# National Renewable Energy Action Plan (NREAP) through 2020

DRAFT

# Draft **National Renewable Energy Action Plan** (NREAP) through 2020 Developed by the State Agency for Energy Efficiency and Energy Saving of Ukraine in pursuance of:

- Decision of the Ministerial Council of the Energy Community D/2012/04/MC-EnC dated October 18, 2012.
- Decree of the Cabinet of Ministers of Ukraine "On Approval of Primary Action Plan for Integration of Ukraine into the European Union" № 73-p dated February 13, 2013.
- Decree of the Cabinet of Ministers of Ukraine "On Approval of the Action Plan on Execution of the National Program for Harmonization of Ukrainian Legislation with the Legislation of the European Union" № 157-p dated March 25, 2013.

# **National Renewable Energy Action Plan (NREAP)** through 2020

- Developed in accordance with requirements of the Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
- Prepared with the use of a special NREAP template developed by the Secretariat of the Energy Community for the Energy Community member states
- Developed in absence of a revised and updated Energy Strategy of Ukraine through 2030

NREAP primary objective is to achieve
11% RES share in the final energy consumption of Ukraine by 2020

# **Key factors** predetermining the need for the development of renewable energy in Ukraine:

- High energy potential of major types of RES
- Own energy deficit (dependence on import of conventional energy resources, increase of their value in the world market, problems related to their external supply)
- Exhaustion of own energy resources (estimated oil and gas reserves – for 40-50 years)
- Environmental impact of energy generation at thermal power plants, radioactive pollution of territories resulting from Chornobyl disaster.
- International commitments of Ukraine (RES share in total energy consumption of Ukraine, which aspires to accede to the European Union, must be at least 11% by 2020)

# **Major factors** promoting the development of renewable energy in Ukraine

- Implementation of the “green” tariff
- Profit tax exemption for core activities of energy companies generating electricity only from renewable energy sources
- Decrease of land tax for renewable energy companies
- VAT exemption for operations on importing certain types of renewable energy equipment to the customs territory of Ukraine
- Import duty exemption for certain types of renewable energy equipment

# **Capacity of RES facilities** as of October 1, 2013

- Installed capacity of facilities generating electricity from renewable energy sources (based on the "green" tariff) constitutes over **960 MW**

- Installed capacity of facilities generating heat energy from renewable energy sources constitutes **520 MW** (mostly through the use of biomass*)

** The use of RES not regulated by NERC pricing policy (consumption of biomass by households, individual wind machines, etc.) is not taken into account.*

# National **indicative target** for the share of **RES** in gross final energy consumption in 2020

| | | |
|---|---|---|
| A | Share of energy from renewable energy sources in the gross final energy consumption in 2009 ($S_{2009}$), % | 3,8 |
| B | Indicate terget on the share of energy from renewable energy sources in the gross final energy consumption in 2020 ($S_{2020}$), % | 11,0 |
| C | Expected total ajusted volume of energy consumption in 2020, ktoe | 77 530 |
| D | Expected volume of energy from renewable energy sources, which corresponds to 2020 indicative (calculated as B x C), ktoe | 8 530 |

# National **indicative targets** through 2020 and reference dynamics for the increase of **RES** share in heating and cooling (H&C), generation of electricity (E) and energy consumption in transport sector (T), %

| | 2009 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| RES-H&C | 3,4 | 6,0 | 6,5 | 7,1 | 8,0 | 8,8 | 9,7 | 10,8 | 12,2 |
| RES-E | 7,1 | 7,2 | 7,6 | 8,3 | 8,7 | 9,4 | 10,2 | 10,9 | 11,5 |
| RES-T | 1,5 | 2,3 | 4,1 | 5,0 | 6,5 | 7,5 | 8,2 | 9,0 | 10,0 |
| Overall RES share | 3,8 | 5,6 | 6,1 | 6,8 | 7,5 | 8,2 | 9,0 | 9,9 | 11,0 |

| As in Part B of Annex I to the Directive | 2011-2012 | 2013-2014 | 2015-2016 | 2017-2018 | 2020 |
|---|---|---|---|---|---|
| | $S_{2009} + 20\% (S_{2020} - S_{2009})$ | $S_{2009} + 30\% (S_{2020} - S_{2009})$ | $S_{2009} + 45\% (S_{2020} - S_{2009})$ | $S_{2009} + 65\% (S_{2020} - S_{2009})$ | $S_{2020}$ |
| RES dynamics (%) | 5,3 | 6,0 | 7,0 | 8,5 | 11,0 |
| RES dynamics (ktoe) | 3 630 | 4 240 | 5 110 | 6 360 | 8 530 |

# **Expected gross final energy consumption** in Ukraine for heating/cooling, electricity generation, and transport sector through 2020, ktoe

| № | | 2009 | 2013 | | 2014 | | 2015 | |
|---|---|---|---|---|---|---|---|---|
| | | базовий рік | 1* | 2** | 1 | 2 | 1 | 2 |
| 1. | Heating | 43 640 | 46 550 | 44 800 | 47 790 | 45 570 | 48 620 | 45 910 |
| 2. | Electicity | 13 791 | 16 390 | 15 950 | 17 390 | 16 780 | 17 890 | 17 110 |
| 3. | Transport | 8 943 | 9 310 | 9 050 | 9 620 | 9 260 | 9 950 | 9 480 |
| 4. | Gross final energy consumption | 66 374 | 72 250 | 69 800 | 74 800 | 71 610 | 76 460 | 72 500 |

| № | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| 1. | 49 510 | 46 280 | 50 460 | 46 680 | 51 460 | 47 100 | 52 520 | 47 540 | 53 780 | 48 020 |
| 2. | 18 400 | 17 440 | 18 930 | 17 770 | 19 470 | 18 100 | 20 030 | 18 430 | 20 710 | 18 830 |
| 3. | 10 290 | 9 700 | 10 650 | 9 930 | 11 030 | 10 170 | 11 440 | 10 420 | 11 910 | 10 680 |
| 4. | 78 200 | 73 420 | 80 040 | 74 380 | 81 960 | 75 370 | 83 990 | 76 390 | 86 400 | 77 530 |

** (1) - reference scenario*
*** (2) - scenario, which takes into account the impact resulting from energy efficiency and energy saving measures*

# **Calculation table** for the renewable energy contribution of each sector to final energy consumption of Ukraine, ktoe

| Expected gross final consumption of RES | 2009 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| (A) For heating and cooling | 1 473 | 2 695 | 2 955 | 3277 | 3 690 | 4 095 | 4 575 | 5 140 | 5 850 |
| (B) For electricity generation | 980 | 1 140 | 1 275 | 1 427 | 1 525 | 1 670 | 1 840 | 2 000 | 2 175 |
| (C) In transport sector | 52 | 90 | 174 | 221 | 298 | 351 | 395 | 445 | 505 |
| (D) Total RES consumption | 2 505 | 3 925 | 4 404 | 4 925 | 5 513 | 6 116 | 6 810 | 7 585 | 8 530 |

# **Calculation table** for the share of renewable energy in transport sector, ktoe

| | 2009 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Expected RES consumption in transport sector | 52 | 90 | 174 | 221 | 298 | 351 | 395 | 445 | 505 |
| Expected RES electricity in road transport | 52 | 60 | 64 | 71 | 78 | 86 | 95 | 105 | 115 |
| Expected consumption of biofuels from wastes, residues, non-food cellulosic and residual material in transport sector | 0 | 30 | 110 | 150 | 220 | 265 | 300 | 340 | 390 |
| Expected RES contribution in achieving the indicative RES-T target | 130 | 210 | 380 | 477 | 635 | 745 | 837 | 942 | 1 068 |

# **Final energy consumption** (estimate of total contribution) expected from each **renewable energy source** in Ukraine for meeting mandatory indicative target through 2020, ktoe

## HEATING AND COOLING

| | 2009 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Geothermal (excluding heat pumps) | 0 | 25 | 35 | 47 | 60 | 75 | 95 | 120 | 150 |
| Solar | 0 | 130 | 170 | 210 | 250 | 300 | 370 | 470 | 600 |
| Biomass: | 1 433 | 2 480 | 2 550 | 2 680 | 2 900 | 3 100 | 3 350 | 3 650 | 4 000 |
| Including solid | 1 433 | 2 475 | 2 540 | 2 665 | 2 875 | 3 060 | 3 290 | 3 570 | 3 900 |
| biogas | 0 | 5 | 10 | 15 | 25 | 40 | 60 | 80 | 100 |
| Renewable energy from heat pumps | 40 | 60 | 200 | 340 | 480 | 620 | 760 | 900 | 1 100 |
| Including airthermal | 27 | 40 | 133 | 226 | 320 | 413 | 507 | 600 | 734 |
| geothermal | 9 | 13 | 44 | 76 | 107 | 138 | 169 | 200 | 244 |
| hydrothermal | 4 | 7 | 23 | 38 | 53 | 69 | 84 | 100 | 122 |
| Total: | 1 473 | 2 695 | 2 955 | 3 277 | 3 690 | 4 095 | 4 575 | 5 140 | 5 850 |
| of which | | | | | | | | | |
| - district heating | 552 | 1 735 | 1 965 | 2 257 | 2 640 | 3 015 | 3 465 | 3 990 | 4 650 |
| - biomass in households | 921 | 960 | 990 | 1 020 | 1 050 | 1 080 | 1 110 | 1 150 | 1 200 |

# **Estimate of total RES** consumption (installed capacity, gross electricity generation) in Ukraine for meeting mandatory indicative target through 2020

**ELECTRICITY**

| | 2009 | | 2015 | | 2018 | | 2020 | |
|---|---|---|---|---|---|---|---|---|
| | МВт | ГВт·год | МВт | ГВт·год | МВт | ГВт·год | МВт | ГВт·год |
| HPP | 4 549 | 11 430 | 4 898 | 12 515 | 5 167 | 12 965 | 5 350 | 13 290 |
| < 1MW | 19 | 12 | 33 | 75 | 47 | 110 | 55 | 130 |
| 1MW –10 MW | 30 | 18 | 65 | 140 | 80 | 175 | 95 | 210 |
| > 10MW | 4 500 | 11 400 | 4 800 | 12 300 | 5 040 | 12 680 | 5 200 | 12 950 |
| Geothermal energy | 0 | 0 | 11 | 60 | 30 | 180 | 50 | 300 |
| Solar (photovoltaic) | 0 | 0 | 1 140 | 1 050 | 2 100 | 2 010 | 2 800 | 2 600 |
| Wind power plants (ground based) | 76 | 41 | 1 000 | 2 100 | 2 100 | 4 670 | 3 000 | 6 700 |
| Biomass: | 0 | 0 | 120 | 440 | 355 | 1 570 | 530 | 2 350 |
| solid | 0 | 0 | 80 | 320 | 285 | 1 260 | 400 | 1 790 |
| biogas | 0 | 0 | 30 | 110 | 70 | 310 | 130 | 560 |
| Total | 4 625 | 11 471 | 7 271 | 16 595 | 9 752 | 21 395 | 11 730 | 25 240 |
| of which CHP | 0 | 0 | 120 | 430 | 355 | 1 570 | 530 | 2 350 |

# **Estimate of total contribution** expected from each **renewable energy source** in Ukraine for meeting mandatory indicative target through 2020, ktoe

## TRANSPORT SECTOR

| ktoe | 2009 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Bioethanol/bio-ETBE | 0 | 30 | 110 | 150 | 200 | 225 | 250 | 280 | 320 |
| Bioethanol (import) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Biodiesel fuel | 0 | 0 | 0 | 0 | 20 | 40 | 50 | 60 | 70 |
| Biodiesel fuel (import) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hydrogen from RES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Electricity from RES | 52 | 60 | 64 | 71 | 78 | 86 | 95 | 105 | 115 |
| Non-motor vehicles | 170 | 183 | 197 | 210 | 225 | 240 | 255 | 270 | 285 |
| Other (biogas, vegetable oils) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 52 | 90 | 174 | 221 | 298 | 351 | 395 | 445 | 505 |

# **Structure of electricity** generation from respective **RES** in 2015 and 2020, %

| | 2015 | 2020 |
|---|---|---|
| Wind power plants | 13,0 | 26,5 |
| Solar power plants | 6,5 | 10,3 |
| Large HPPs | 76,1 | 51,3 |
| Micro, mini, and small HPPs | 1,3 | 1,4 |
| Bio power plants | 2,7 | 9,3 |
| Geothermal power plants | 0,4 | 1,2 |
| Total | 100,0 | 100,0 |

## In the sphere of electricity generation, full-scale implementation of **NREAP** will require the commissioning of:

- **2 471 MW** renewable energy capacity/facilities in 2015 and 6 530 MW renewable energy capacity in 2020 (exclusive of the capacity of large HPPs)

- **7 271 MW** renewable energy capacity in 2015 and 11 730 MW in 2020 (including the capacity of large HPPs)

This will make it possible to generate **16 595 GWh** of RES electricity in 2015 and **25 240 GWh** in 2020 constituting, accordingly, 8,3% and 11,5% of total electricity consumption

## In the sphere of heating and cooling, full-scale implementation of **NREAP** will require the following:

- Replacement of conventional PER in in the volume of 3,3 mtoe.
- Replacement of conventional PER in 2020 in the volume of 5,8 mtoe.

The above RES energy production in heating and cooling sector will constitute 7,1% and 12,2% in 2015 and 2020, accordingly, of the aggregate final energy consumption in the sector.

# Full-scale implementation of **NREAP** will make it possible to accomplish the following tasks by 2020:

- Priority implementation of RES investment projects, which have a high level of readiness for implementation and can promptly secure the saving of conventioal fuel and energy resources

- Organizing the production of equipment for renewable energy needs and implementatoin of this equipment in different regions of Ukraine, including the establishment of demonstration and pilot facilities.

- Reform of production towards the establishment of specialilzed facilities for desinging, production, commissioning, and operation of RES-based equipment, creation of new types of renewable energy equipment and technologies aimed at enhancing the efficiency of RES use and decreasing the cost of energy equipment.

- Creation of information and analytical base of modern equipment and advanced techologies, development of R&D basis, training and professional development of engineers and technical specialists, creation of certification and regulatory framework with regard to all spheres of RES use, securing of state economic policy encouraging RES use, as well as improvement of legislation, financing mechanisms, etc.

Produced with the financial support of the
European Union in the framework of the project
“Capacity Building of the State Agency for Energy
Efficiency and Energy Conservation in Ukraine”

Держенергоефективності України