



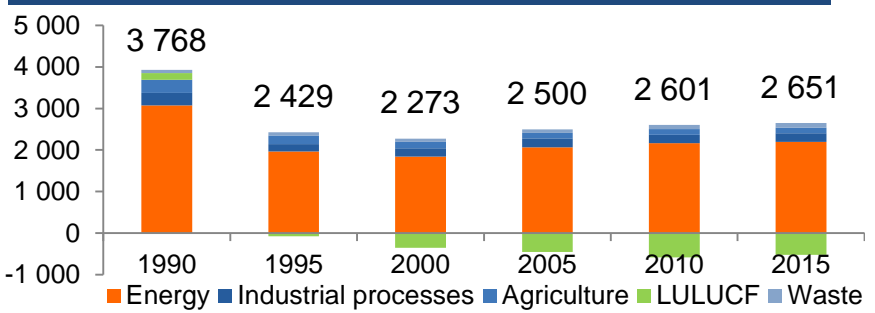
*Climate responsibility  
of En+ Group  
in power sector*

November 2017

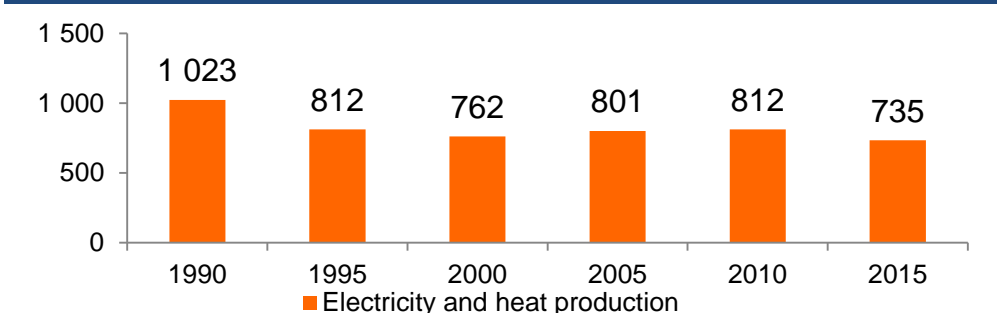
**En+**  
GROUP

# GHG dynamics in Russia

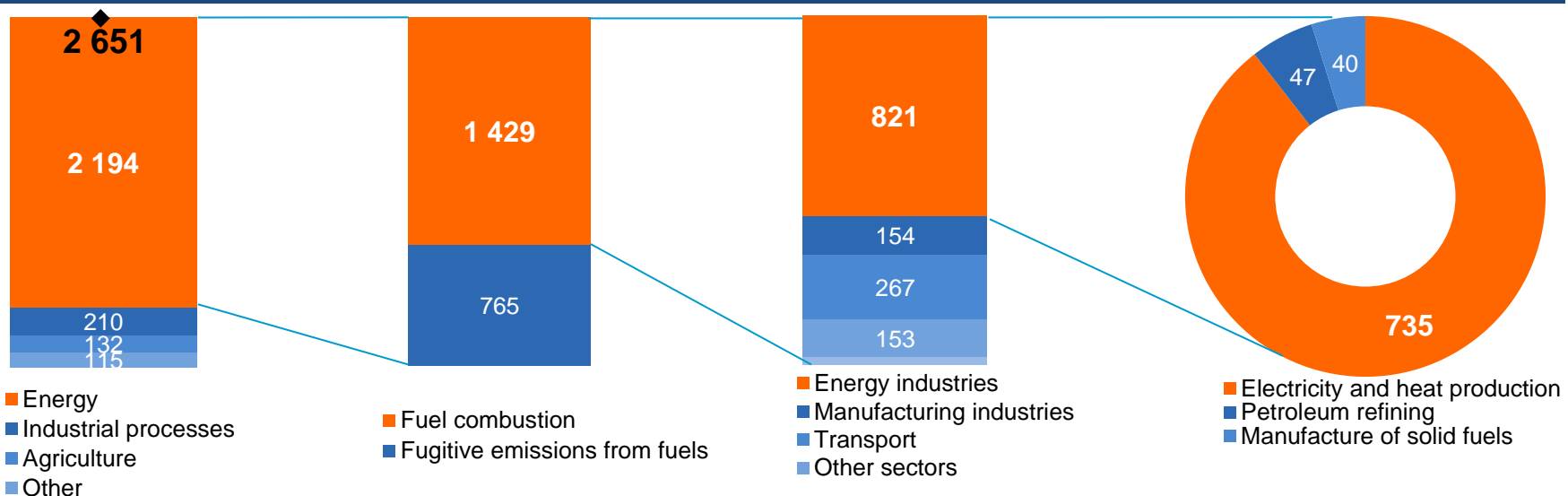
### Total GHG emissions dynamics (mt CO2)



### Electricity and heat production GHG emissions dynamics (mt CO2)

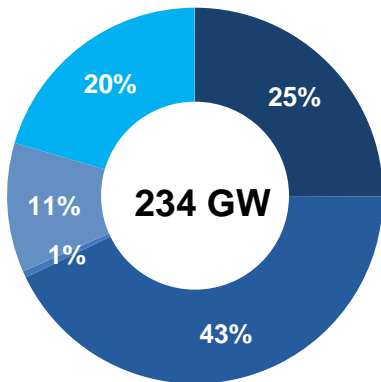


### GHG emissions by sector (mt CO2)

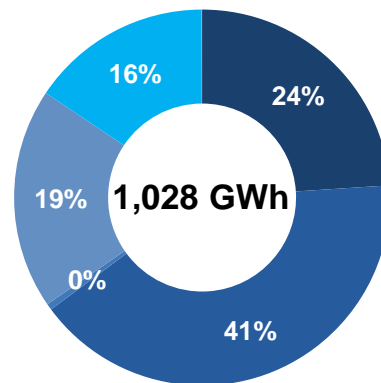


# Electricity Mix and Hydropower Potential

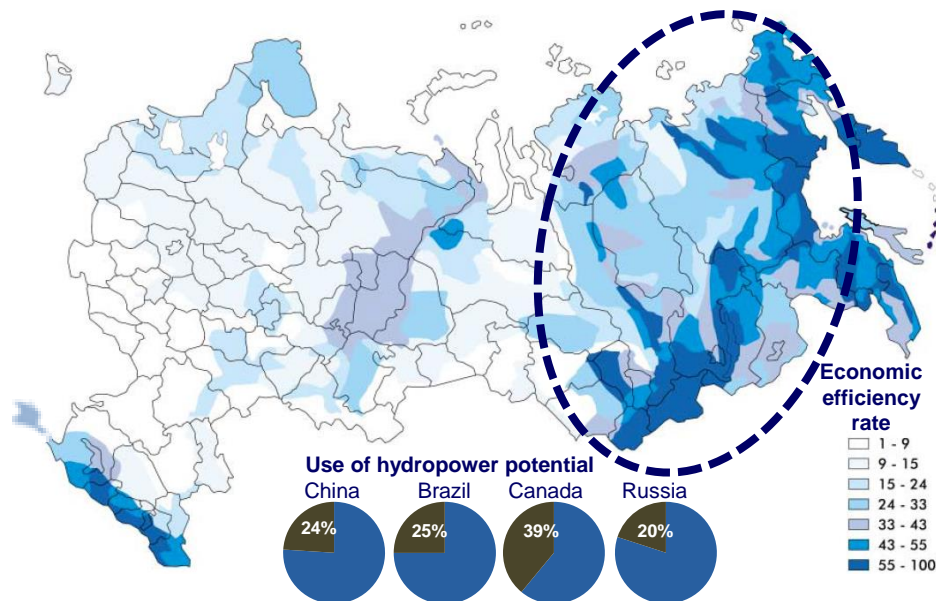
## Capacity



## Generation



## Hydropower potential



- Russia has a substantial hydropower potential. About 9% of the world's hydropower resources are concentrated in its territory. By hydropower resources Russia ranks second after China in the world.
- Use of hydro potential in Russia is significantly lower than in other countries.

Hydropower amounts around 20% from total installed capacity and provides around 16% of total power generation in Russia

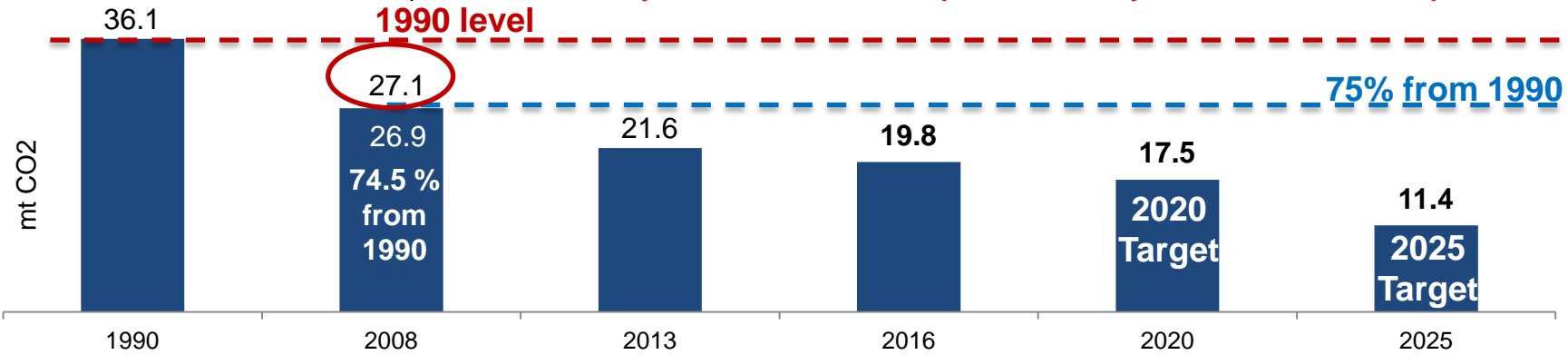
# En+ Power CO2 emission trend, targets and decarbonization plan

## Current status

Over the past 25 years GHG emissions were significantly decreased (from 36.1 mt CO2 eq. in 1990 to 19.8 mt CO2 eq. in 2016)

## Target

To decrease GHG emissions in comparison with 2016 by 12% to 17.5 mt CO2 eq. in 2020 and by 42% to 11.4 mt CO2 eq. in 2025



### GHG emissions reduction projects

1.3 mt CO<sub>2</sub> Emissions cut

- Increase of hydro power generation share instead of CHP generation as a result of more efficient use of water flow

0.4 mt CO<sub>2</sub> Emissions cut

- Decrease of electricity and heat losses in electric grids and heating networks

0.4 mt CO<sub>2</sub> Emissions cut

- Closure of inefficient fossil fuel generation

6.3 mt CO<sub>2</sub> Emissions cut

- Conversion of CHPs from coal to gas – transition to a lower carbon emitting energy generation

# Modernization of HPPs

En+ Power is implementing a modernization program of our hydropower plants located in Siberia that will boost annual power output without increasing the amount of hydro resources in use. It will help to partly substitute energy generated by local coal-fired plants and allow to further cut greenhouse gas emissions



## Bratsk HPP

## Ust-Ilimsk HPP

## Krasnoyarsk HPP

## Irkutsk HPP

Total 12 X

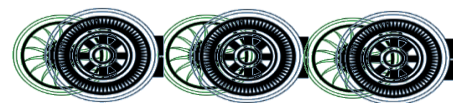
In total 4 X

Runners

Hydro units

Completed 12 X

Completed 3 X



2017

2017 - 2018

2018 - 2022

2017 - 2022

**1,075 GWh**   
 Output increase

**363 GWh**   
 Output increase

**616 GWh**   
 Output increase

**200 GWh**   
 Output increase

**1.246 mt CO2**   
 Emissions reduction

**0.421 mt CO2**   
 Emissions reduction

**0.714 mt CO2**   
 Emissions reduction

**0.231 mt CO2**   
 Emissions reduction

### Results of modernization program



**Annual growth of HPP output**  
2,25 GWh

**GHG emissions reduction**  
2.6 mt CO2

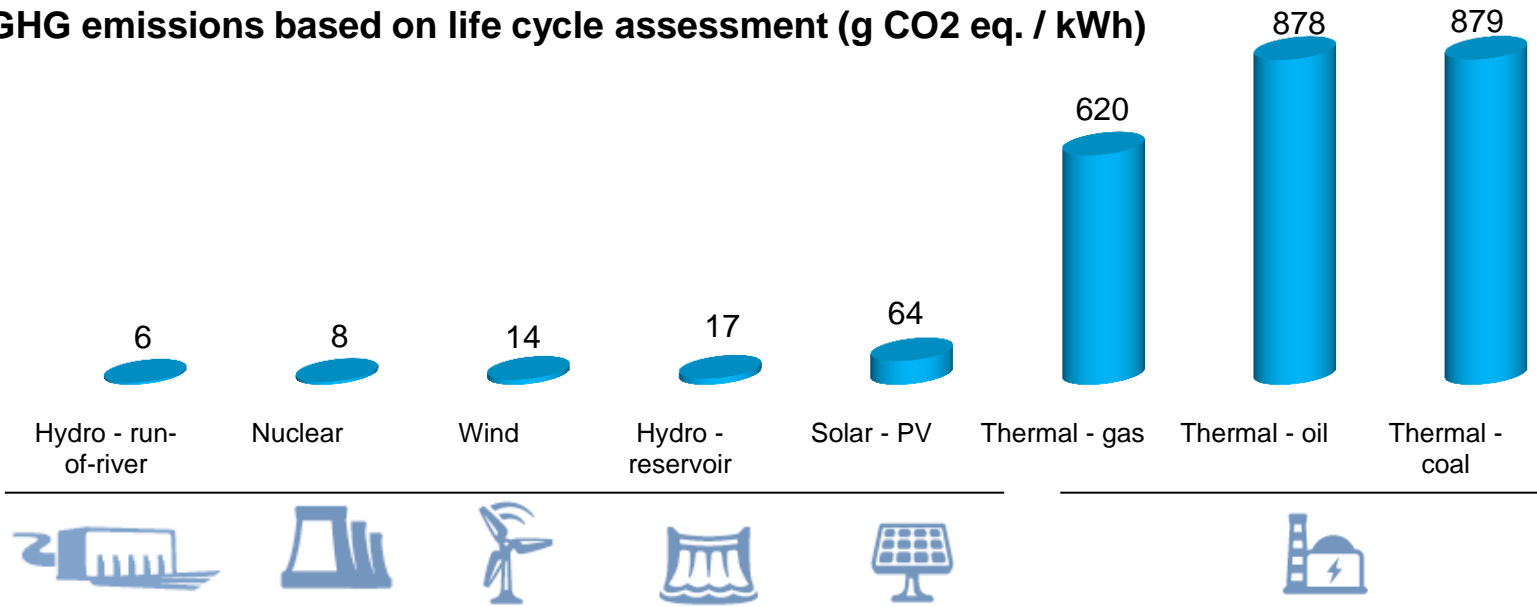


# Hydropower and GHG emissions

Several scientific studies confirm low emissions of HPPs in comparison with other types of generation:

- A life cycle assessment determines and quantifies the environmental impacts of a product, process or service over its entire life cycle.
- According to a study by CIRAIG the greenhouse gas (GHG) emission rate of hydropower, calculated based on a life cycle assessment is lower than for other renewables like solar power.
- Hydropower has a 70 times lower carbon footprint than coal-fired thermal plant (based on a full life cycle).

**GHG emissions based on life cycle assessment (g CO2 eq. / kWh)**

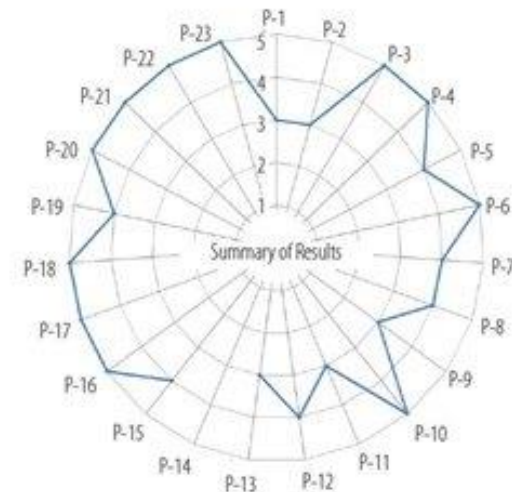


Source: <http://www.hydroquebec.com/sustainable-development/documentation-center/pdf/comparing-power-generation-options-and-electricity-mixes.pdf>

- The Hydropower Sustainability Assessment Protocol is a tool that promotes and guides more sustainable hydropower projects. It provides a common language that allows governments, civil society, financial institutions and the hydropower sector to talk about and evaluate sustainability issues.
- The Hydropower Sustainability Assessment Protocol, developed by the International Hydropower Association, is recognized the best global practice for assessing hydropower plants.
- Within the framework of this methodology, HPPs are analyzed according to various topics:

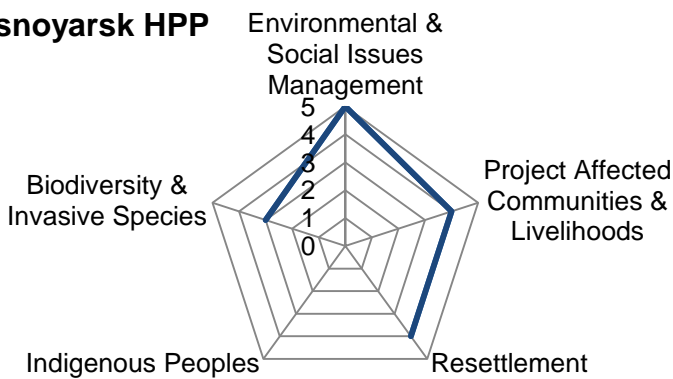
## Example List of Topics Assessed:

- |   |  |
|---|--|
| P-1 Communications and Consultation     | P-13 Project-Affected Communities      |
| P-2 Governance                          | P-14 Resettlement (Not relevant)       |
| P-3 Demonstrated Need and Strategic Fit | P-15 Indigenous Peoples                |
| P-4 Siting and Design                   | P-16 Labour and Working Conditions     |
| P-5 Environmental and Social Management | P-17 Cultural Heritage                 |
| P-6 Integrated Project Management       | P-18 Public Health                     |
| P-7 Hydrological Resource               | P-19 Biodiversity and Invasive Species |
| P-8 Infrastructure Safety               | P-20 Erosion and Sedimentation         |
| P-9 Financial Viability                 | P-21 Water Quality                     |
| P-10 Project Benefits                   | P-22 Reservoir Planning                |
| P-11 Economic Viability                 | P-23 Downstream Flow Regimes           |
| P-12 Procurement                        |  |

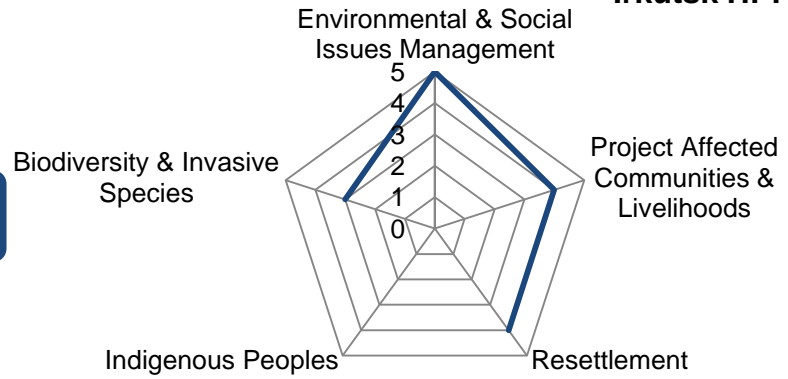


# Examples of partial unofficial in-house assessment

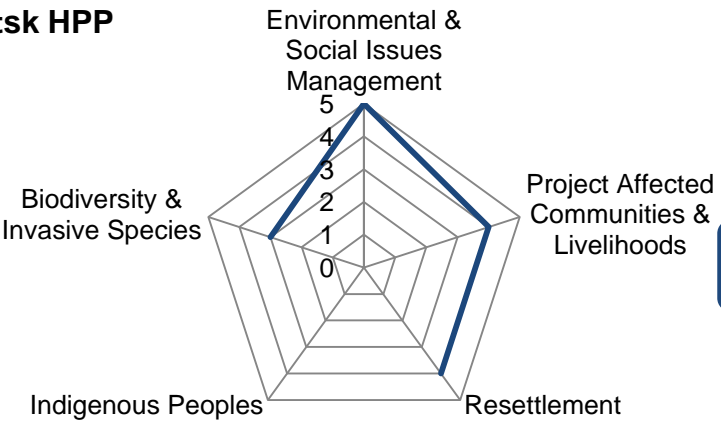
**Krasnoyarsk HPP**



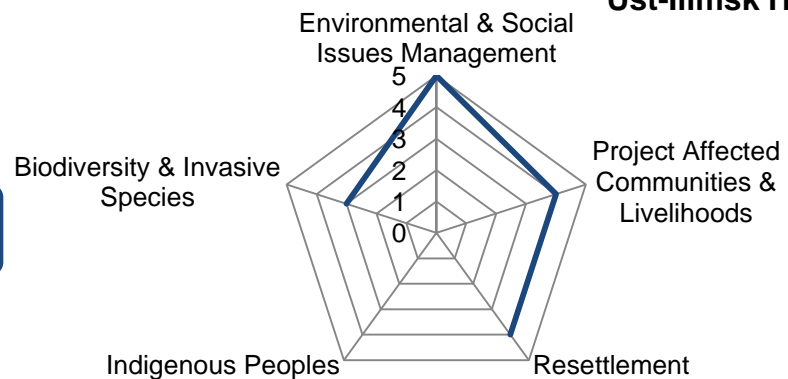
**Irkutsk HPP**



**Bratsk HPP**



**Ust-Ilimsk HPP**



Best practices

5

3

Normal practices

*\* Disclaimer: This assessment is an Unofficial assessment as it does not comply with the necessary terms required of an Official assessment. The results of this assessment do not necessarily reflect the quality required of an Official assessment and may not be an accurate reflection of the sustainability of the assessed project*



# Abakan solar power plant

## Description

The project of Abakan solar power plant was selected in the contest of renewable energy projects in accordance with the program of state support for renewable energy industry in 2013.

- Location – Abakan city, Republic of Khakassia
- COD – 4Q 2015
- Installed capacity – 5.2 MW
- Planned capacity extension up to 35 MW – 50 MW during 2017 – 2019

## Further development

- Total land area in the property of SPV «Abakan Solar Power Plant», LLC – 125 Ha.
- Land area used for Abakan Power Plant (5,2 MW) – 20 Ha.
- Land area available for Project Expansion (excluding land for 5,2 MW) – 105 Ha.
- 30-45 MW of solar capacities can be installed on these land plots.

## Project status

- En+ Power considers the opportunity of further extension of Abakan Power Plant.

Location

