

# Support Legislative, Regulatory Framework for Bioenergy Value Chains in Ukraine

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Deputy Coordinator of the EBRD and GEF Project  
“Support legislative, regulatory framework for bioenergy value chains in Ukraine”



# The Project at a glance

**Timeframe of the project:** May 2020 – August 2021

**Main consultant:** COWI A/S, Denmark

**Subconsultant:** NGO Renewable Energy Agency, Ukraine

- **Task 1. Bioenergy Policy Action Plan**

Development of **Road Map and Action Plan** for bioenergy capacity to reach targets set in the National Energy Strategy of Ukraine.

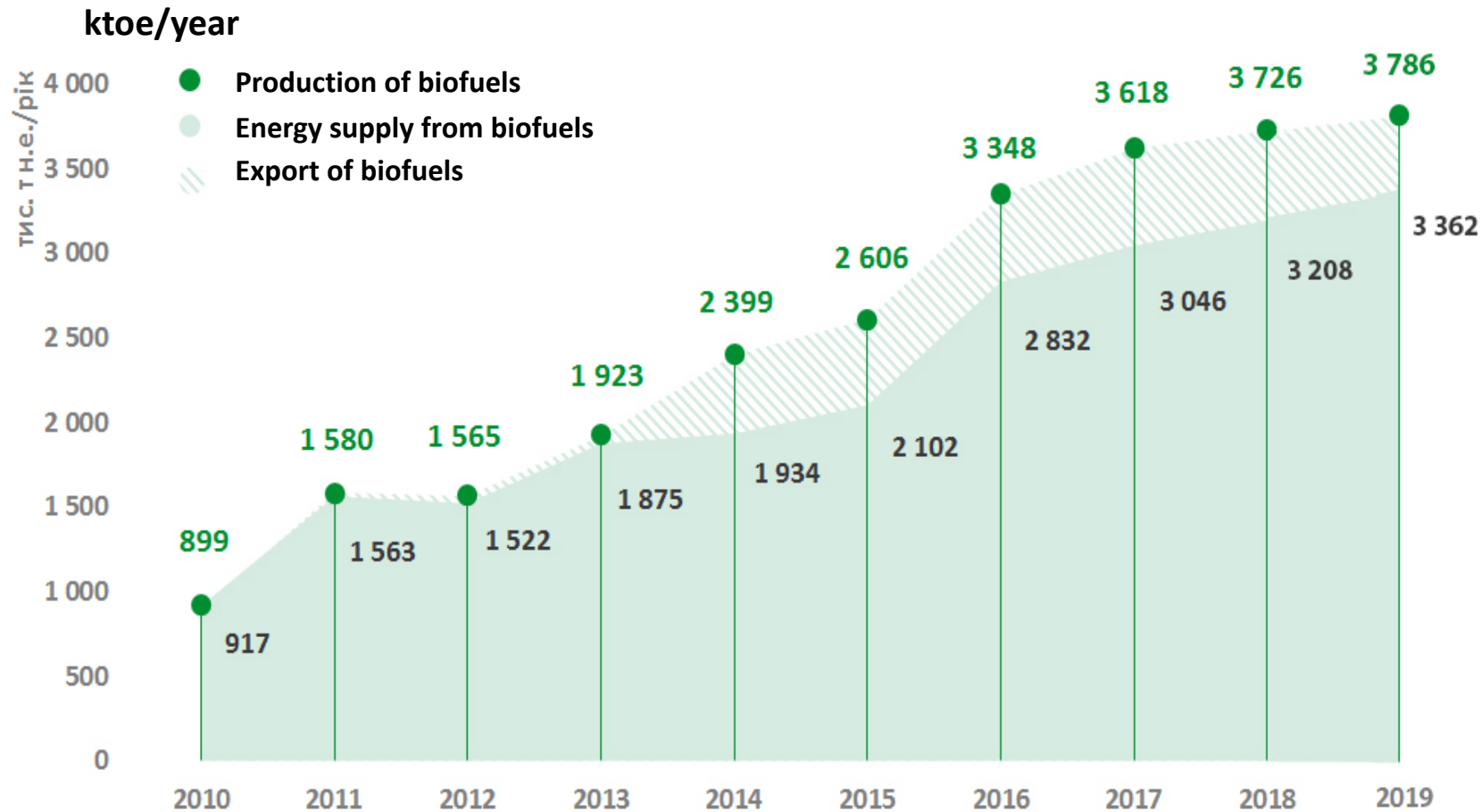
- **Task 2. Legislation and incentives for bioenergy technology & value chain development**

Development of **legislation and incentives** for bioenergy technology transfer and bioenergy value chains.

- **Task 3. Biomass certification & exchange**

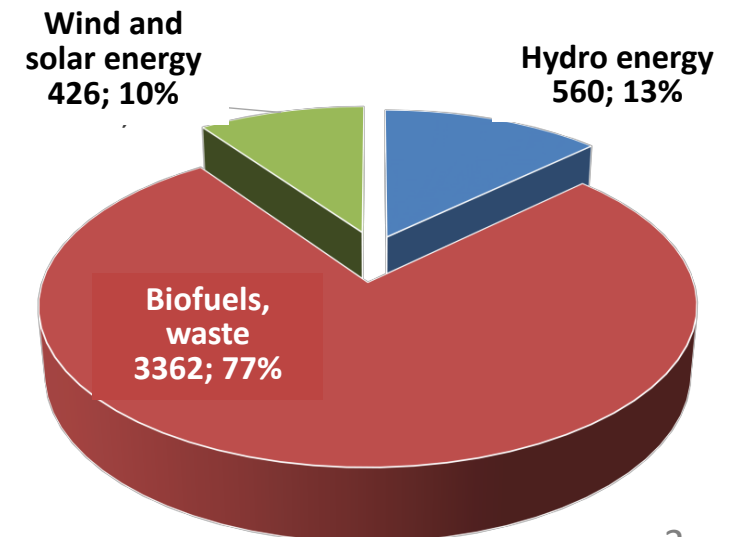
Development of **biomass certification schemes** to enable biomass exchange operation.

# Development of RES in Ukraine – contribution of bioenergy



Average annual bioenergy growth in Ukraine is 16%

Structure of the total primary energy supply from RES, ktoe



3.36 Mtoe = 4.2 billion m<sup>3</sup> NG/ year.

It is 14% of 30 billion m<sup>3</sup> NG/ year total NG consumption in Ukraine.

Source: State Statistics Service of Ukraine

# Estimation of the energy potential of biomass in Ukraine (2018)

Type of biomass	Theoretical potential, Mt	Potential available for energy (economic potential)	
		Share of the theoretical potential, %	Mtoe
Straw of grain crops	32.8	30	3.36
Rapeseed straw	4.9	40	0.68
By-products of grain maize production (stalks, cobs)	46.5	40	3.56
By-products of sunflower production (stalks, heads)	26.9	40	1.54
Secondary agricultural residues (sunflower husk)	2.4	100	1.00
Wood biomass (fuel wood, felling residues, wood processing waste)	8.8	96	2.06
Wood biomass (deadwood, wood from shelterbelt forests, biomass from APPR*)	8.8	45	1.02
Biodiesel (from rapeseed)	-	-	0.39
Bioethanol (from maize and sugar beet)	-	-	0.82
Biogas from waste and by-products of the agro-industrial complex	2.8 billion m <sup>3</sup> CH <sub>4</sub>	42	0.99
Landfill gas	0.6 billion m <sup>3</sup> CH <sub>4</sub>	29	0.14
Sewage gas (industrial and municipal wastewater)	0.4 billion m <sup>3</sup> CH <sub>4</sub>	28	0.09
Energy crops:			
- willow, poplar, miscanthus (on 1 million ha of unused agricultural land)	11.5	100	4.88
- maize for biogas (on 1 million ha of unused agricultural land)	3.0 billion m <sup>3</sup> CH <sub>4</sub>	100	2.57
<b>Total</b>	-	-	<b>23.10</b>

44%

32%

\*APPR – agrarian plantations pruning and removal

## Forecast for the energy potential of biomass in Ukraine (2050)

Type of biomass	Theoretical potential, Mt	Potential available for energy (economic potential)	
		Share of the theoretical potential, %	Mtoe
Straw of grain crops*	49.2	30	5.04
Rapeseed straw	4.9	40	0.68
By-products of grain maize production (stalks, cobs)*	58.1	40	4.45
By-products of sunflower production (stalks, heads)	26.9	40	1.54
Secondary agricultural residues (sunflower husk)	2.4	100	1.00
Wood biomass (fuel wood, felling residues, wood processing waste)*	12.3	96	2.88
Wood biomass (deadwood, wood from shelterbelt forests, biomass from APPR)	8.8	45	1.02
Biodiesel (I and II generation)*	-	-	1.10
Bioethanol (I and II generation)*	-	-	2.33
Biogas from waste and by-products of the agroindustrial complex	8.4 billion m <sup>3</sup> CH <sub>4</sub>	83	5.92
Biogas from MSW*	0.7 billion m <sup>3</sup> CH <sub>4</sub>	70	0.42
Sewage gas (industrial and municipal wastewater)*	0.4 billion m <sup>3</sup> CH <sub>4</sub>	31	0.11
Energy crops*:			
- willow, poplar, miscanthus (on 2 million ha of unused agricultural land)	34.5	100	14.65
- maize for biogas (on 2 million ha of unused agricultural land)	7.5 billion m <sup>3</sup> CH <sub>4</sub>	100	6.43
<b>Total</b>	-	-	<b>47.57</b>

27%

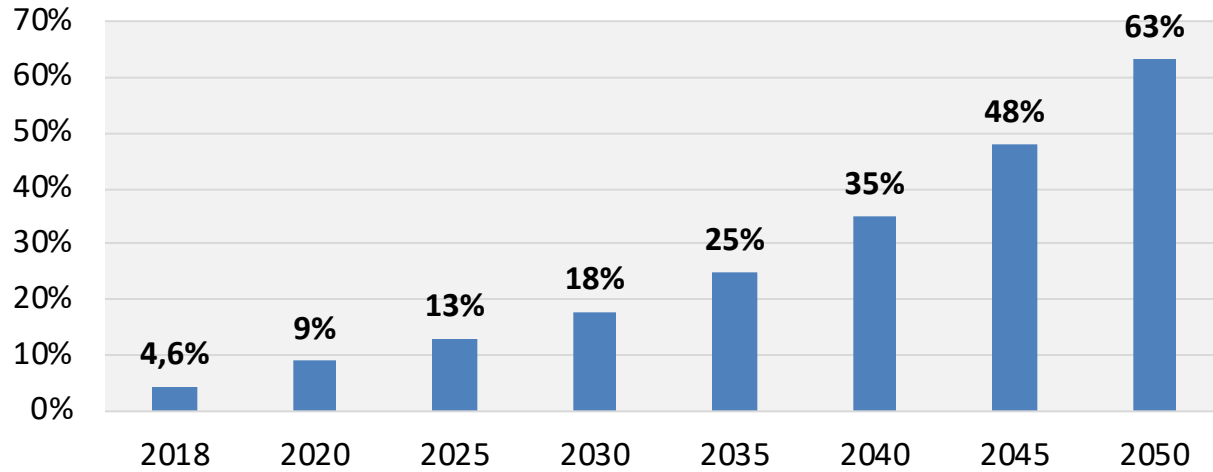
44%

\* Components of the biomass potential, the growth of which is expected by 2050. Other components are left at their level estimated for 2018 according to the conservative approach.

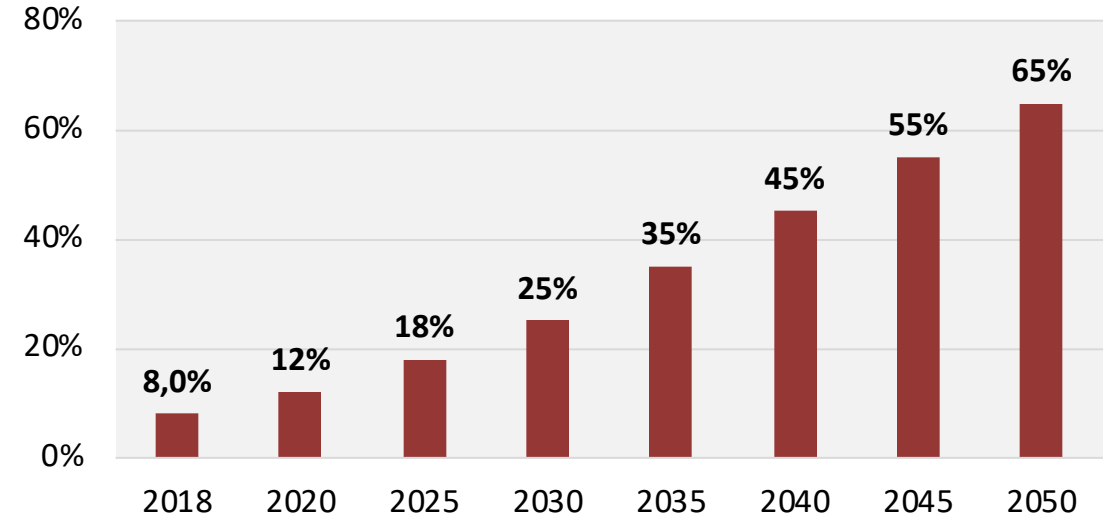
# Forecast for the development of renewable energy in Ukraine until 2050

***70% (RES in electricity) × 0.49 + 65% (RES in heat) × 0.37 + 35% (RES in transport) × 0.14 = 63% RES in TPES***

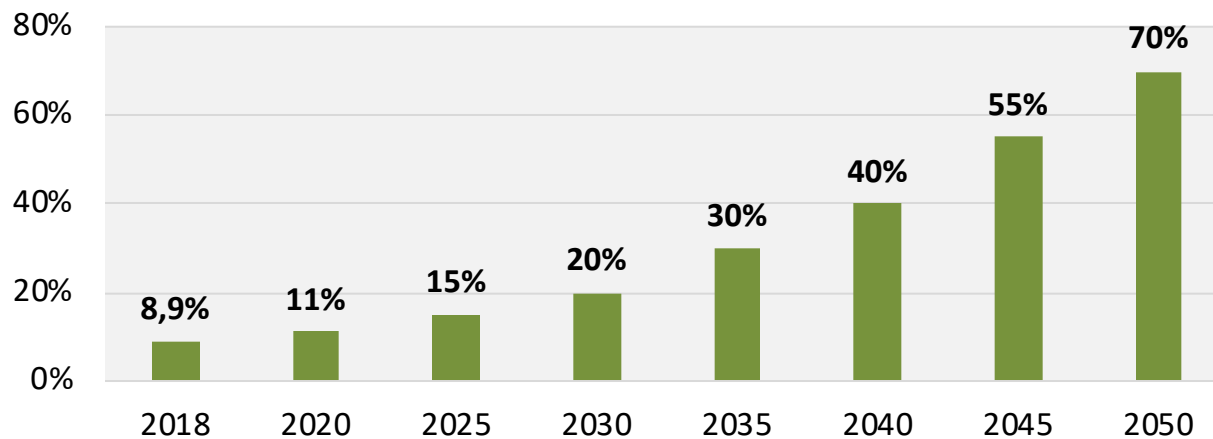
**Forecasted share of RES in Ukraine's total primary energy supply (TPES)**



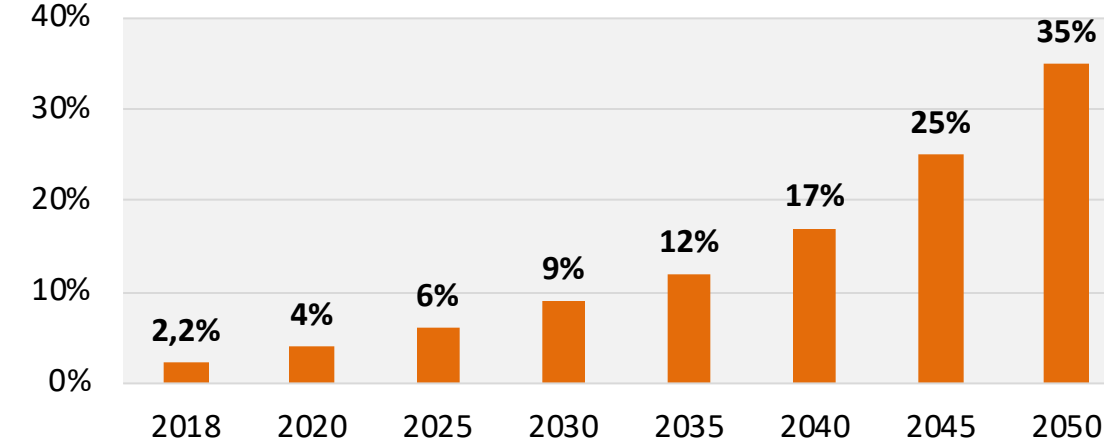
**Forecasted share of RES in the *heat production***



**Forecasted share of RES in the *power production***

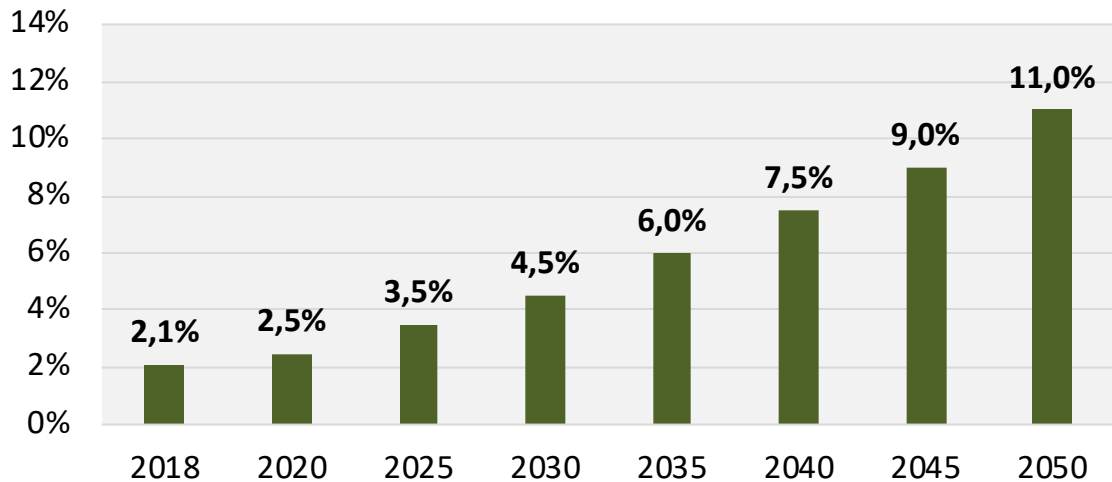


**Forecasted share of RES in the *transport sector***

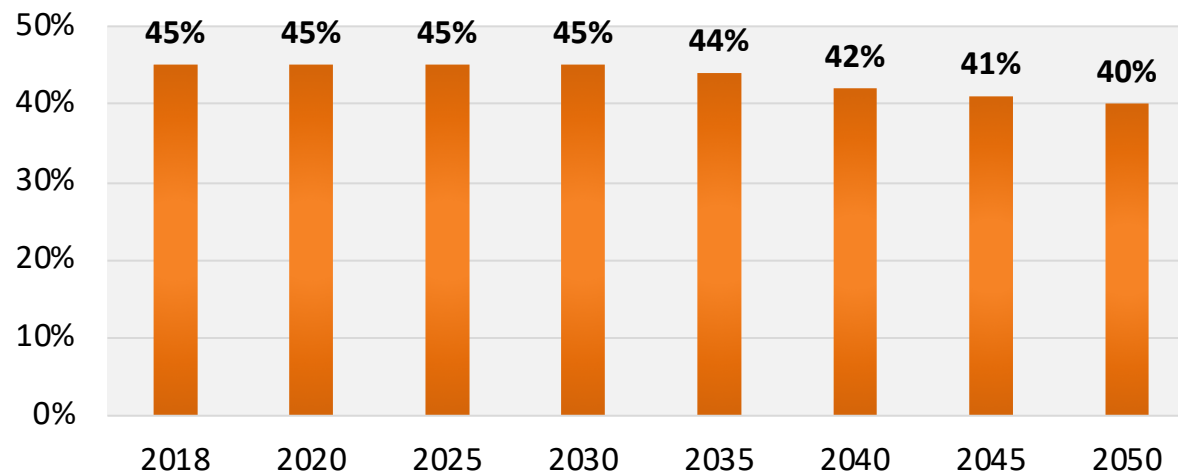


# Forecast for bioenergy development in Ukraine until 2050

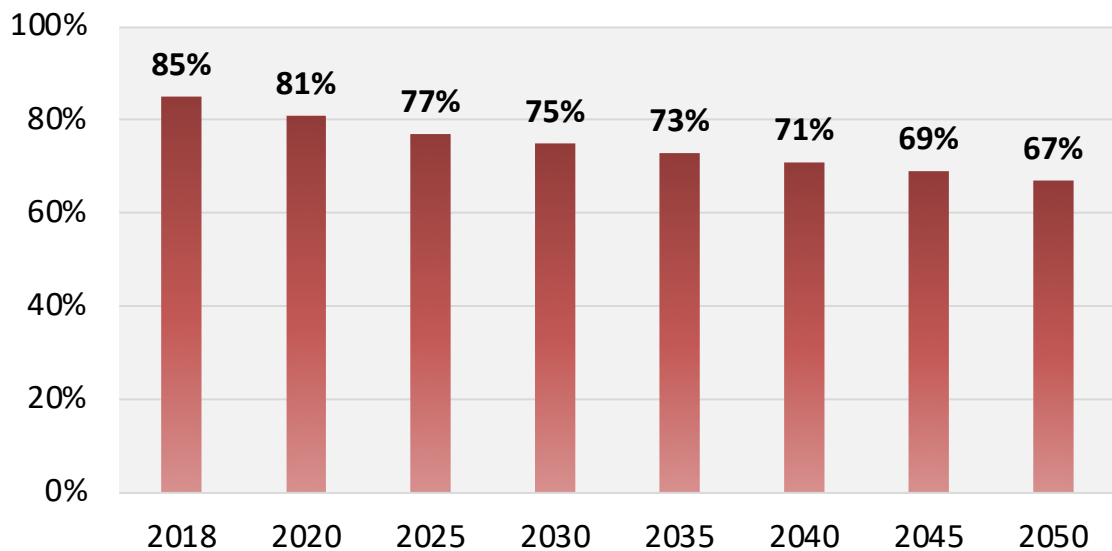
## Forecast for biomass share of all RES in *power production*



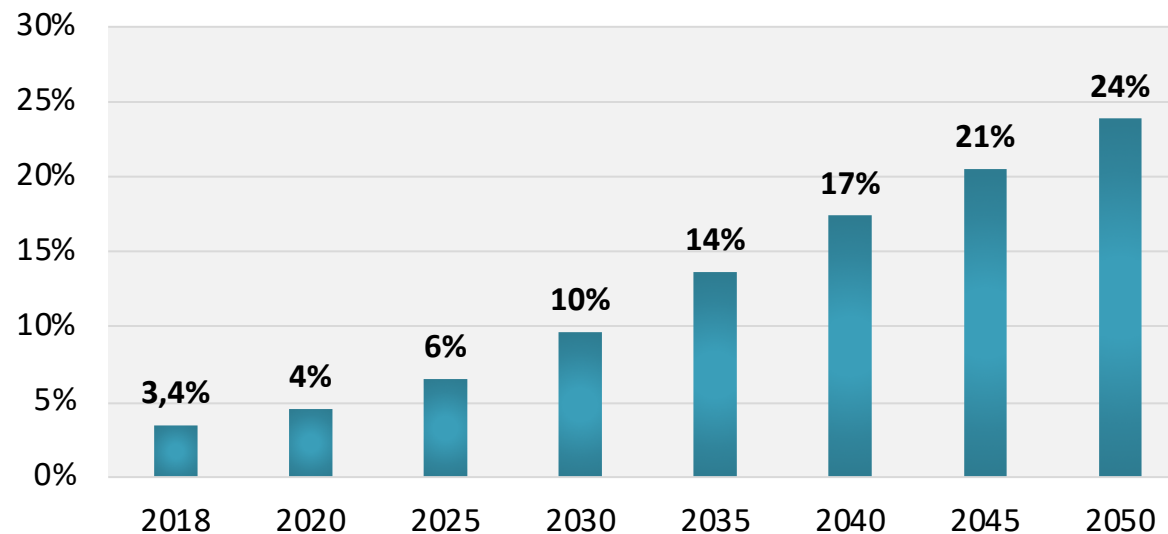
## Forecast for biomass share of all RES in *transport sector*



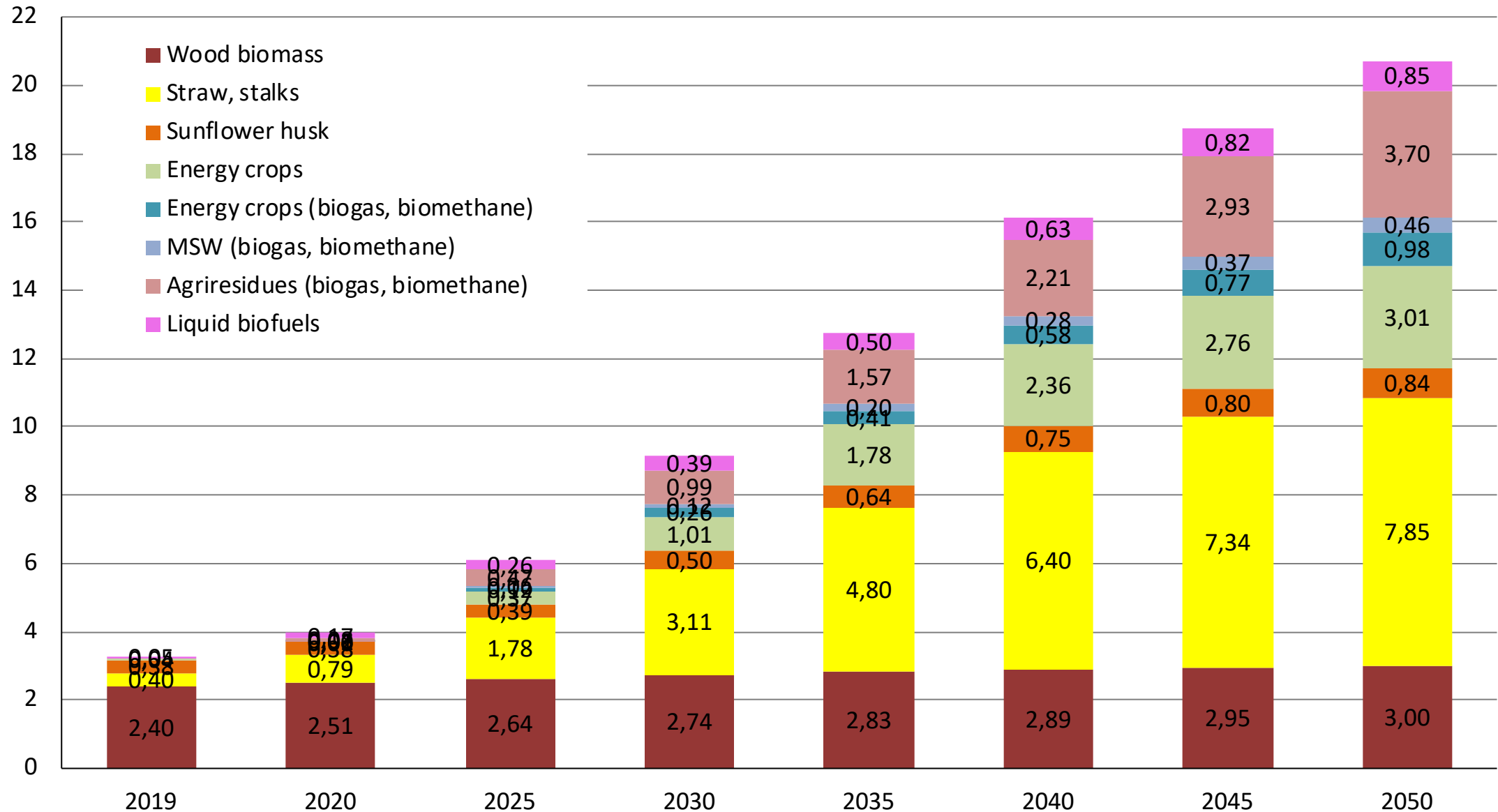
## Forecast for biomass share of all RES in *heat production*



## Forecasted contribution of bioenergy to *TPES*

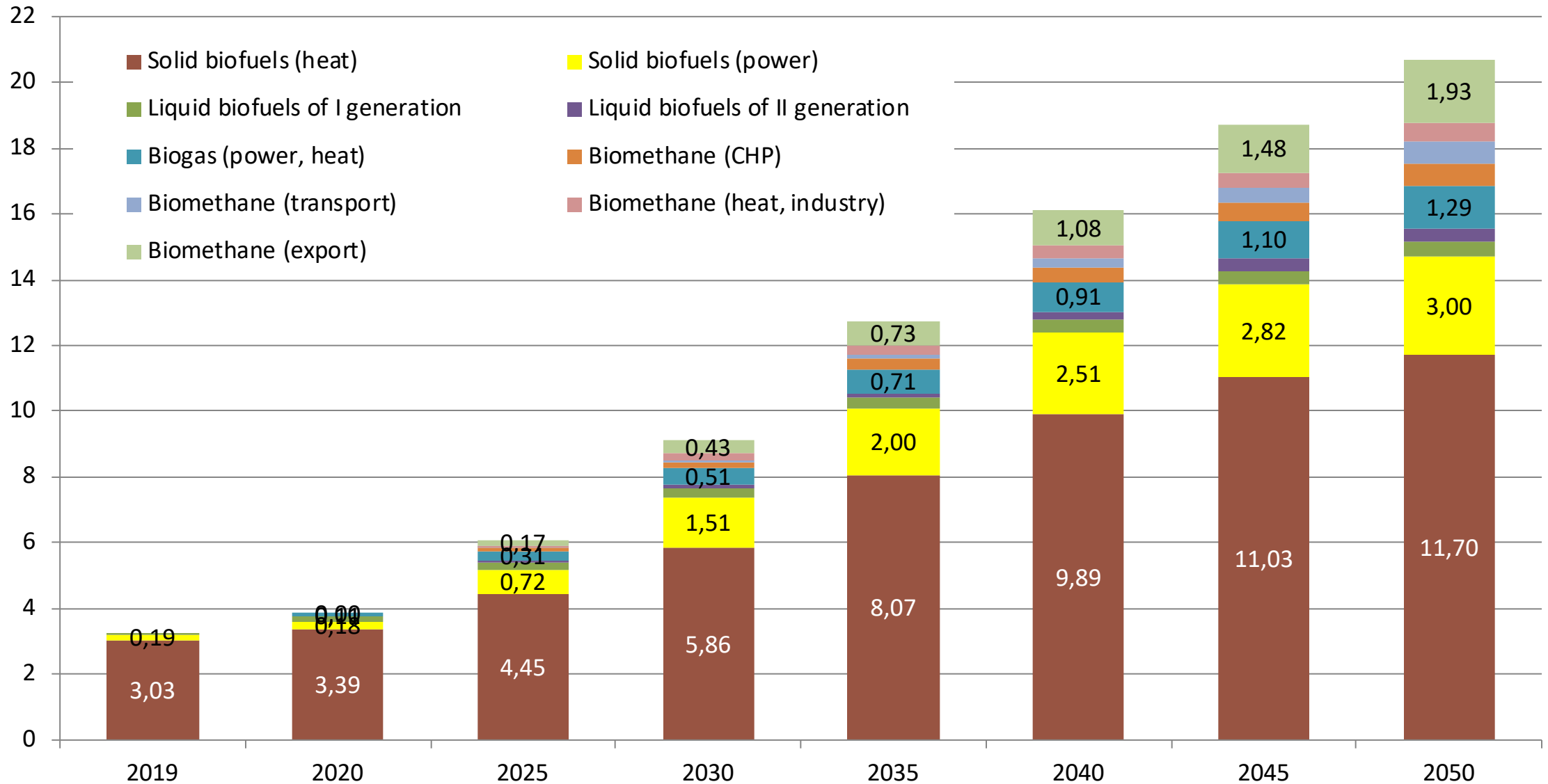


# Suggested structure of the production of biofuels in Ukraine by their types, Mtoe



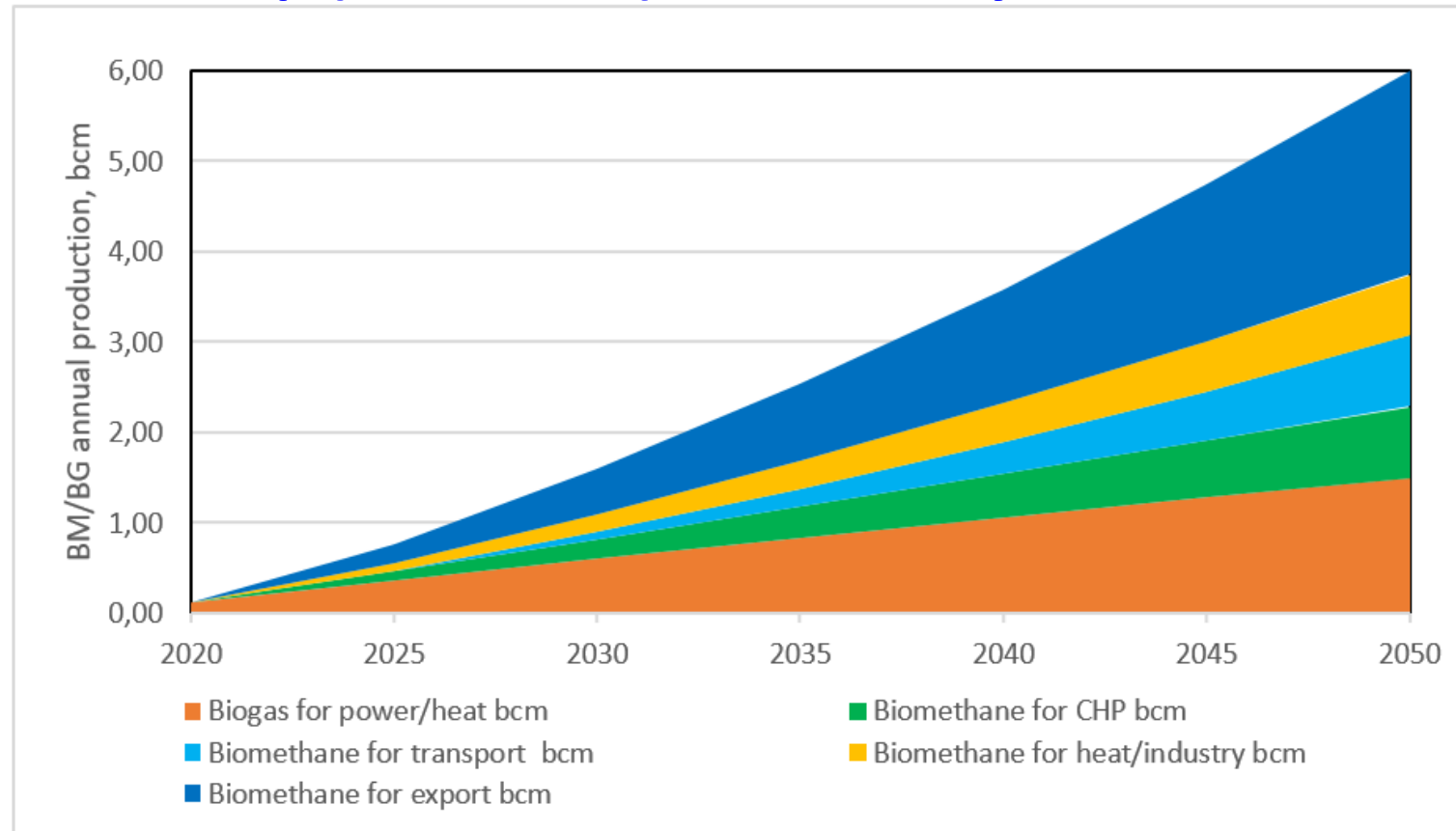


# Suggested structure of the production biofuels in Ukraine by type of the obtained energy carrier, Mtoe



# Biogas/biomethane road map (2020-2050), billion m<sup>3</sup>/year

	2030	2050
Biogas for CHP, billion m <sup>3</sup> CH <sub>4</sub> /year	0.6	1.5
<b>Biomethane, billion m<sup>3</sup> CH<sub>4</sub>/year, including:</b>	<b>1.0</b>	<b>4.5</b>
Export	50%	50%
CHP	22.5%	17.5%
Heat	20%	15%
Transport	7.5%	17.5%



Biogas / biomethane, bcm CH <sub>4</sub> /year	2020	2025	2030	2035	2040	2045	2050
Biogas for power/heat	0.13	0.36	0.60	0.83	1.06	1.28	1.50
Biomethane total	0	0.40	1.00	1.71	2.53	3.46	4.50
Biomethane for CHP	0	0.20	0.50	0.85	1.26	1.73	2.25
Biomethane for transport	0	0.01	0.08	0.18	0.34	0.54	0.79
Biomethane for heat/industry	0	0.10	0.23	0.36	0.50	0.64	0.79
Biomethane for export	0	0.09	0.20	0.31	0.43	0.55	0.67
<b>TOTAL (biogas + biomethane)</b>	<b>0.13</b>	<b>0.76</b>	<b>1.60</b>	<b>2.54</b>	<b>3.59</b>	<b>4.74</b>	<b>6.00</b>

# Bioenergy Policy Roadmap until 2050 for Ukraine

Year	Installed capacity of bioenergy equipment		Consumption of biofuels Mtoe	Replacement of NG, billion m <sup>3</sup>	Replacement of petrol and diesel Mt	Reduction of CO <sub>2</sub> emission Mt/year	Investments, billion EUR		Creation of new jobs
	MW <sub>th</sub>	MW <sub>el</sub>					min	max	
2020	8231	225	3.85	4.34	0.17	9.19	1.58	2.62	17342
2025	12385	918	6.09	6.39	0.26	14.35	4.32	7.0	33870
2030	19185	1886	9.13	9.19	0.43	21.20	8.08	13.1	57648
2035	29949	2618	12.74	12.66	0.60	29.37	12.04	19.5	87067
2040	38822	3265	16.10	15.72	0.82	36.91	15.87	25.6	115220
2045	44493	3740	18.73	17.71	1.11	42.62	19.02	30.7	136595
<b>2050</b>	<b>48056</b>	<b>4091</b>	<b>20.70</b>	<b>19.00</b>	<b>1.24</b>	<b>46.71</b>	<b>21.35</b>	<b>34.5</b>	<b>150550</b>

## Legislation drafted

Title of the law / draft law	Status
1. Law of Ukraine “On amendments to certain laws of Ukraine regarding the development of <b>biomethane production</b> ”.	Adopted by the Parliament; № 1820-IX as of 21.10.2021.
2. Draft Law of Ukraine “On amendments to the Law of Ukraine "On Pesticides and Agrochemicals" regarding the state registration of the <b>digestate from biogas plants</b> ”.	Registered in the Parliament; № 5039 as of 05.02.2021.
3. Draft Law of Ukraine "On amendments to certain legislative acts of Ukraine regarding the mandatory use of <b>liquid biofuels</b> (biocomponents) in the field of transport".	Adopted in the first reading by the Parliament; № 3356-d as of 05.11.2020.
4. Draft Law of Ukraine “On amendments to certain legislative acts of Ukraine regarding the promotion of <b>energy crops growing</b> ”.	Registered in the Parliament; № 5227 as of 12.03.2021.
5. Draft Law of Ukraine “On amendments to the Article 288 of the Tax Code of Ukraine regarding rent payments for land plots on which <b>energy crops</b> are grown”.	Registered in the Parliament; № 5228 as of 12.03.2021.

## Legislation drafted

Title of the draft law	Status
6. Draft Law of Ukraine "On amendments to certain legislative acts of Ukraine regarding the development of <b>trading of solid biofuels</b> “.	Under consideration of responsible ministries.
7. Draft Law of Ukraine “On amendments to the Tax Code of Ukraine regarding the establishment of a <b>zero carbon dioxide emissions tax rate</b> for installations carrying out such emissions from biofuel combustion”.	Under consideration of responsible ministries.
8. Draft Law of Ukraine "On amendments to the Law of Ukraine "On Heat Supply“ to improve the mechanism of formation and establishment of <b>tariffs for thermal energy, including that produced from alternative energy sources</b> ".	Under consideration of responsible ministries.
9. Draft Law of Ukraine "On amendments to certain laws of Ukraine on introduction of <b>competition in district heating systems</b> ".	Under consideration of responsible ministries.

# Biomass certification & exchange

- ✓ **Obligatory within the “biomass exchange”** based on the established **quality classes** (origin of biomass and quality indicators - humidity, ash content, combustion value, size etc.)

*Draft Law of Ukraine "On amendments to certain legislative acts of Ukraine regarding the development of **trading of solid biofuels** “.*

- A biomass seller is responsible for biomass quality and provide quality certificates.
  - Quality certificates are issued by accredited laboratories according to Ukrainian standards.
  - Quality certificates are checked at the “biomass exchange” according to the established quality classes.
- ✓ **Voluntary outside the “biomass exchange”.**

Laboratories accredited in Ukraine according to DSTU ISO/IEC 17025

<https://naau.org.ua/reyestr-akreditovanix-ooov/>

# Sustainable use of biomass for energy

- Separate memo prepared on this and attached as Annex 1 to Final Report
- It provides
  - Background information
    - Definitions of concepts used (e.g. sustainable biomass)
    - Overall reflections based on recent research, development and stakeholder views
    - Existing regulatory framework at international EU and EU Members State levels
  - Points of attention regarding sustainable biomass produced within forestry and agriculture, respectively
- Expected actions: introduction of specific recommendations on sustainability:
  - Adoption of RED II Directive;
  - Additional requirements for agribiomass to ensure organic soil carbon accumulation.
- Making a long story short: If Ukraine ensures compliance with the RED II and, hence, production of sustainable biomass, the country will have a huge potential for use and export of biomass for energy (e.g. EU Hydrogen Strategy from July 2020 identifies Ukraine as potential key partner in strategy implementation).

# Bioenergy concept note

## Key messages:

### 1) Green energy transition in Ukraine has just begun.

Ukraine declared a **green energy transition** as a key for further development of the energy sector. **Bioenergy is a leading sector of renewable energy in Ukraine.** In recent years, the number of facilities and installed capacity for the production of heat and power from biomass has gradually increased.

**2) National targets imply a growing demand for renewable energy sources** - NDC2, Energy Strategy of Ukraine until 2035, Strategy of Economic Development until 2030, Heat Supply Concept. **Development of a sustainable bioenergy sector** makes it possible to reach the targets.

**3) Timing for changes is appropriate. Bioenergy installations and technologies** can contribute to replacement of fossil fuel plants and NPPs capacities that will be decommissioned by 2050.

**4) Sustainability shall be ensured.** From July 1, 2022 liquid biofuels (biocomponents) in the field of transport must meet the **criteria of sustainability** (draft Law №3356-d). However, it is not enough to ensure sustainability for bioenergy in Ukraine. **Ukraine should consider implementation of Directive (EU) 2018/2001 (RED II).**

**5) Need for reforms to exploit bioenergy potential.** There are policy barriers that can interfere with the achievement of national targets and bioenergy potential exploitation. **Legislation has been drafted** to address them.



# Savings from the decrease in production/import of fossil fuels exceeds costs due to the increase in production of bioenergy

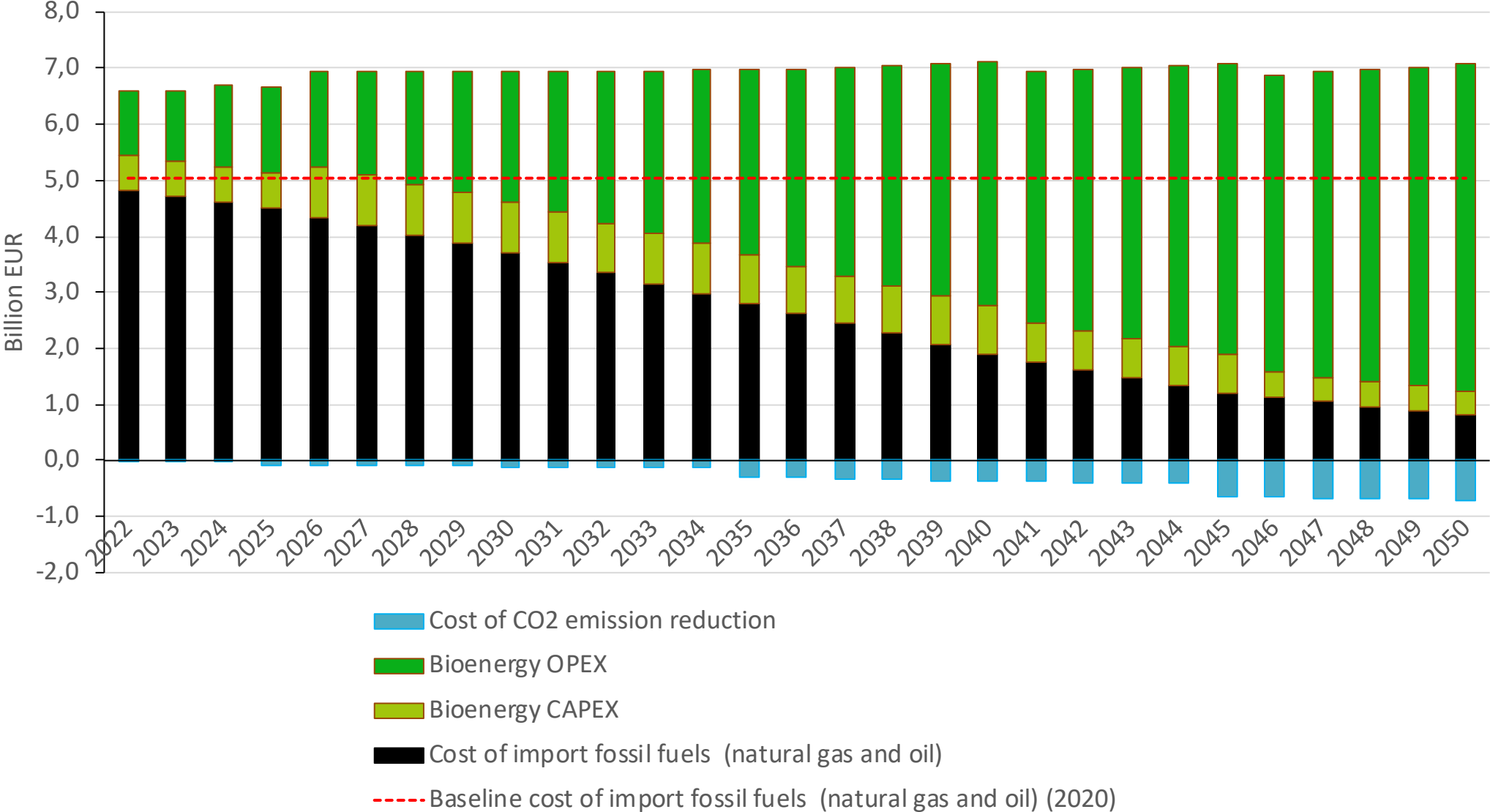
	2022	2025	2030	2035	2040	2045	2050
<b>INCREASE IN THE PRODUCTION OF BIOENERGY</b>							
Installed capacity of bioenergy equipment							
- MW <sub>th</sub>	9862	12321	19056	29883	38698	44309	47671
- MW <sub>el</sub>	533	982	2015	2684	3389	3924	4476
Cumulative CAPEX average, billion EUR	3.53	5.67	10.57	15.75	20.76	24.87	27.92
Cumulative OPEX, billion EUR	1.13	5.34	15.42	29.95	49.53	73.74	101.58
Cumulative CAPEX + OPEX, billion EUR	<b>4.66</b>	<b>11.01</b>	<b>25.99</b>	<b>45.7</b>	<b>70.29</b>	<b>98.61</b>	<b>129.50</b>
CAPEX (non-cumulative), billion EUR/year	0.71	0.72	0.99	1.04	1.01	0.83	0.62
<b>DECREASE IN THE PRODUCTION / IMPORT OF FOSSIL FUELS</b>							
Replacement of fossil fuels, Mtoe/year	4.40	5.45	7.90	10.89	13.59	15.49	16.67
- replacement of natural gas, billion m <sup>3</sup>	5.16	6.39	9.19	12.66	15.72	17.71	19.00
- replacement of petrol and diesel, Mt	0.21	0.26	0.43	0.60	0.82	1.11	1.24
Cost of replaced fossil fuels, billion EUR/year*	1.34	1.66	2.44	3.37	4.25	4.95	5.36
Cumulative cost of replaced fossil fuels, billion EUR	<b>1.34</b>	<b>6.00</b>	<b>16.65</b>	<b>31.63</b>	<b>51.11</b>	<b>74.46</b>	<b>100.44</b>
Reduction of CO <sub>2</sub> emission, Mt/year	11.25	14.35	21.20	29.37	36.91	42.62	46.71
Cost of CO <sub>2</sub> emission reduction, million EUR/year	11.25	71.74	106.01	293.73	369.12	639.30	700.66
Cumulative cost of CO <sub>2</sub> emission reduction, billion EUR	0.01	0.11	0.57	1.37	3.06	5.29	8.67
Cumulative cost of replaced fossil fuels and CO <sub>2</sub> emission reduction, billion EUR	<b>1.35</b>	<b>6.11</b>	<b>17.22</b>	<b>33.00</b>	<b>54.18</b>	<b>79.76</b>	<b>109.12</b>

\* For natural gas price of 223 Euro/1000 m<sup>3</sup>

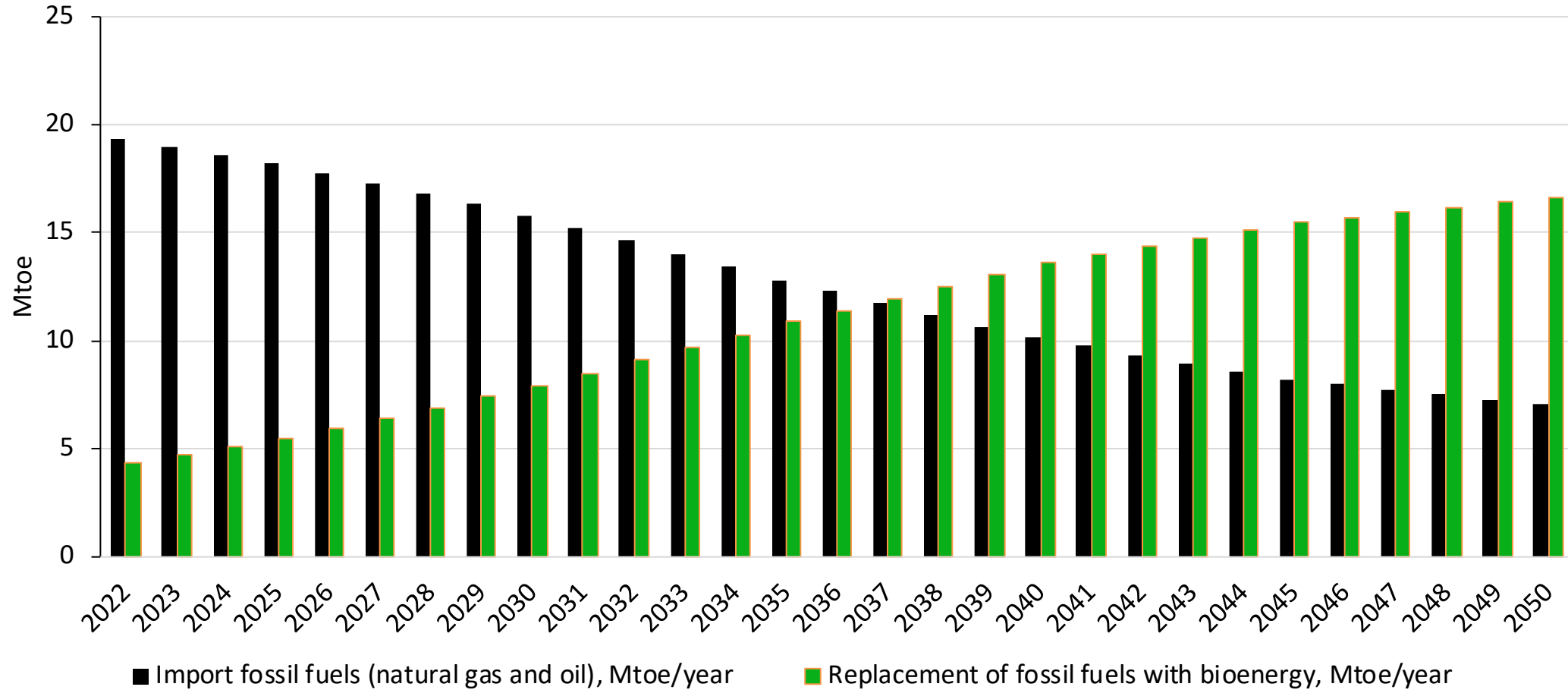
# CAPEX and OPEX of bioenergy projects in different sectors until 2030

<b>CAPEX, billion EUR</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>	<b>2022-30</b>
<b>Solid biofuels (total)</b>	<b>0.41</b>	<b>0.41</b>	<b>0.41</b>	<b>0.41</b>	<b>0.65</b>	<b>0.65</b>	<b>0.65</b>	<b>0.65</b>	<b>0.65</b>	<b>4.91</b>
Solid biofuels for heat	0.19	0.19	0.19	0.19	0.28	0.28	0.28	0.28	0.28	2.15
Solid biofuels for power	0.22	0.22	0.22	0.22	0.37	0.37	0.37	0.37	0.37	2.75
<b>Liquid biofuels (total)</b>	<b>0.03</b>	<b>0.03</b>	<b>0.03</b>	<b>0.03</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.40</b>
Liquid biofuels, I gen.	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.15
Liquid biofuels, II gen.	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.04	0.26
<b>Biogas for power/heat</b>	<b>0.12</b>	<b>0.12</b>	<b>0.11</b>	<b>0.10</b>	<b>0.10</b>	<b>0.09</b>	<b>0.09</b>	<b>0.08</b>	<b>0.08</b>	<b>0.90</b>
<b>Biomethane</b>	<b>0.15</b>	<b>0.15</b>	<b>0.16</b>	<b>0.17</b>	<b>0.17</b>	<b>0.18</b>	<b>0.19</b>	<b>0.19</b>	<b>0.20</b>	<b>1.55</b>
<b>Total</b>	<b>0.71</b>	<b>0.71</b>	<b>0.71</b>	<b>0.72</b>	<b>0.98</b>	<b>0.98</b>	<b>0.98</b>	<b>0.98</b>	<b>0.99</b>	<b>7.76</b>
<b>OPEX, billion EUR</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>	<b>2030</b>	<b>2022-30</b>
<b>Solid biofuels (total)</b>	<b>0.90</b>	<b>0.99</b>	<b>1.13</b>	<b>1.18</b>	<b>1.30</b>	<b>1.42</b>	<b>1.54</b>	<b>1.66</b>	<b>1.78</b>	<b>11.91</b>
Solid biofuels for heat	0.77	0.83	0.91	0.93	1.00	1.07	1.14	1.21	1.28	9.14
Solid biofuels for power	0.13	0.16	0.22	0.26	0.30	0.35	0.40	0.45	0.50	2.77
<b>Liquid biofuels (total)</b>	<b>0.15</b>	<b>0.16</b>	<b>0.18</b>	<b>0.19</b>	<b>0.21</b>	<b>0.23</b>	<b>0.26</b>	<b>0.28</b>	<b>0.30</b>	<b>1.96</b>
Liquid biofuels, I gen.	0.15	0.15	0.16	0.16	0.17	0.19	0.20	0.21	0.22	1.62
Liquid biofuels, II gen.	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.34
<b>Biogas for power/heat</b>	<b>0.04</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>	<b>0.10</b>	<b>0.60</b>
<b>Biomethane</b>	<b>0.04</b>	<b>0.05</b>	<b>0.08</b>	<b>0.10</b>	<b>0.11</b>	<b>0.12</b>	<b>0.14</b>	<b>0.15</b>	<b>0.16</b>	<b>0.95</b>
<b>Total</b>	<b>1.13</b>	<b>1.24</b>	<b>1.44</b>	<b>1.53</b>	<b>1.70</b>	<b>1.86</b>	<b>2.02</b>	<b>2.18</b>	<b>2.34</b>	<b>15.42</b>

# Economics of fossil fuel replacement by bioenergy, billion EUR



# Replacement of fossil fuels by biomass in 2022–2050, Mtoe



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**Thank you for your attention!**

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