



Energy Willow as the basis of energy independence of Ukraine

Strategy 2020 - 2024



OUR GOAL



ECOLOGY-ENERGY INDEPENDENT UKRAINE



 VERBA



BIOMASS (WILLOW) MARKET POTENTIAL IN UKRAINE

5 mln ha
marginal
lands

1.5 mln ha
30% Potential
volume for
energy willow
planting

18 T/ha
annual
growth of
energy
willow

*** 14.21 mln t**
biofuels
(humidity 15%) **

****Substitution potential
gas needs
of Ukraine is**
22,5%
**=7,24 bln m³ of
gas/year**

*****=59,66**
bln UAH

Annual growth in
Ukraine's economy
due to reduction of
purchase volume
gas

* 1.5 mln ha x 18t/ha = 27 mln t of biofuel (50% humidity)

27 mln t / 1,9 (drying coefficient **) = 14.21 mln t of biofuel (15% humidity)

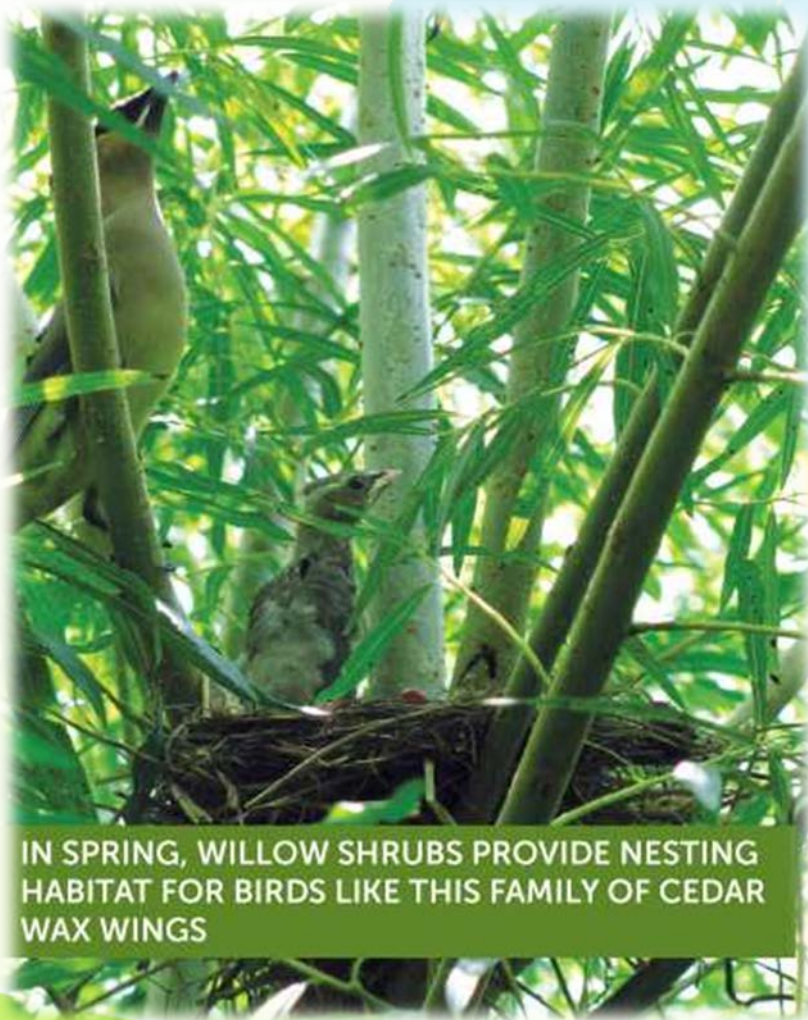
** In 2018, Ukraine used 32.3 bln m³ of natural gas

***The cost of 1 m³ of gas per 23.08.2019 is 8.24 UAH

OBSTACLES

- Lack of state support
- Insufficient funding
- Absence of the existing biomass market in Ukraine
- Lack of a scientifically developed strategy for the development of bioenergy potential of Ukraine
- Lack of Professional staff
- Lack of specialized equipment for planting and collecting willow

V HOW TO ACHIEVE



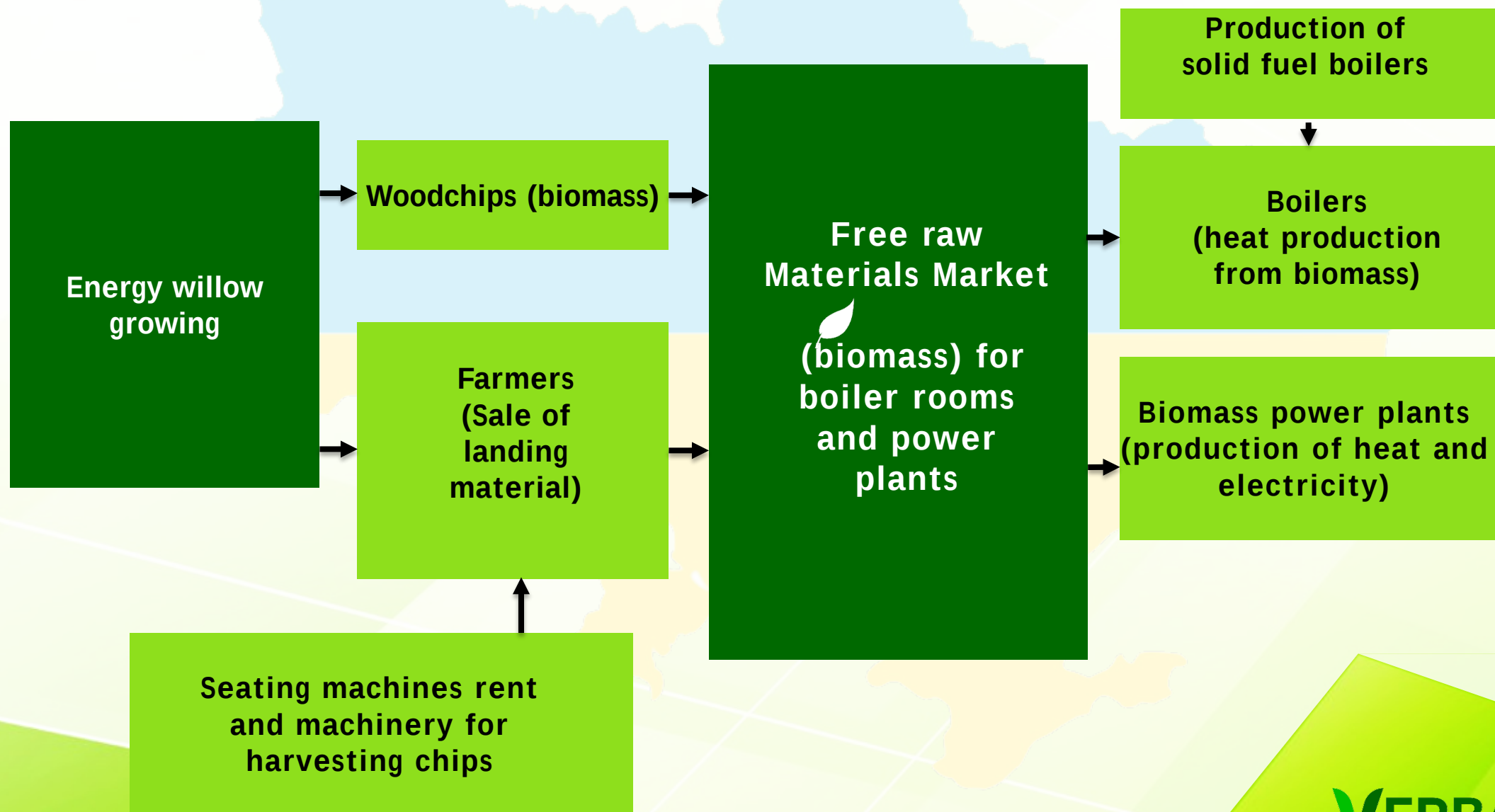
IN SPRING, WILLOW SHRUBS PROVIDE NESTING HABITAT FOR BIRDS LIKE THIS FAMILY OF CEDAR WAX WINGS

Landing of **new forests** on unoccupied (marginal) lands

Why:

- Generation of electricity and heat without pollution of the atmosphere (with zero carbon emissions)
- Improving the natural environment for human existence, because forests are lungs, they are an ecosystem of every Ukrainian's life
- Ukraine's energy independence from other countries' energy resources. Sustainable economic development of each farm and as a result - the state as a whole
- Creating prerequisites for the development of a competitive biomass market as an alternative energy source in Ukraine
- Popularization and promotion of growing willow as the most potential energy resource in the biomass market across Ukraine

FULL CYCLE OF WILLOW-HEAT





THE IDEA

VERBA - all-Ukrainian project aimed at the study of marginal lands of Ukraine (III-V categories), creation of a scientific map of these lands and selection of energy plants (willow, poplar, miscanthus and others) by region, depending on the type of forest plant conditions (TLU). Growing and creating a complete cycle of electricity and heat production from biomass

Social contribution

The new Ukrainian adapted varieties of energy willow will allow all farmers to grow energy willow throughout Ukraine to heat their own households, schools, kindergartens and other private and public buildings, not at the expense of gas, but by the method of direct burning of wood chips (crushed material of energy willow)

Political value

Having trained farmers across Ukraine on lands where agricultural management does not provide a good economic effect to grow the energy willow, we will reduce the dependence of the regions and districts from the central government: no subsidies for heating required, no need to pay for gas. The money remains in the same area with the farmer.
The price of wood chips of energy willow is much less than gas!

Economic effect

For growing energy willow, lands that have not yet brought any profit will be involved

Each farmer will be able to use marginal land (flood meadows, peat, sands, loamy soils)

ECONOMIC BENEFITS FARMER/STATE

- Neglecting unproductive (marginal) lands is a loss of profit with 5 million hectares of land across Ukraine on both sides. Even a third of this area will save Ukraine over UAH 59 billion every year for the purchase of foreign gas
- Decentralization and de-monopolization of energy sources are cost savings farms
- The presence of a scientifically sound fund of marginal lands (III-V categories) is a cost-effective collaboration on use of these lands by farmers / state
- The economically sustainable growth of the farmer and the state is a WIN-WIN strategy
- Energy independence and environmental security is a strong state, which creates all the conditions for the work and prosperity of every Ukrainian



OVERVIEW OF THE RENEWABLE ENERGY MARKET



AGRICULTURAL BIOMASS MARKET POTENTIAL IN UKRAINE

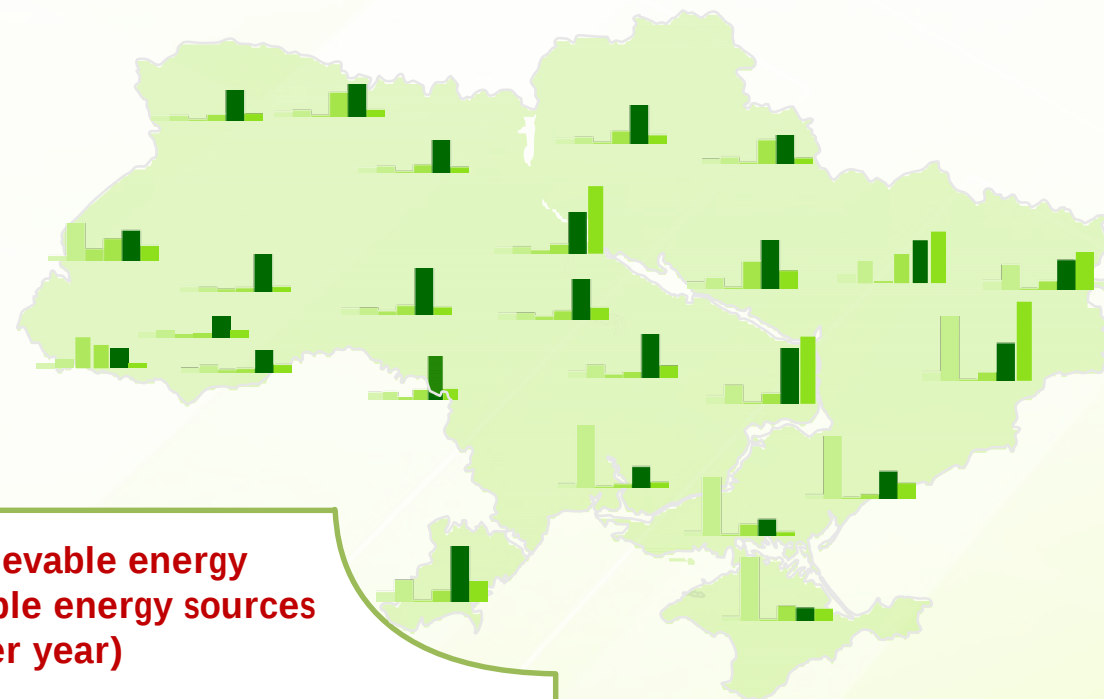
POTENTIAL of renewable energy sources of Ukraine

31 mln t/year
energy potential of
agricultural biomass
without consideration
willow biomass

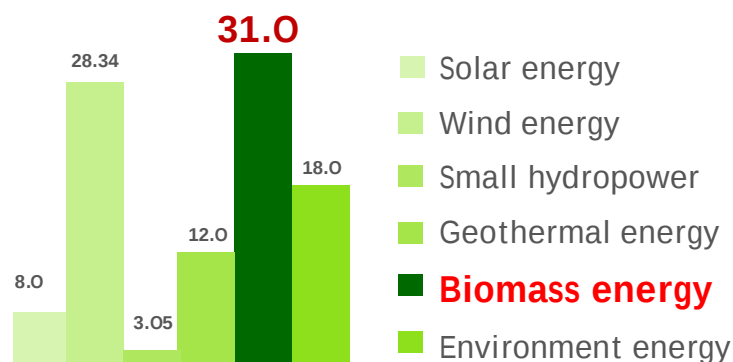
Over 70%
of Ukraine's territory
is covered by the
agricultural sector

40 mln
population

603 628 km²
the largest country
within Europe



Technically achievable energy potential of renewable energy sources (mln t per year)



VERBA



BENEFITS OF THE BIOFUEL OBTAINED FROM ENERGY WILLOW



The cost of energy carriers

- o Raw materials of domestic production
- o Ability to predict the cost of wood chips in the presence of a fixed cost of laying a plantation
- o Calorific value to the calorific value of coniferous species of trees – 16-18.5 Mj/kg

Woodiness of the state area

- o Due to the rapid growth (more than 3 meters per year) and the intensive accumulation of wood mass (about 18 tons per year from 1 hectare) planting willow can in a short period of time to provide large areas of green plantations
- o The energy willow plantation of 1 hectare consumes more than 200 tons of CO₂ from air for 3 years
- o Willow is a "carbon-neutral" fuel source, i.e. no additional CO₂ emissions

Low requirements to soil

- o Adapted to a wide range of conditions - grows on marginal agricultural lands
- o Successfully grown on sandy soils, in slit or on loamy soils
- o Soils with high clay content, as a rule, have lower yields during the first few years. However, further yields in these areas may be higher compared to soils with low clay content

Recultivation of low productive lands

- o From 1 hectare of willow plantation, more than 60-80% of nutrients returns to the soil along with the fallen leaves.
- o The soil is enriched with carbon dioxide and bacteria that increase its fertility.
- o After the 8th Harvest, on the 25th year, the land is not approached for growing crops before, in its bulk, become suitable for farming
- o Removal of heavy metals from contaminated land and wastewater treatment
- o Strengthening of shores
- o The ash after combustion of willow is used as one of the best fertilizers



UKRAINE MARKET OVERVIEW: POTENTIAL CLIENTS



Farms

Each farm has a number of lands that are not suitable or less suitable for farming, on which it is possible to grow energy willow.



Agrarian Holdings

Own a large bank of land and a large assortment of equipment. As a rule, a certain percentage of land of categories IV and V exists at each farm. These lands are not suitable or not enough suitable for agriculture. Lands of those types can be used for growing energy willow.



Thermoelectric power plants (TPP)

Which work or can work on solid fuel.



Power stations

Which operate at a "green" rate and use biomass as a fuel.



Boiler houses

Communal, private and industrial boiler houses that can be converted to solid fuels. Typically, a solid fuel boiler installs near with the existing gas boiler and cuts it into the existing heating network without significant expenses.



Enterprises producing wood pellets or briquettes

The energy of willow can be used for the production of pellets and briquettes.



Governors of the cities

Who are interested in transferring power plants and boiler houses to alternative energy sources.



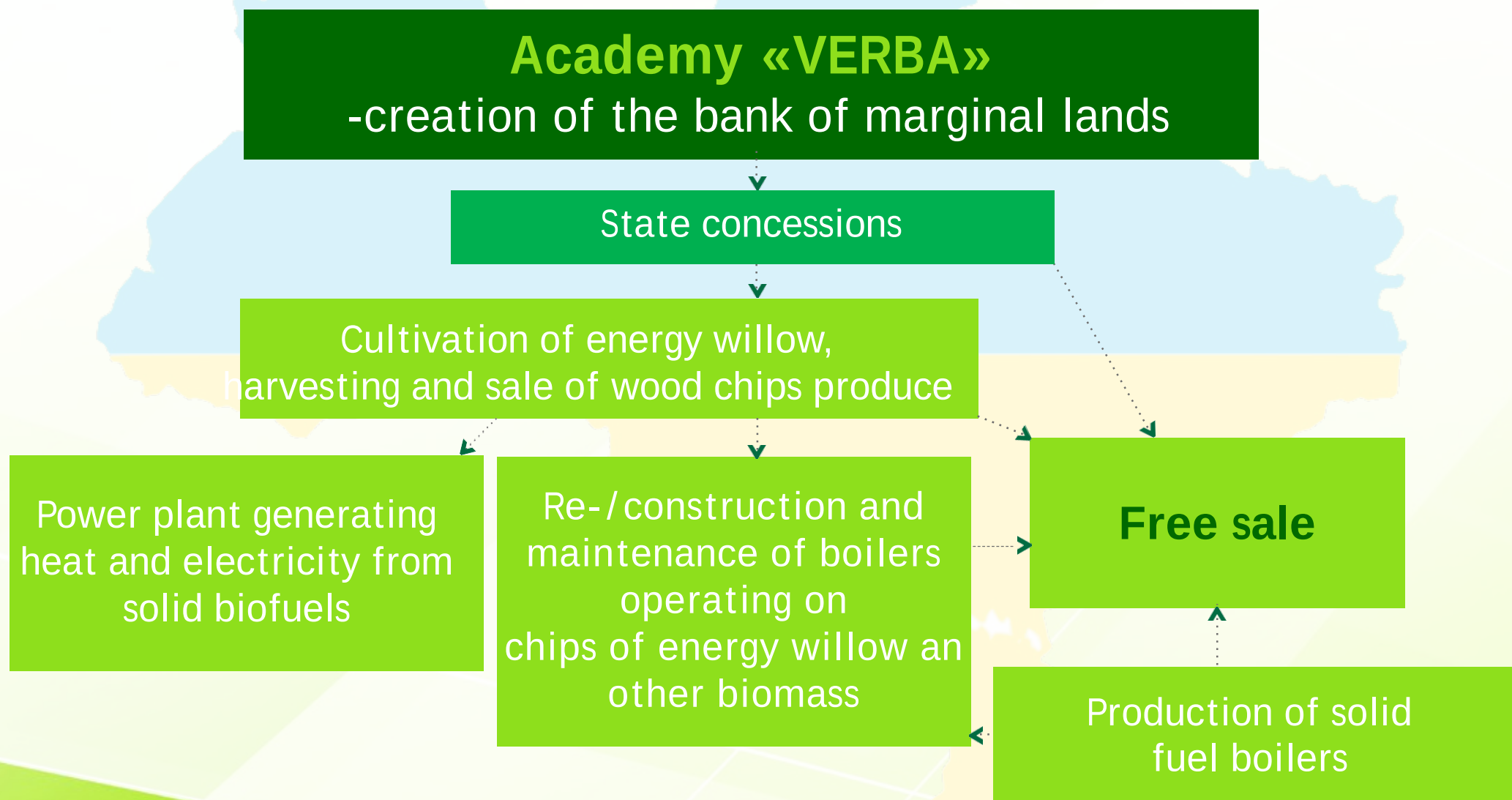
Heads of village councils

On the balance of which are available lands that are not suitable or not enough suitable for agriculture.



**ALL-UKRAINIAN ENERGY
RESOURCE BIOTECHNOLOGY
ACADEMY**

ECOSYSTEM



VERBA KEY PRIORITIES

- ☐ Development of the biomass market in Ukraine
- ☐ Creation of marginal lands bank
- ☐ Creation of own meristem laboratory
- ☐ Selection of energy plants with experimental areas for cultivation of energy plants in all major regions of Ukraine
- ☐ Development and patenting of new varieties of energy crops for specific conditions of different regions of Ukraine
- ☐ Development of technological maps of willow planting for specific conditions of Ukrainian regions
- ☐ Cooperation with farmers, education, support and provision of planting material for biomass cultivation and processing
- ☐ Stimulation the transfer of boiler-houses to alternative fuels in all regions of Ukraine

SELECTION OF NEW UKRAINIAN VARIETIES OF ENERGY WILLOW

4 Ukrainian varieties have been registered, which have already been entered into the international base

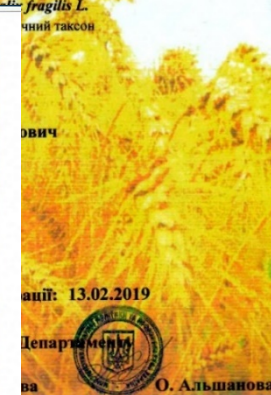
Salix fragilis "Adam"

Salix fragilis "Yevanhelina"

• *Salix viminalis* "M1"

• *Salix viminalis* "Katia"

11 varieties
are at the
Stage of research





V EXPERIMENTAL PLOTS



#	Location	Note	The year of laying	Area, ha
1	Urban type village Kozyn, Obukhiv district, Kyiv region	own experimental plot	2016	0.04
2	Village Hoholin, Brovary district, Kyiv region	own experimental plot	2016	0.25
3	Village Leliaky, Zhmerenskyi district, Vinnytsia region	own experimental plot	2016	0.90
4	Village Leliaky, Zhmerenskyi district, Vinnytsia region	own experimental plot	2017	0.50
5	Village Stritivka, Kaharlytskyi district, Kyiv region	own experimental plot	2018	0.90
6	Urban type village Kozyn, Obukhiv district, Kyiv region	own experimental plot	2019	0.04
7	Novohrad-Volynskyi, Zhytomyr region	cooperation with TSEFEI-EKO LLC	2019	6.10
8	Kyiv, Kyiv region	cooperation with the Department of Reforestation and Forest Reclamation of the NUBiP	2019	0.02
9	Obukhiv, Kyiv region	cooperation with the farm "Budmo"	2019	0.05
10	Village Nemishaievo, Borodianskyi district, Kyiv region	cooperation with the separate subdivision of NUBiP of Ukraine "Nemishaiiv Agrotechnical College"	2019	2.00
TOTAL				10.80

EXPERIMENTAL WILLOW PLOTS



✓ GROWTH OF ENERGY WILLOW IN DIAMETER



Diameter of the 3-year old rooted seedling is 2.5 cm

THE GROWTH OF THE ENERGY WILLOW

Maximum grow of 1-year old separate samples is 3.45 m



1-year-old Willow plantation on experimental site
Village Stritovka, Kyiv region, TLU - C1

Recovery of the plantation for the year, after harvesting the first harvest.

Maximum grow of a separate samples is 4.55 m



4-year-old Willow Plantation on the experimental site,
urban village Kozyn, Kyiv region, TLU-C₃

V CURRENT STATE OF PROTECTIVE STRIPS IN UKRAINE

Today, most of the protective strips are in disrepair and they began to actively cut. The demolition of emergency trees spend significant money and human resources. The raw material from the cut trees is not used in industrial way, and is burned at once in place





UTILITY MODEL REGISTERED IN USA AND SUBMITTED FOR REGISTRATION IN UKRAINE

Use of rotational-plantation strips of fast-growing willow and poplar cultivators to protect roads and railways

The utility model belongs to several industries, namely:

- Agricultural
- Transport
- Energy (renewable energy)

and consists in the use of new type of roadside (rotary-plantation) roadblocks instead of traditional road and rail protection.

The object of the utility model is the way how to use rotational-plantation strips of fast-growing willow and poplars bioenergy cultivars that are intended to be used for road protection.

The traditional forest roadside protection strips created by DBN B.2.3-4-2015 have a number of disadvantages: high cost of creation, maintenance of operational functions and their replacement

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Registration Number
TXu 2-147-545
Effective Date of Registration:
April 26, 2019

Title _____

Title of Work: The way to procedure the rotational plantation bands of fast-growing willow and poplar cultivars to protect roads and railways

Completion/Publication _____

Year of Completion: 2019

Author _____

• Author: Leonid Melezhyk
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Work made for hire: No
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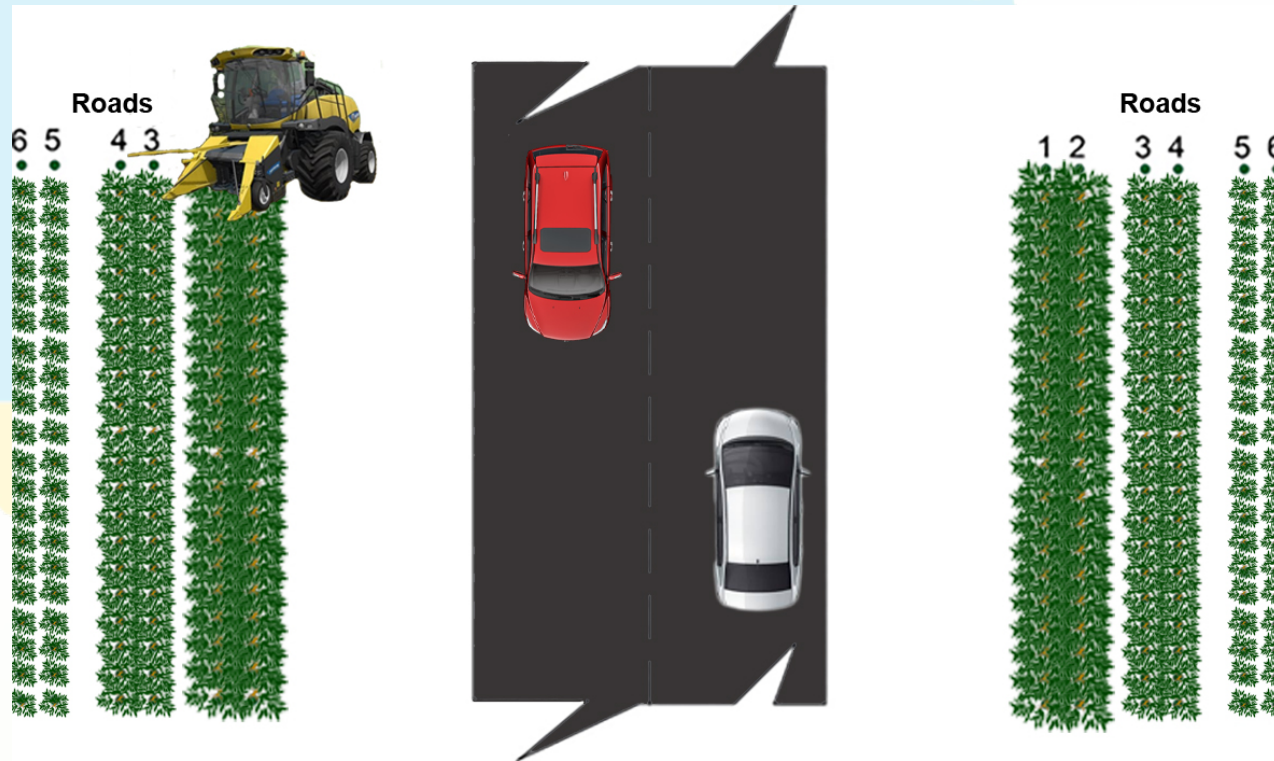
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Certification _____

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SCHEME OF LANDING 6 ROW ROTARY PLANTATION PROTECTION STRIP



- The novelty of the utility model is the possibility of harmonious execution of rotational-plantation strips the traditional snow-protection functions with ecological and economical features and ensuring the profitable use of such strips.
- The utility of the utility model is the ability to replace traditional subsidized roadside protection strips, rotary-plantation strips of fast-growing energy willow cultivars, and a poplar with a positive economic balance
- The task set by the utility model is achieved by replacing traditional roadside protective strips with rotary plantations planted according to the scheme

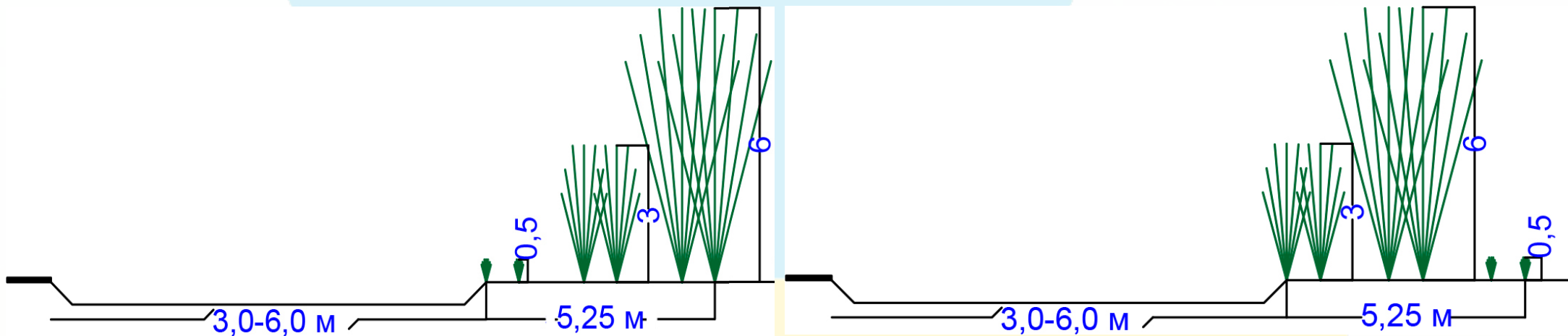


HARVESTING CHIPS FROM AN ENERGY WILLOW PLANTATION



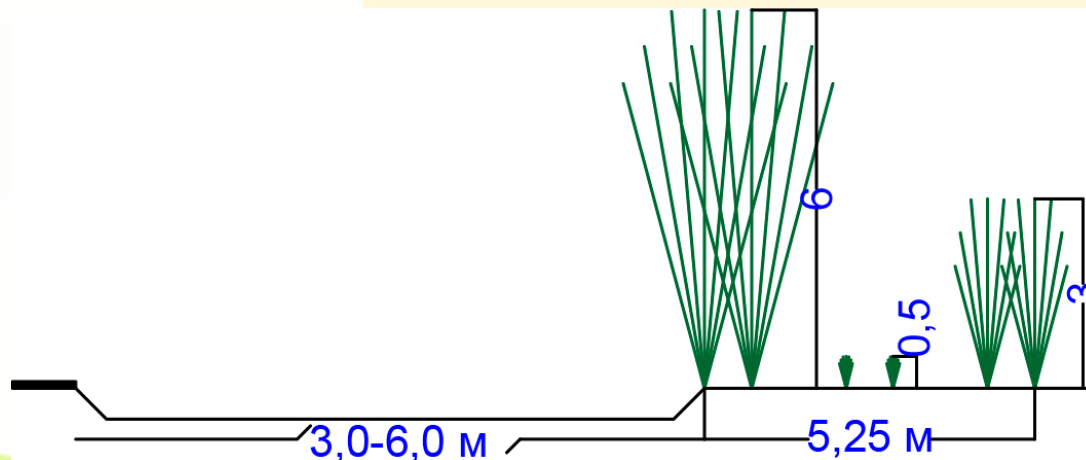


ANNUAL COLLECTION SCHEDULE OF CHIP FROM ROTATIONAL-PLANTATION STRIPS



1, 4, 7, 10, 13, 16, 19, 22 years of cultivation

2, 5, 8, 11, 14, 17, 20, 23 years of cultivation



3, 6, 9, 12, 15, 18, 21, 24 years of cultivation

CONTRIBUTION INTO UKRAINE'S GROWTH

⊙ **Heat energy Independence:**

- at reduced tariffs, not less than 30%, due to the use of own raw materials (willow chips)
- provision of boilers with local fuel
- independence from imported coal

⊙ **Economic growth:**

- new jobs in the regions
- increased turnover and local taxes paid

⊙ **Ecological security:**

- willow grows efficiently and quickly, significantly improving soil fertility, restoring it
- Significant CO2 absorption (200 tons/ha for three years)



PROJECT OWNER PROFILE

Leonid Melezhyk

Founder & CEO (owner)

MGI <http://mgi.org.ua>

'Energy willow' LLC <https://www.verba.kiev.ua/>

Elite Edelweiss <http://hunter.ua>

8 + years
In bioenergy

20 + years
Experience
in growing
plants

EDUCATION

1993

Power engineer, Ukrainian national agricultural University

2000

Lawyer (diploma with honors), Kyiv Institute of Tourism, Economics and Law

2008

Degree MBA, business administration, the Open University in the United Kingdom

2016-2019

Post-graduate student of the forest and forest reclamation NUBiP of Ukraine.

Dissertation Theme: «Agrobiologically and technological principles of creation and exploitation of energy willow plantations in the Right-bank Forest-steppe of Ukraine»

INDUSTRY SKILLS

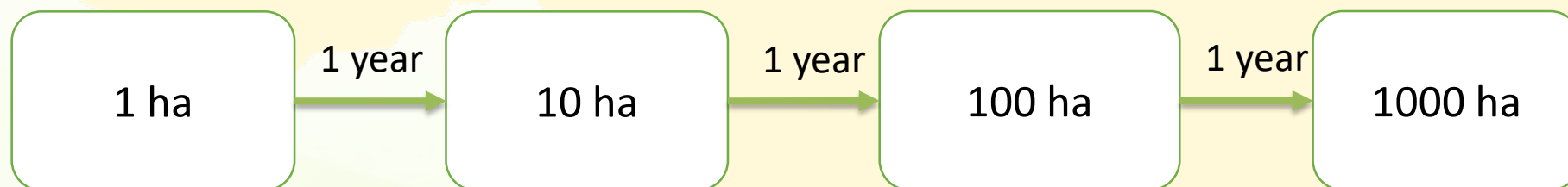
- Business
- Investments
- Business administration
- Management
- Jurisprudence
- Engineering
- Landscaping
- Watering system
- Planting
- Thermal engineering
- Green energy
- Cultivation of energy willow



TERMS OF COOPERATION

- ☐ We provide planting material!
- ☐ You prepare the fields and care for the seedlings.
- ☐ Throughout the year, we jointly conduct active scientific work to identify the best grades in different types of land.

Multiplier Reproduction of willow



- ☐ Harvest in the form of planting material – used to expand its own areas or transmitted to another farmer.



IN COOPERATION OUR SYNERGY!

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