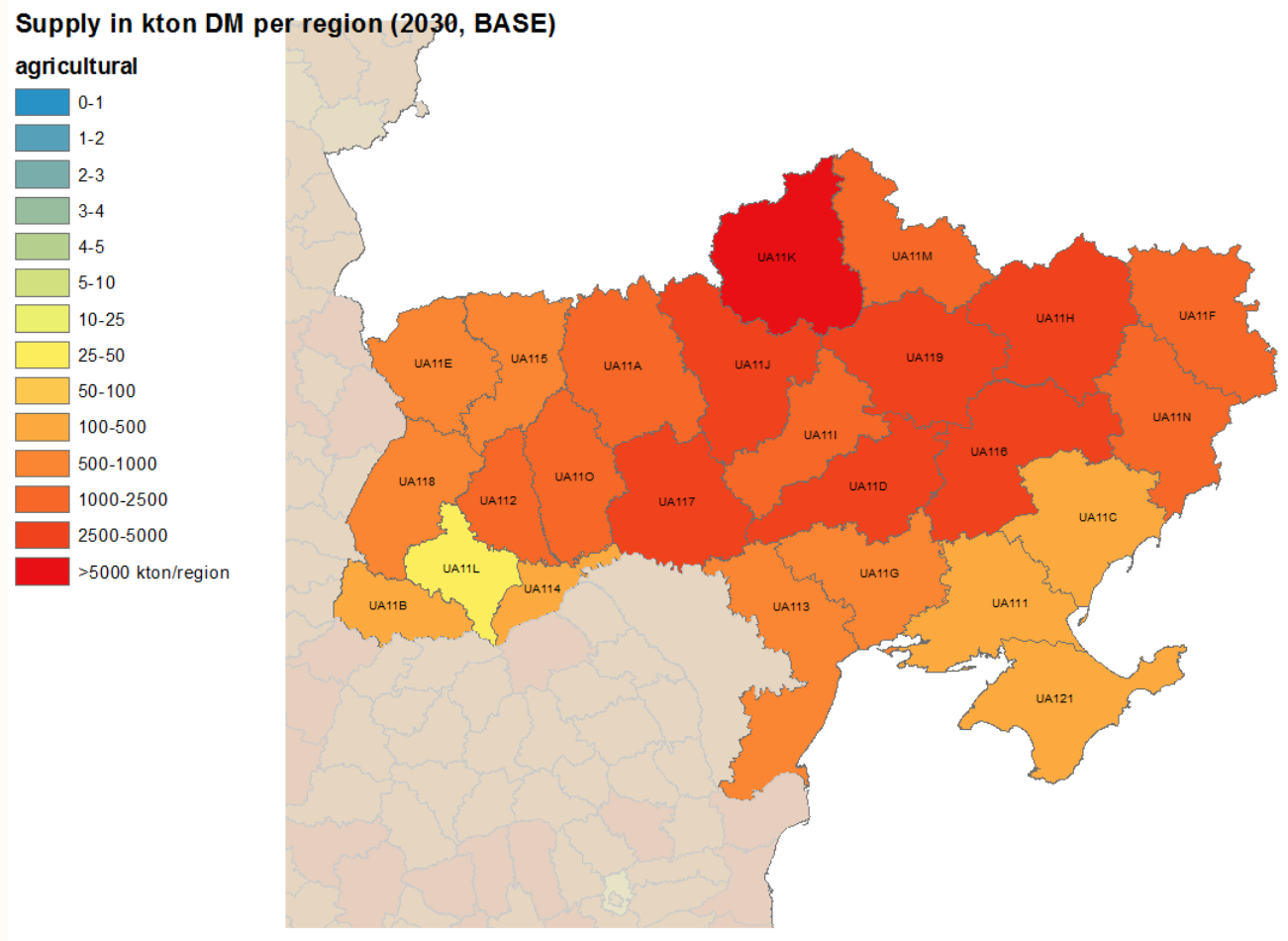
Forest

Supply in kton DM per region (2030, BASE)



- Estimated sustainable potential can reach up to 16.6m dry tonnes/ year

Agriculture

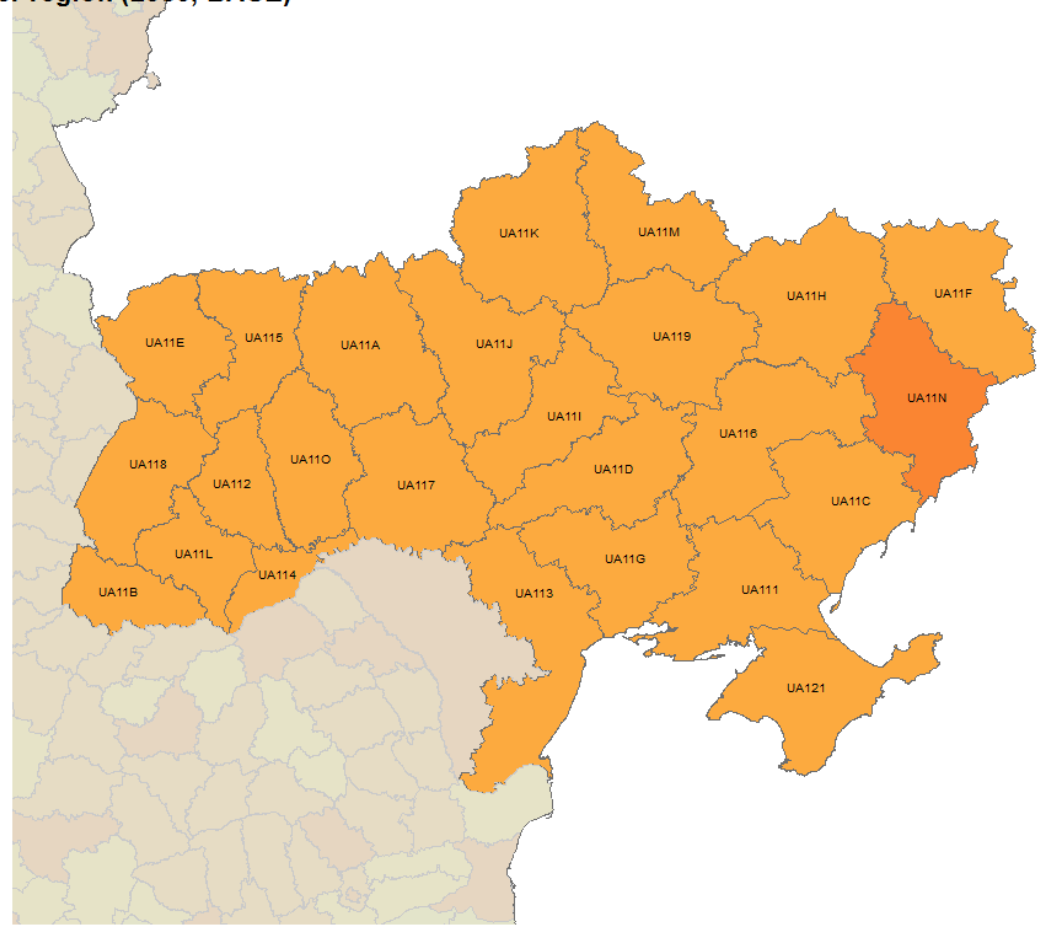
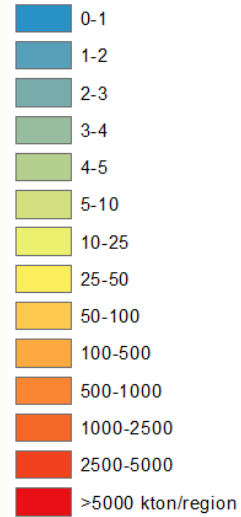


- Estimated sustainable potential can reach up to 43.2m dry tonnes/ year

Biowastes and post consumer wood

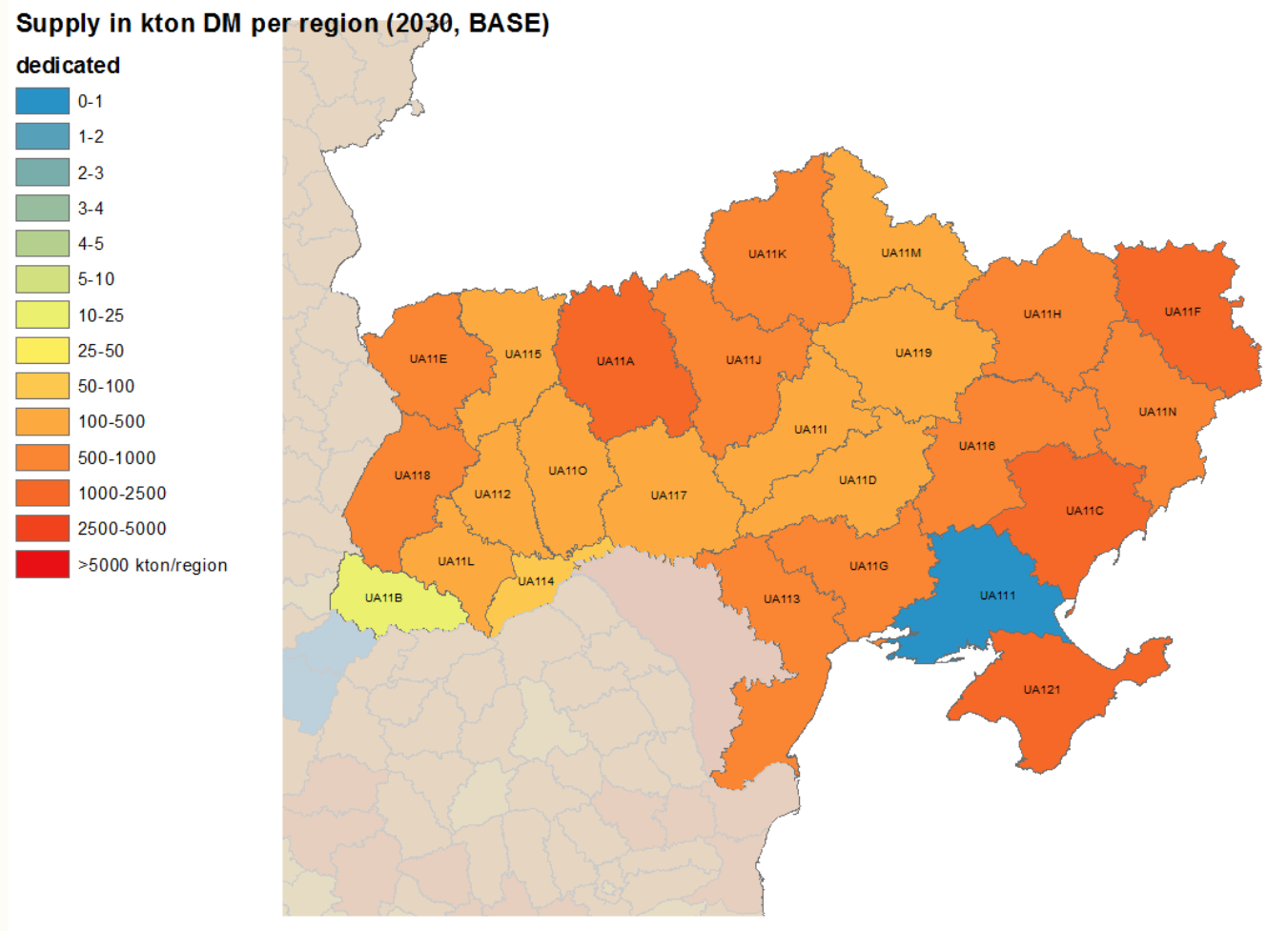
Supply in kton DM per region (2030, BASE)

waste



- Estimated sustainable potential can reach up to 5.3m dry tonnes/ year

Dedicated perennial crops



- Estimated sustainable potential can reach up to 14.9m dry tonnes/ year

Which value chains have high resource and energy efficiency?

- The following show value chains with relatively high efficiency in the following aspects
 - Energy efficiency
 - Greenhouse gas emissions
 - Air quality
 - Technological maturity

Value chains: forest and agriculture

	Energy efficiency	Greenhouse gases	Air quality	Technological maturity
Combustion at small scale including households				
Strength	High conversion efficiency with modern technology	Low fossil input in the value chain	-	Fully commercial, long experience
Weakness	Older stoves have low conversion efficiency. Heat not always efficiently used.	-	High emissions from older wood stoves.	-
Combustion at small-medium scale including buildings				
Strength	High conversion efficiency	Low fossil input in the chain	-	Fully commercial, long experience
Weakness	-	-	Emissions better than smaller scale but higher than natural gas.	-
Combustion at medium scale, heat led				
Strength	High conversion efficiency	Low input of fossil fuels; high GHG savings especially for Combined Heat and Power	Better control options for emissions	Fully commercial
Weakness	-	-	Higher emissions than natural gas combustion.	-
Biochemical - lignocell. hydrolysis and fermentation				
Strength	-	High GHG savings in case of process integration and limited fossil input.	Ethanol has low emissions as transport fuel.	-
Weakness	Around 50% conversion efficiency	-	-	Pre-commercial phase

Value chains: wastes

	Energy efficiency	Greenhouse gases	Air quality	Technological maturity
Waste incineration and energy recovery				
Strength	Adding energy recovery to waste management improves its pathway; high efficiency if CHP	High GHG benefit, particularly compared to landfill (avoided methane emissions); energy recovery substitutes fossil fuels	If landfill is avoided, lower air emissions.	Fully commercial
Weakness	Relatively low net energy output; - auxiliary fuel may be required due to low calorific value of fuel	-	Issues in terms of emissions of waste incineration. Emission control is circa one third of project cost.	-
Combustion at medium scale, heat driven)				
Strength	>85% conversion efficiency in case of heat only; 65-85% efficiency for CHP installations.	Low input of fossil fuels; especially in case of CHP GHG savings can be high	Better control options for PM emissions compared to small scale installations.	Fully commercial
Weakness	-	-	Still higher PM emissions than natural gas combustion.	-
Gasification & CHP at medium scale - heat driven				
Strength	Up to 80% conversion efficiency, depending on heat only or CHP installations.	Low/no input of fossil fuels; especially in case of CHP GHG savings can be high	Low emissions of gas engine or turbine	(Early) commercial

What is the national policy landscape?

- The following slides provide diagrams to illustrate how existing policies / measures support one or more of the following:
 - Biomass supply
 - Logistics
 - Conversion
 - Distribution
 - End use
- Policies / measures are categorised as: (1) Regulation, (2) Financing and (3) Information

* Policy mapping and respective recommendations are the result of intensive review but as the field is dynamic the authors appreciate there may be missing elements.

Current policy: forest

Biomass Supply

Logistics

Afforestation and reforestation

Additional activity for development of forestry

Forest Code of Ukraine

Land Code of Ukraine

Law on plant life

Law on Safety for Forestry workers

Sphere of competence of the State Forestry Committee

State Forest Committee validating the form of Certificate of origin of timber and sawn timber for export operations

Forests of Ukraine 2002-2015

Certificate timber for export

Conversion

Distribution

End Use

Alternative Energy Sources

Combined Heat and Power (cogeneration) and Waste Energy Potential

National Renewable Energy Action Plan- NREAP

Feed-in tariffs

Corporate profit tax exemptions

Electric energy

Energy savings

Fuel excise tax

VAT and Customs Duties Exemptions

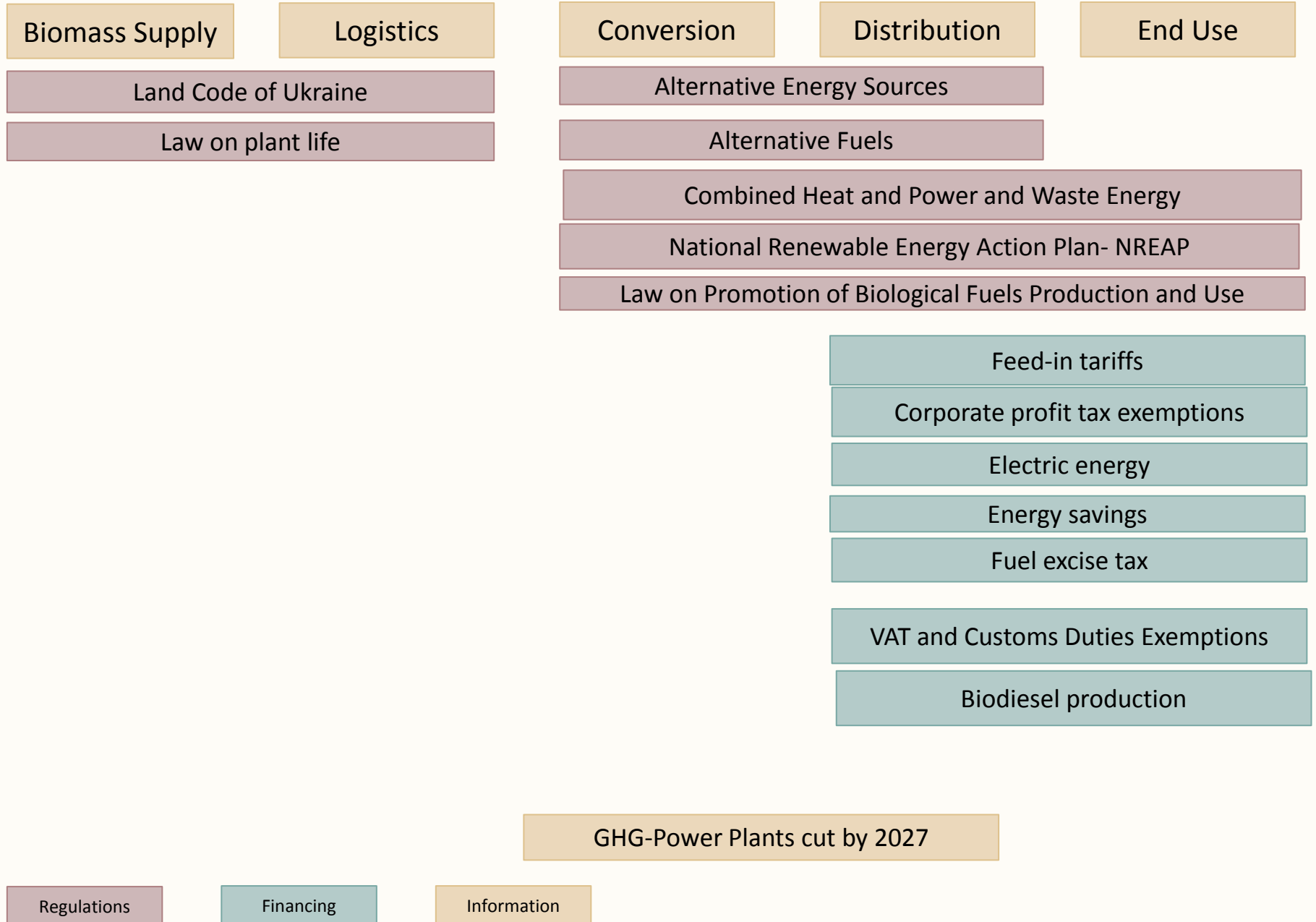
GHG-Power Plants cut by 2027

Regulations

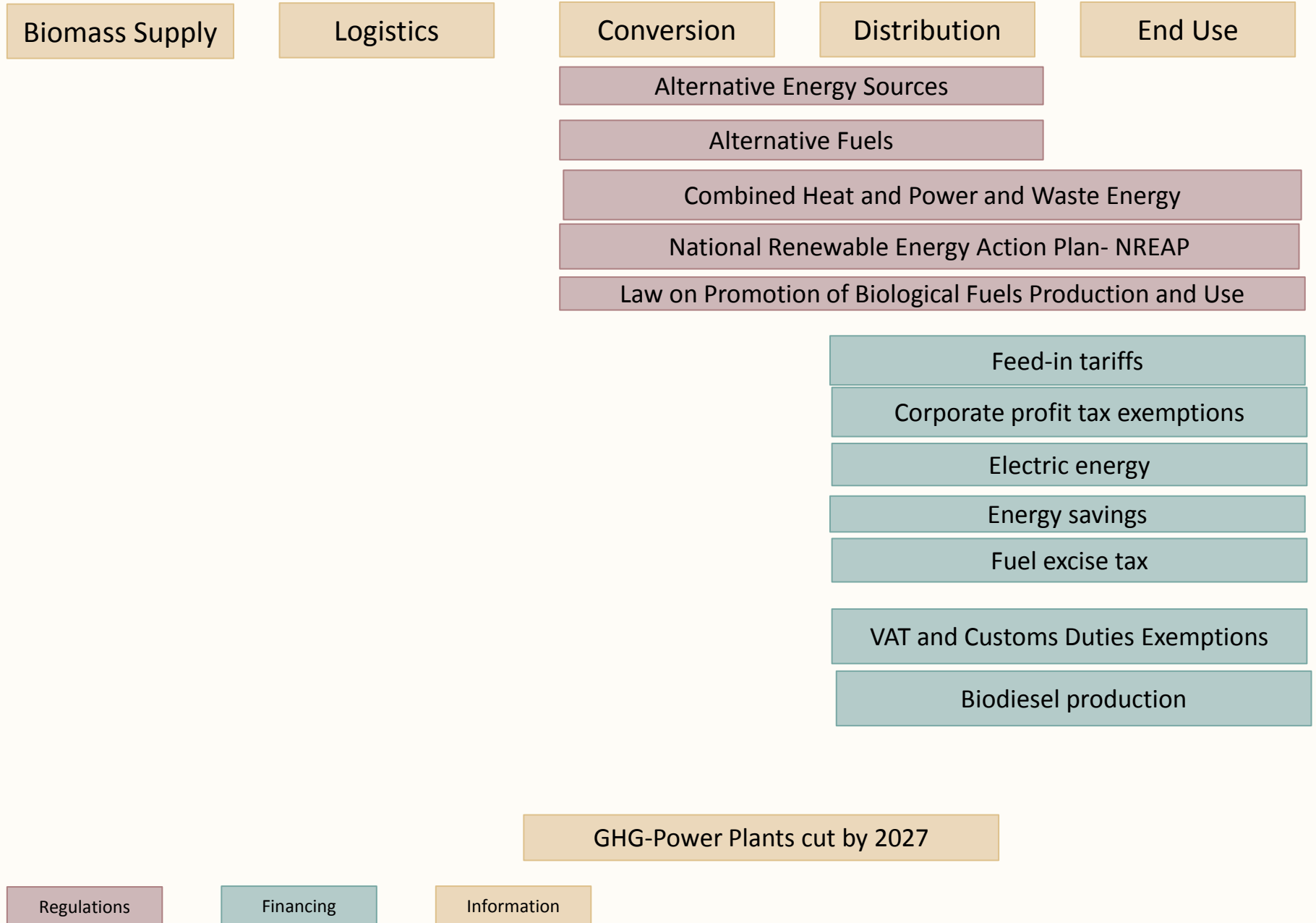
Financing

Information

Current policy: agriculture & dedicated crops



Current policy: wastes



What improvements can be made based on good practice?

- The following slides illustrate selected policies from Member States that have had significant positive impact in promoting the use of lignocellulosic biomass
- Based on this Good Practice, recommended new policies are shown (shaded boxes) to complement existing policies



* Policy mapping and respective recommendations are the result of intensive review but as the field is dynamic the authors appreciate there may be missing elements.

Good Practice- Feedstocks

● High impact ● Moderate impact

Biomass sourcing

Logistics

Wastes

AT: Waste management & Regulation on recycling of waste wood ●

BE: VLAREM- collecting & treatment ●

DE: Kreislaufwirtschaftsgesetz-KrWG- Waste disposal ●

NL: strategic initiative for anaerobic digestion of MSW- organics ●

FI: private forest owners ●

FI: forest certification ●

BE: Subsidies for afforestation and forest management ●

Agricultural biomass

AT: ÖPUL – Austrian Agri-environmental Programme: Tailored investment support with market sector focus ●

DE: EEG- Feedstock bonus for plants using straw ●

Dedicated crops

DE: ÖPUL – “Gemeinschaftsaufgabe Agrarstruktur und Küstenschutz” provides farmers with financial support for the cultivation of short rotation coppices. ●

Good Practice- End use sectors

● High impact ● Moderate impact



Heat

- UK: Renewable Heat Initiatives (RHI) ●
- AT: Climate and Energy Fund-Subsidy scheme wood heating. ●
- NL: Energy Investment Allowance (EIA), tax reductions for boilers ●
- ES: BIOMCASA I & II, funding for efficient use of biomass ●
- DE: repayment bonus from market program (MAP) and soft loans with low interest rates public sector bank KfW ●

CHP

- AT: Green Electricity Act & CHP Act: refines scales of applications and target specific sectors and biomass resource types and end uses. ●
- DE: Renewable Energy Sources Act 2014 - Act (EEG 2014); Market premium (in EEG § 35); Flexibility premium for existing installations (EEG, § 54) ●
- UK: Renewables Obligation (RO) scheme, based on green certificates favouring certain technologies ●

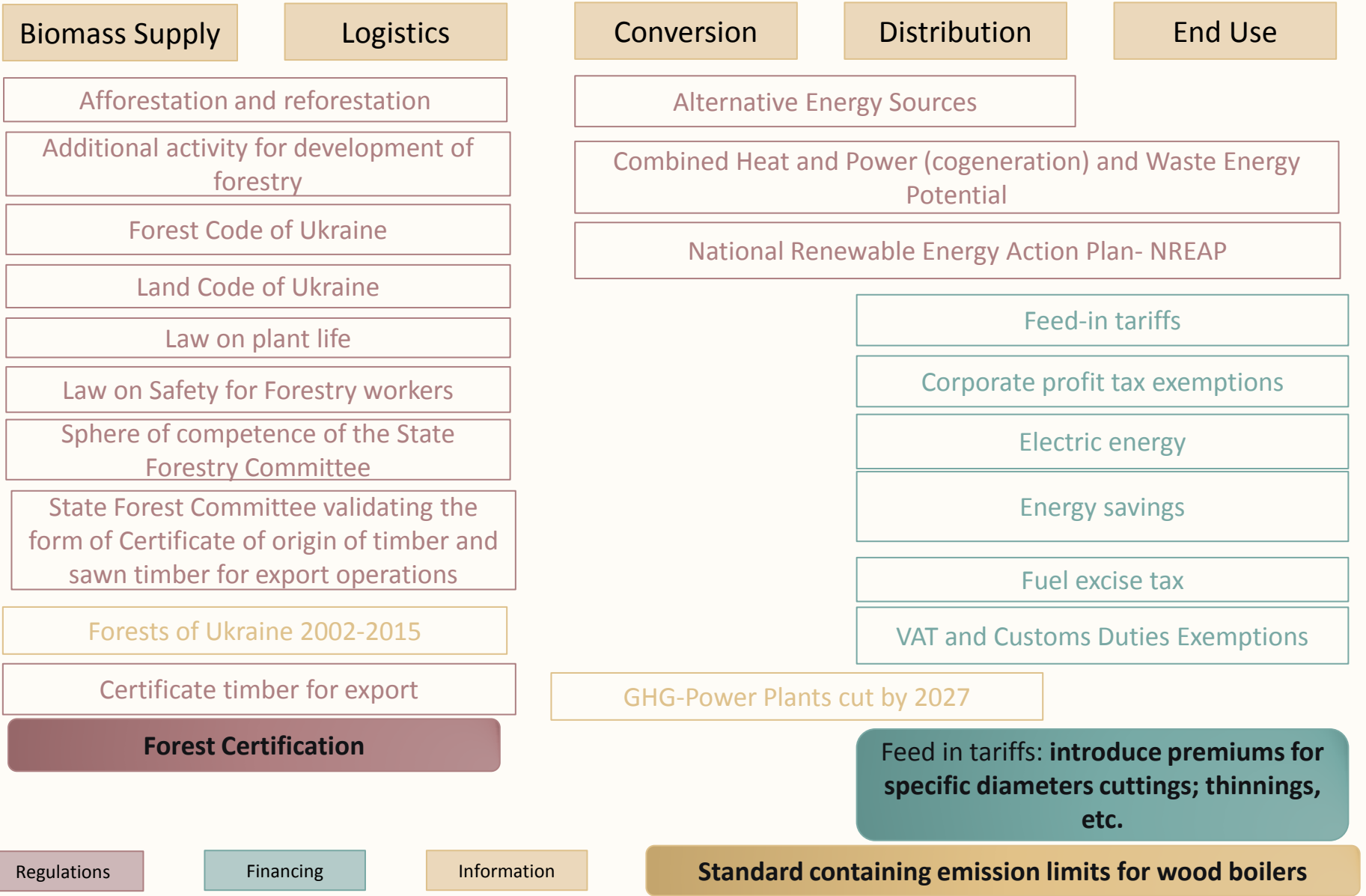
Transport biofuels

- DE: Federal Immission Control Act (BImSchG) ●
- UK: Renewable Transport Fuel Obligation (RTFO) and certification system ●
- DE: Energy Tax Act (EnergieStG) : It accounts for transport biofuels ●
- FI: Act of Excise Duty on Liquid Fuels, a taxation system, in which each component of a liquid fuel is taxed separately, based on its energy content and carbon dioxide emission, meaning reduced taxation for biofuels ●

Biobased products

- DE: National Bioeconomy Strategy
- DE: National Bioeconomy Strategy
- SE : Swedish Research and Innovation Strategy for a Bio-based Economy

Policy interventions to consider: forest



▪ Shaded boxes show recommended new policies to complement existing policies

Policy interventions to consider: agriculture & dedicated crops

Biomass Supply

- Land Code of Ukraine
- Law on plant life

Logistics

Conversion

- Alternative Energy Sources
- Alternative Fuels
- Combined Heat and Power and Waste Energy
- National Renewable Energy Action Plan- NREAP
- Law on Promotion of Biological Fuels Production and Use

Distribution

End Use

- Feed in tariffs introduce premiums for agricultural residues & dedicated crops**
- Corporate profit tax exemptions
- Electric energy
- Energy savings
- Fuel excise tax
- VAT and Customs Duties Exemptions
- Biodiesel production

Standards for agricultural biomass

GHG-Power Plants cut by 2027

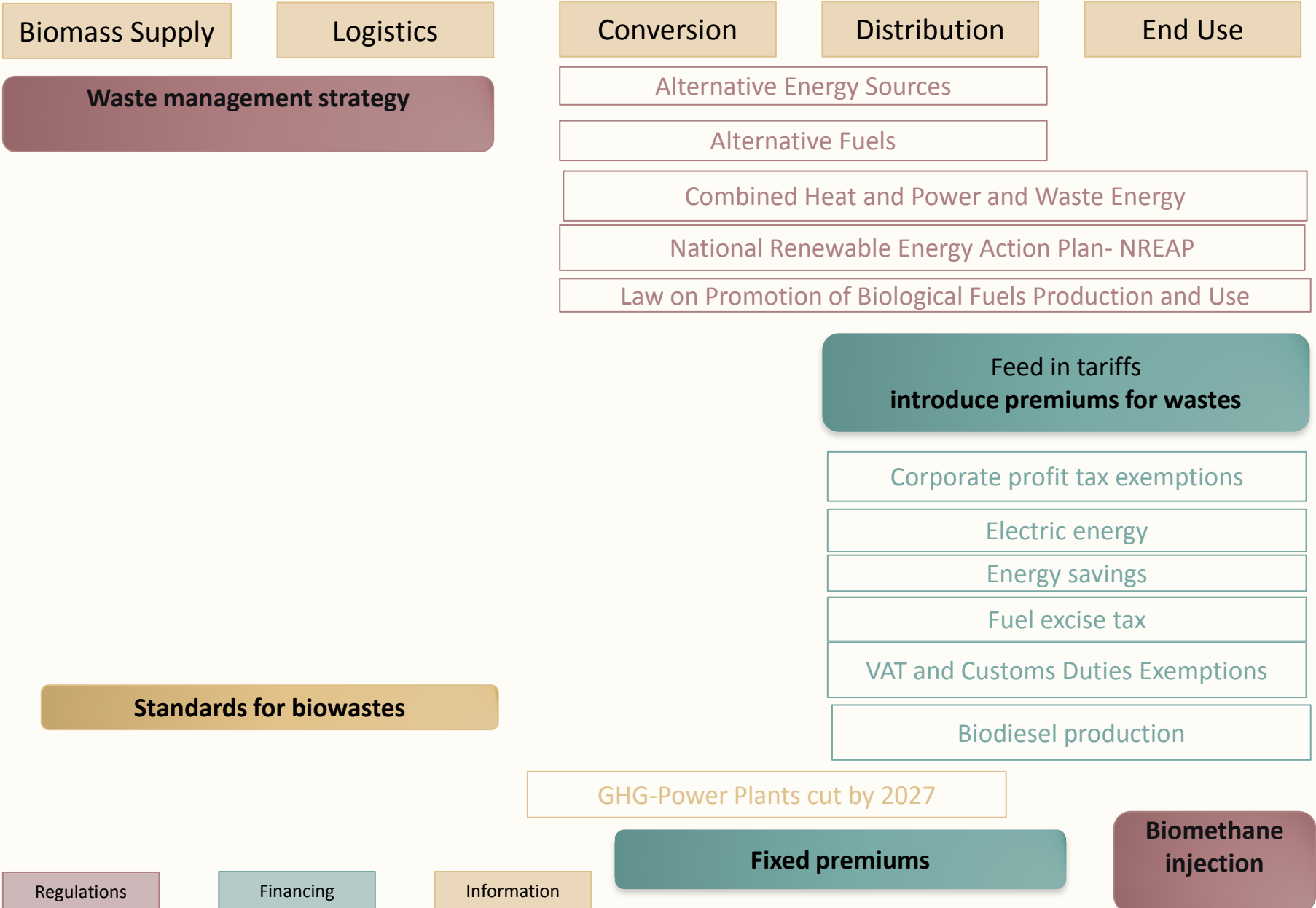
Regulation on agricultural raw materials for biofuels and bioliquids

Regulations

Financing

Information

Policy interventions to consider: wastes



Conclusions

- Ukraine has very high national lignocellulosic biomass potential at around 66.1m dry tonnes / year (excluding primary forest harvest), with agriculture being the main source, with dedicated crops also very substantial.
- The existing policy framework is generally well developed with a number of measures for each sector.
- The study has recommended a number of new targeted laws, regulations, standards and finance mechanisms to help Ukraine realise its large potential for a bio based economy by 2030.

More information on: <http://s2biom.alterra.wur.nl/>

c.panoutsou@imperial.ac.uk

