Roadmap for lignocellulosic biomass in the Danube region

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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:

- domestic, sustainable lignocellulosic biomass feedstock potentials at national, regional and local levels;
- resource and energy efficient value chains which are expected to be implemented at scale by 2030;
- Policy related roadmap actions, based on good practice, that can facilitate uptake of indigenous lignocellulosic biomass.

Key questions, addressed by S2Biom

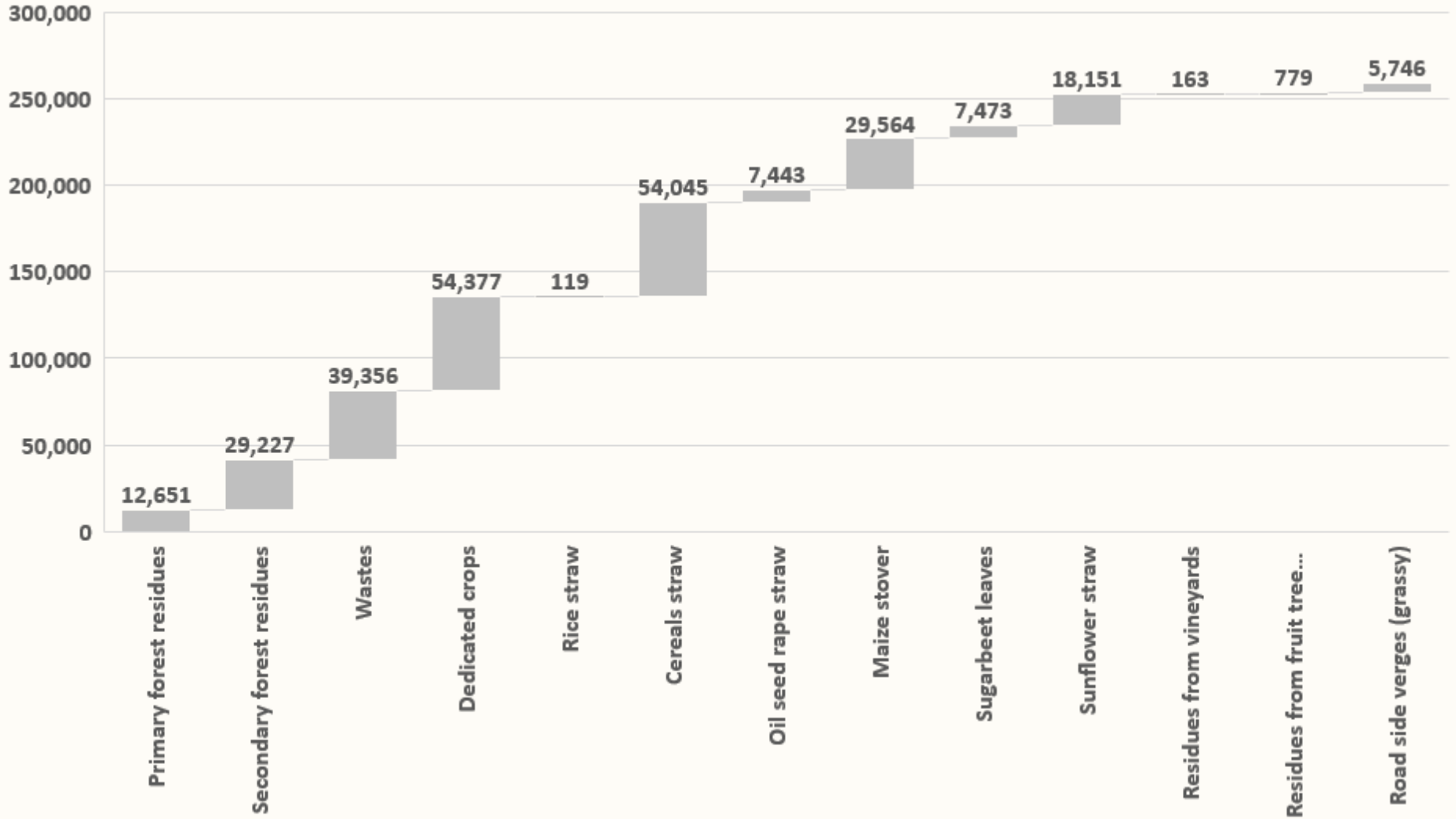
- What is estimated sustainable potential by 2030?
- What are the sustainable potentials by biomass type and where can they be found?
- Which value chains have high resource and energy efficiency?
- Which are the recommended roadmap actions based on current good practices

What is estimated sustainable* potential by 2030?

- Sustainable potential from residues, dedicated crops, biowastes and post consumer wood in the Danube region totals **260 m dry tonnes / year**.
- Primary forestry production accounts for an additional **118m dry tonnes / year**.
- The following slide presents a graph of potential available lignocellulosic biomass by source, excluding primary forestry production.

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

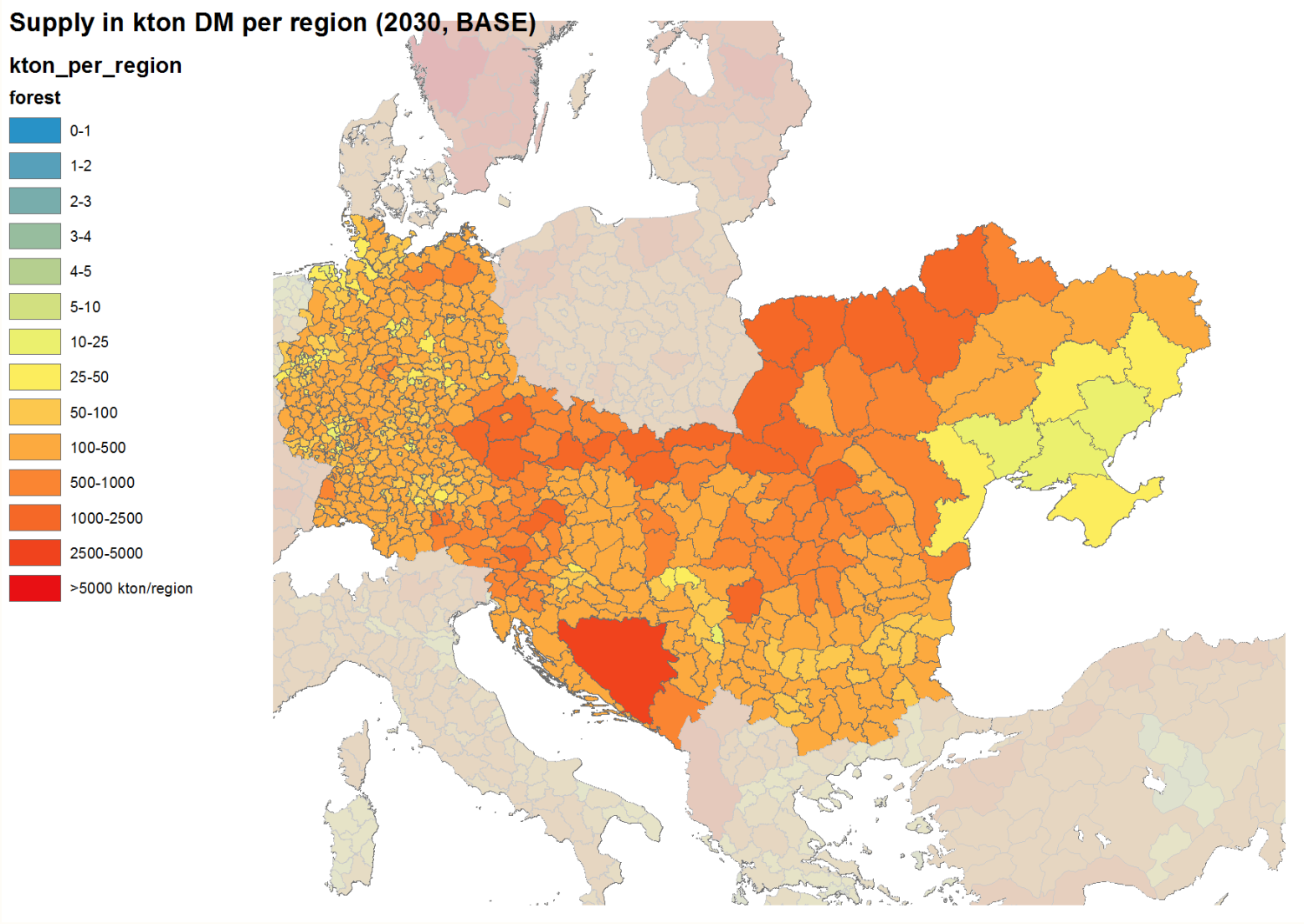
Lignocellulosic biomass availability by source by 2030 ('000 dry tonnes)



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

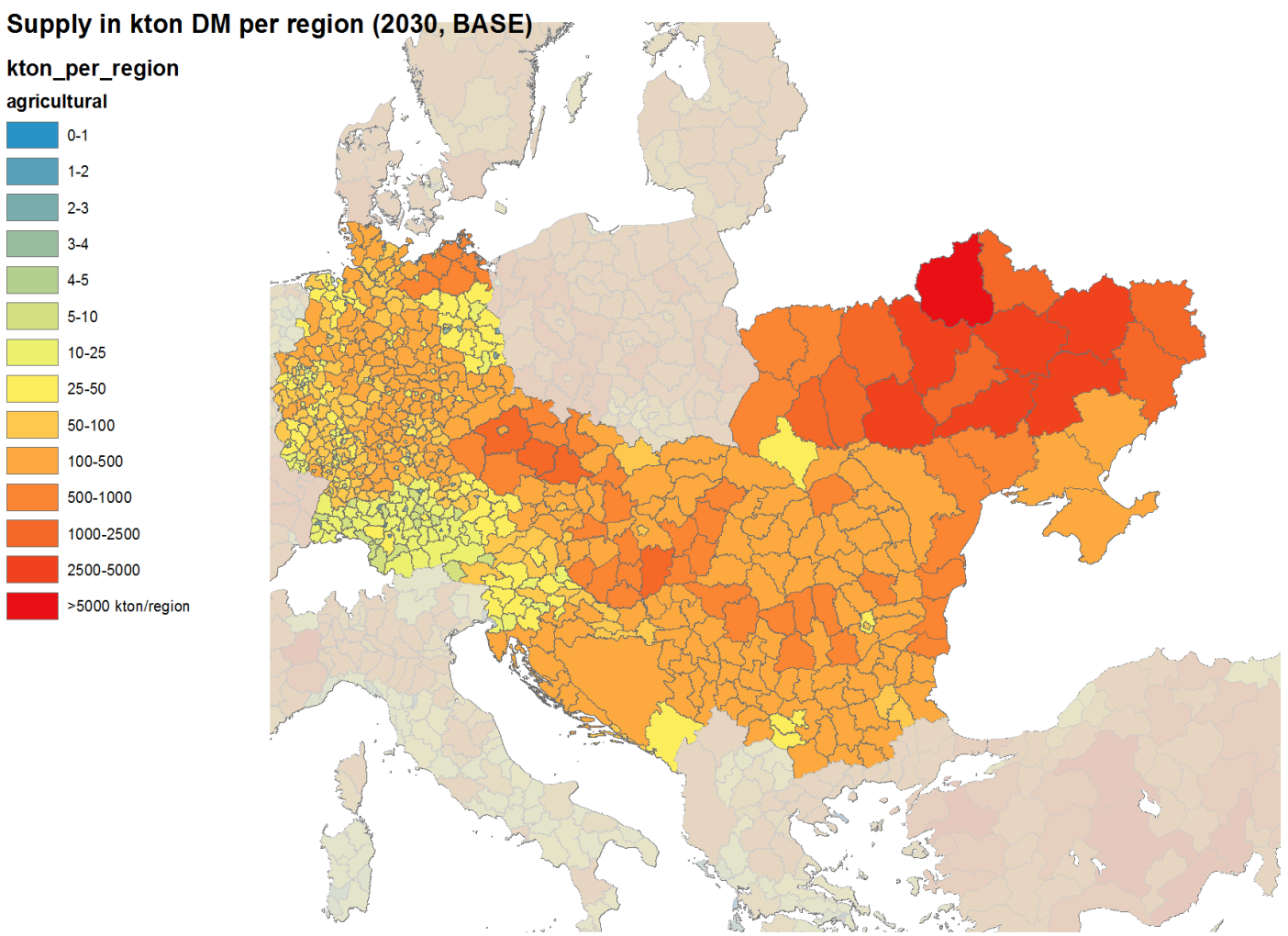
- The following slides present maps of estimated sustainable potential lignocellulosic biomass by region and by main source, namely:
  - Forest (primary forestry production, field residues and secondary forest residues)
  - Agriculture (primary field residues and tree prunings)
  - Biowastes and post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

Forest



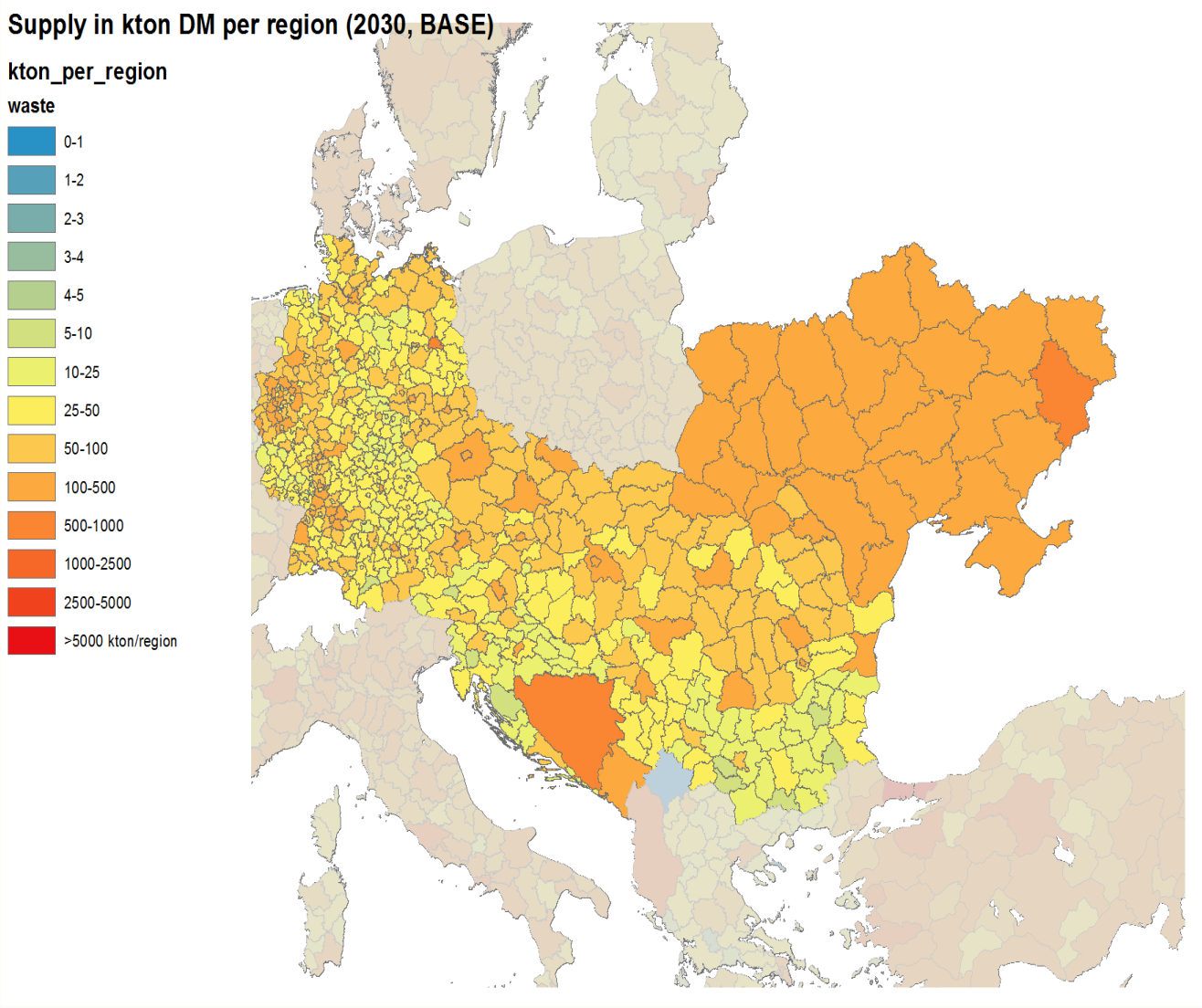
- Annual sustainable potential up to **160 m dry tonnes**

Agriculture



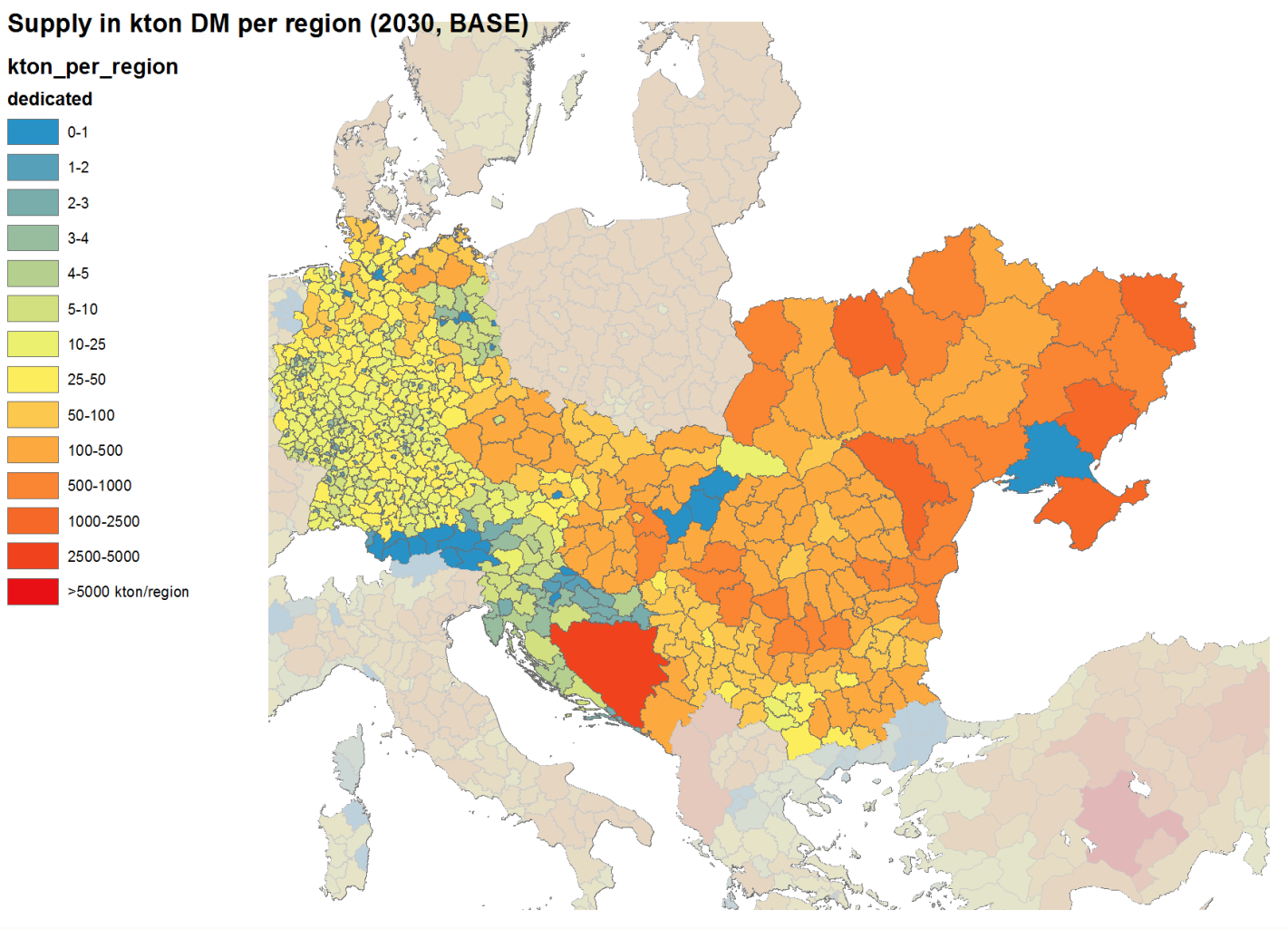
- Annual sustainable potential up to **124m tonnes**

Biowastes and post consumer wood



- Annual sustainable potential up to **40m tonnes**

Dedicated perennial crops



- Annual sustainable potential up to **54m tonnes**

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

Good practices in policy which can be used as feedstock and sector related recommendations*?

- The following slides illustrate selected policies from Member States that have had significant positive impact in promoting the use of lignocellulosic biomass

*** Good practices in policy 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

Forest biomass

- 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

	Conversion	Distribution	End Use
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	

Cross sectoral coherence in policy

Agriculture

Agricultural biomass has high shares in the overall potentials. However, due to the diversity of agro-food chains among regions and farming systems policy coherence is critical to mobilise agricultural residue streams.

Sectorial policies between agriculture, forestry, wastes and environment and regional development must also be aligned in the formation of future policy at national, regional and local level.

Forestry

Not all forest ecosystems are the same. Future policy for forest biomass should:

- build on local circumstances & learn from Best Practices;
- form suitable incentives per cluster of countries that face similar issues (e.g. storm prone areas: bring down stock; drained peat areas: reduce drainage; high stocked area: bring down stock and combine with innovation in products; outgrown coppice: regenerate, stimulate local biomass innovation and plant adapted species, etc.; source: European Forest Institute)

Wastes

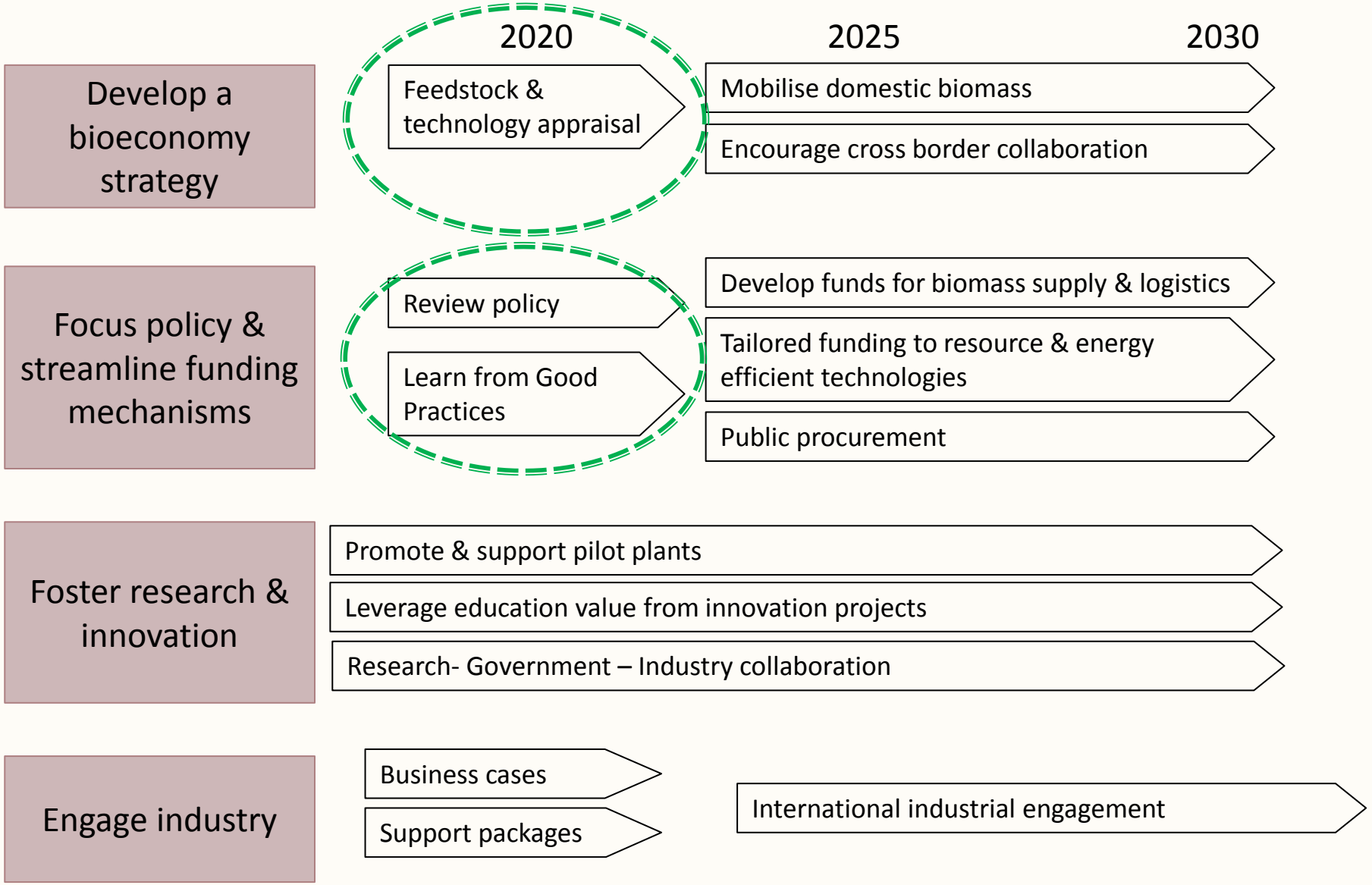
Wastes should not be 'wasted'

- Refine terms and conditions in the Waste Directive and account for all potential uses and waste transportation issues.
- Feedstock bonus to mobilise unutilised potentials: It is essential to introduce feedstock bonus schemes for the most important biomass feedstocks which remain un-mobilised. The scheme could be in the form of premium with favourable pricing.

Environment

Regional Development

Recommended roadmap actions



Concluding remarks

Opportunities: create value for regions and local communities

- Indigenous biomass supply
- Cost reduction potentials
- Policy interventions towards bioeconomy based on market development

Challenges: complex system

- Biomass mobilisation
- Policy: Supply requires cross sectoral coherence
- Create strong partnerships: triple helix (to be discussed today)

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