Climate benefits of road transport gasification in Russian Federation and methane leakage

THE RUSSIAN PRESIDENTIAL ACADEMY OF NATURAL ECONOMY AND PUBLIC ADMINISTRARION (RANEPA)

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Regular ETSAP Workshop
Beijing, 2014

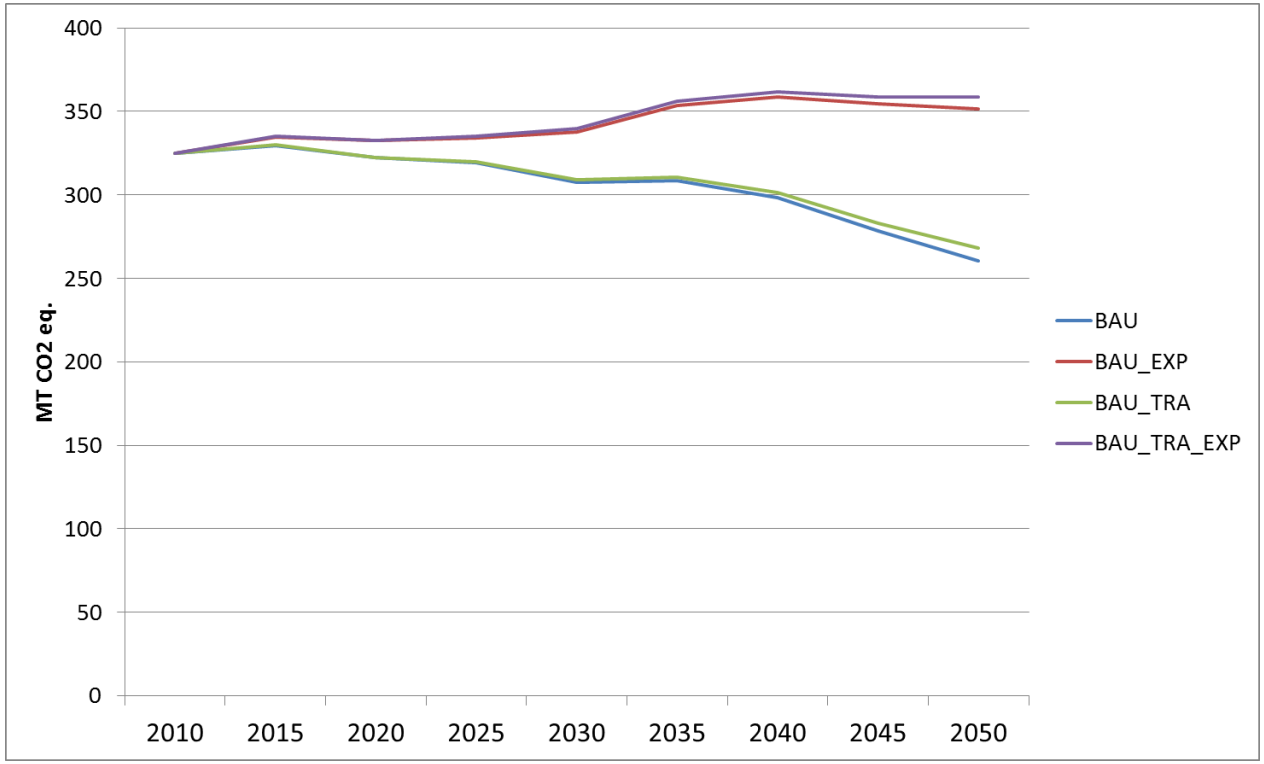
Motivation

- Medvedev signed law to promote use of natural gas in road transport to reduce emissions
- Uncertainty of exports of natural gas to Europe
- Shale gas revolution
- How will it influence on emissions?

Scenarios

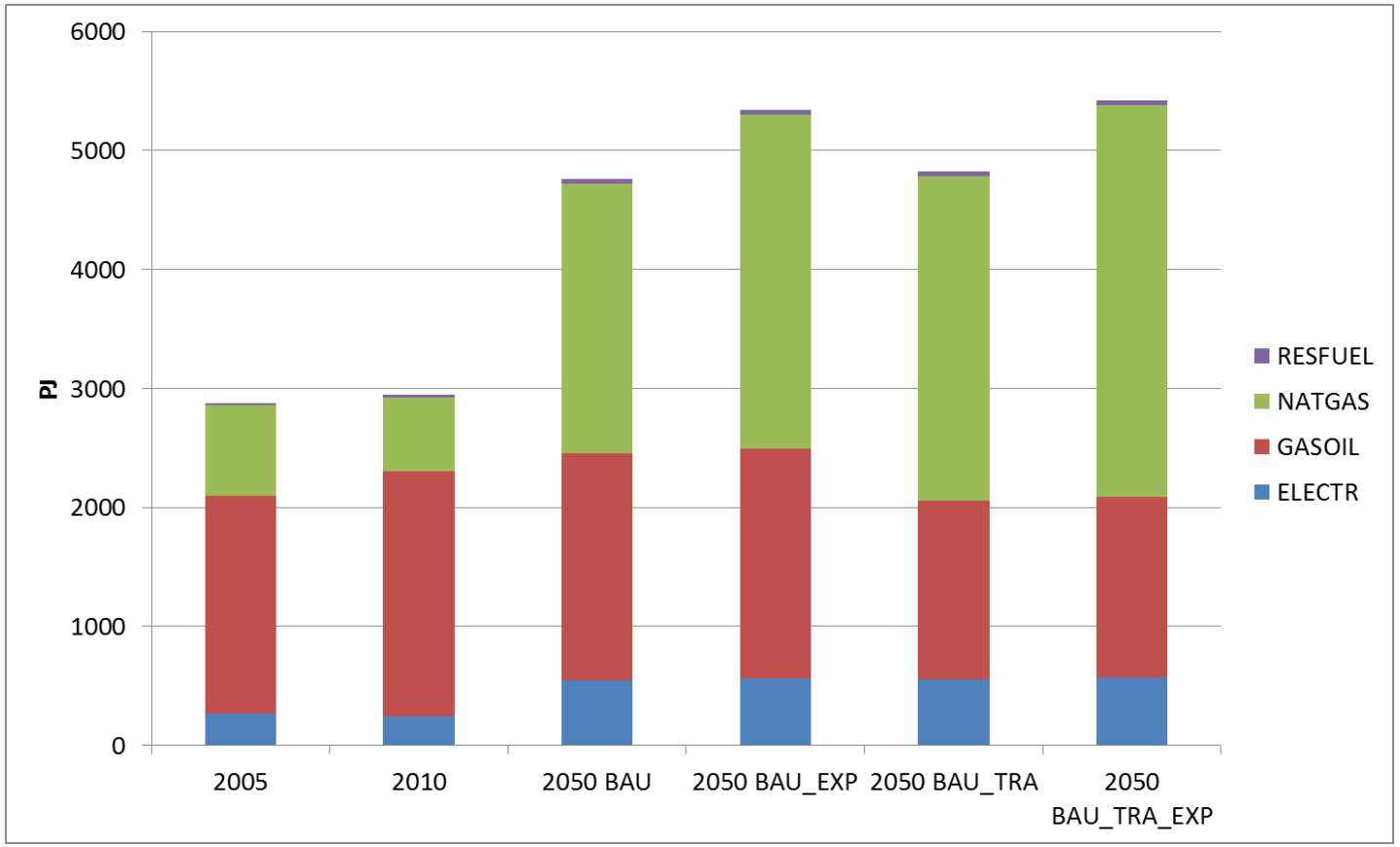
- BP forecast: gas transportation via pipeline will grow for 60% by 2030
- BP forecast: demand for natural gas from OECD countries will grow by 50% as transition fuel for decarbonized economies
- Role of Russian export to Europe is uncertain due to cost and political decisions: cost of extraction in Russia is $50 US, shale gas extraction costs vary from $20 to $100 US
- Medvedevs law was motivated not by ecological aspect but to increase domestic demand in case of falling export

Emissions dynamics in transport sector



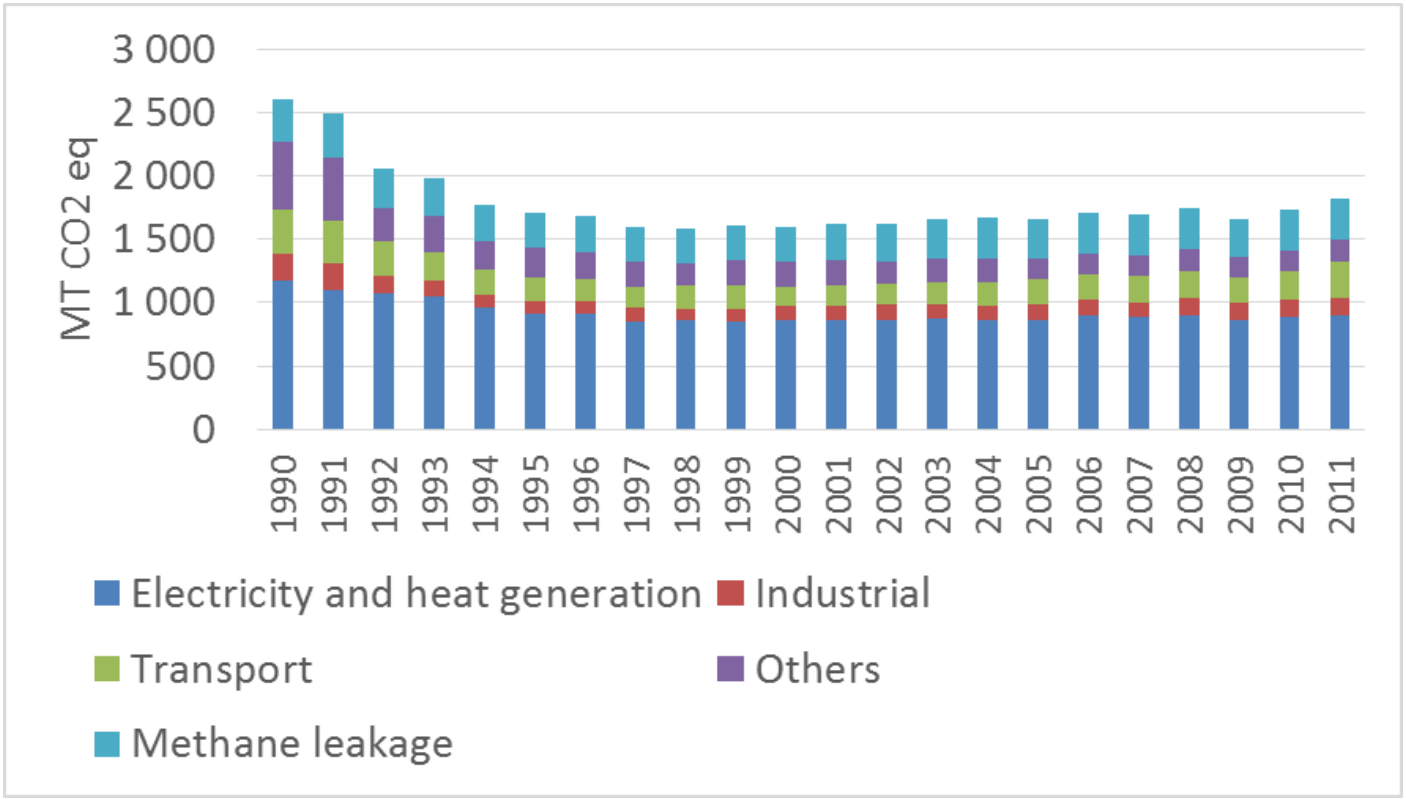
- BAU_EXP : growth of natural gas exports for 50%
- BAU_TRA : shift of road transport to natural gas (LPG,LNG,CNG)
- Shift to natural gas increases emissions

Fuel structure in transport sector



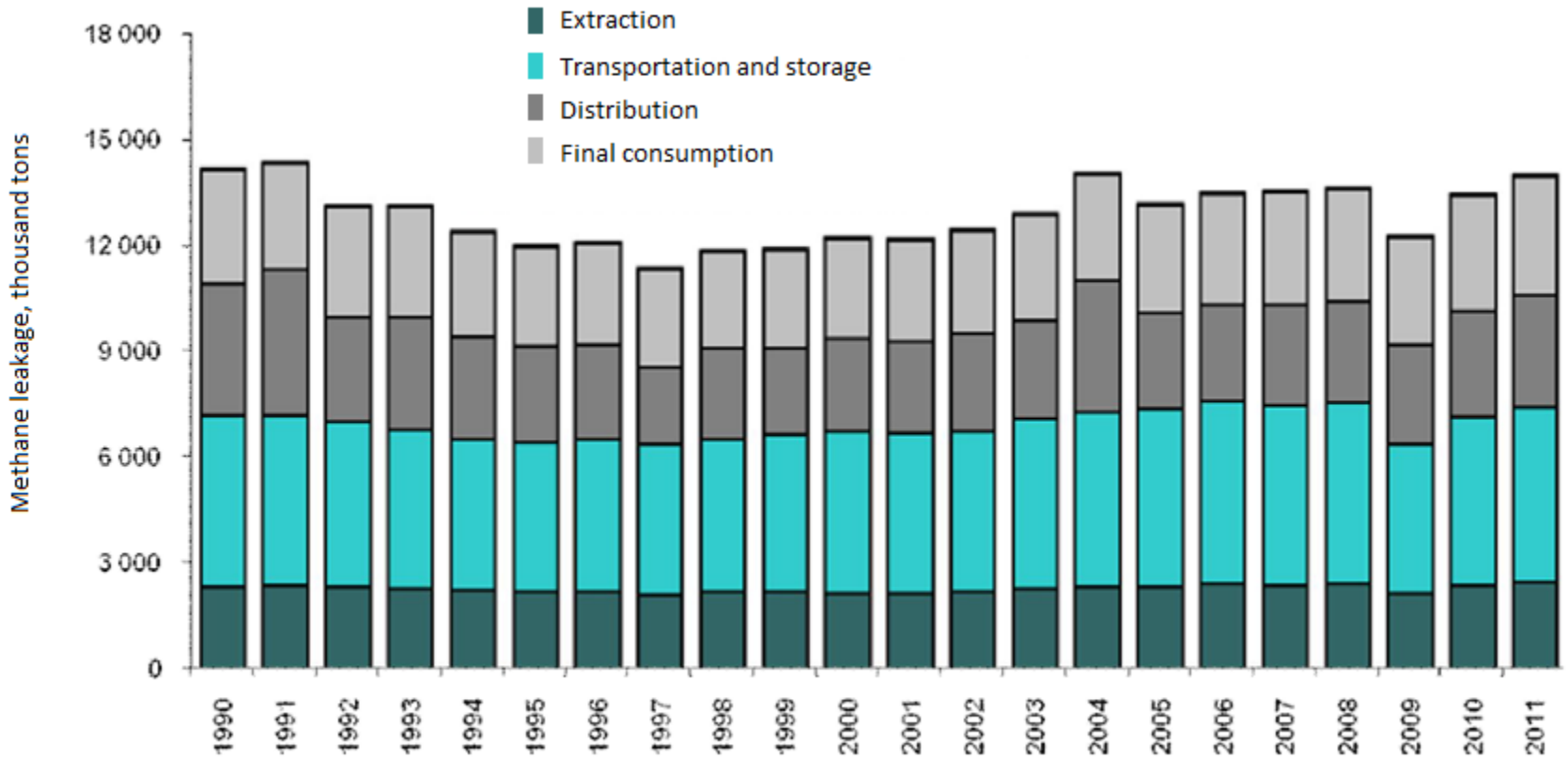
- Natural gas consumption is 5 times more compared to 2010
- Buses and HDV according to Medvedev's directive use LNG
- LDV use LPG because it is twice cheaper than gasoline and diesel fuel

Methane leakage



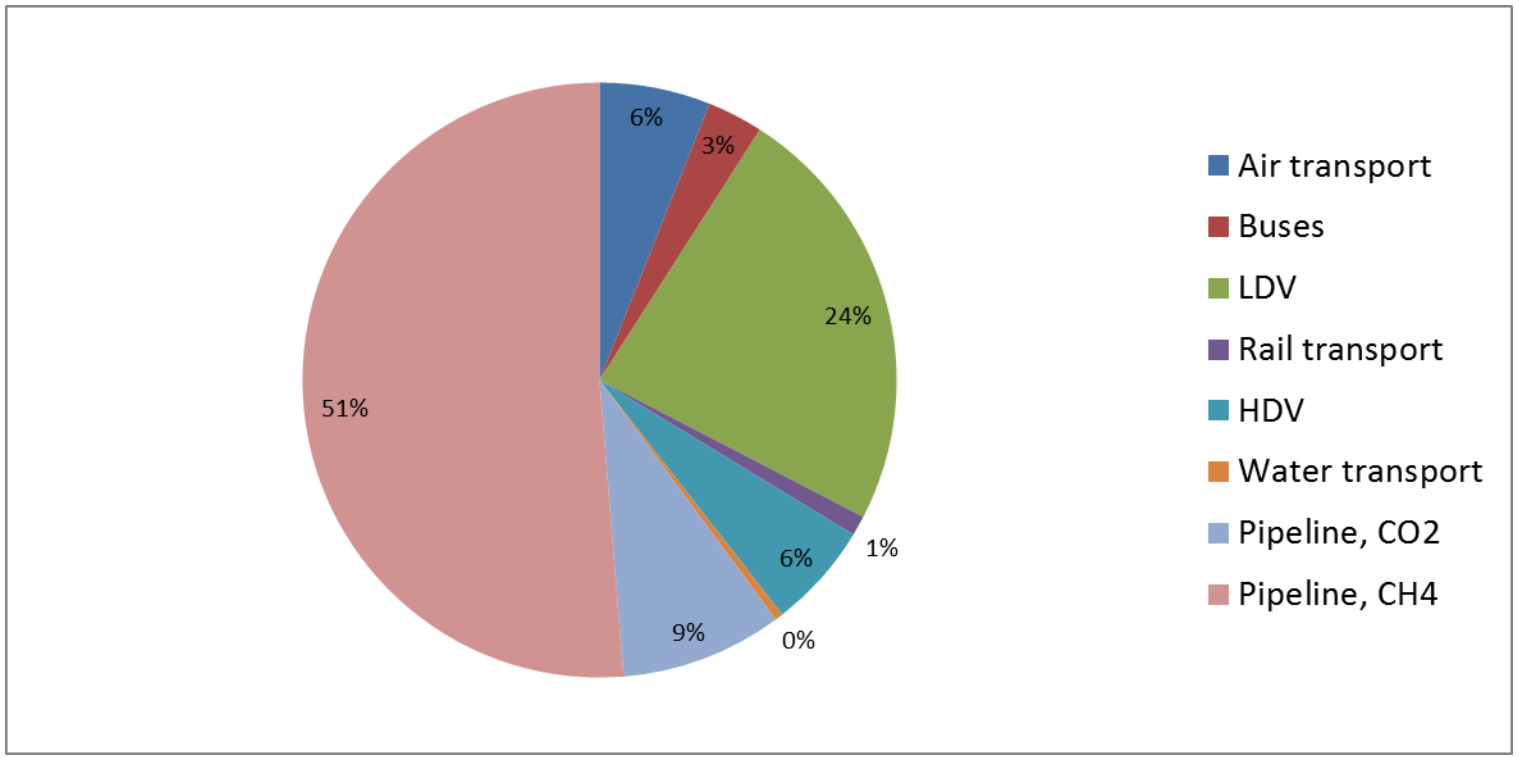
- Transport sector emissions share in 2011 – 18.7%, with methane leakage – 33.6%
- Leakage equal to 20 bln cubic meters (50% of planned export to China)

Methane leakage



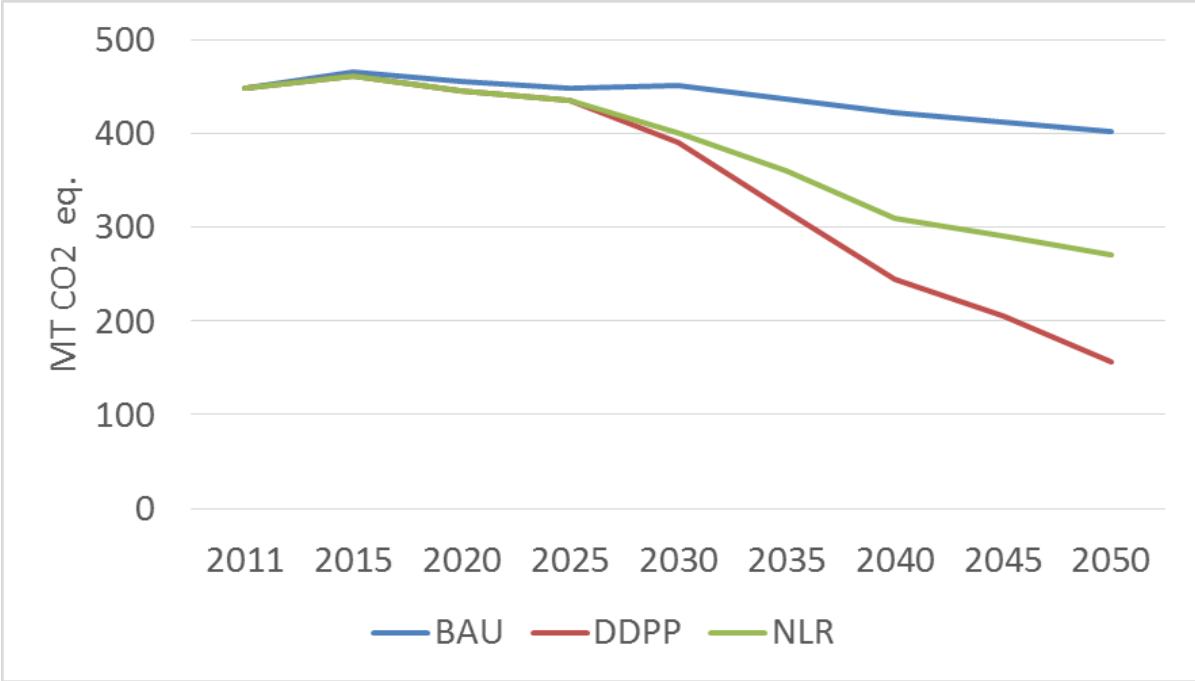
- Methane leakage at transportation and storage ~ 83% of all methane leakages
- Even thought on picture it is much less, at extraction most of leakages are due to transportation via local pipelines, witch are concerned as part of extraction process

Emissions structure of transport sector in 2011



- Share of methane leakage is 51% of transport sector emissions.
- LDV emissions share is 24%

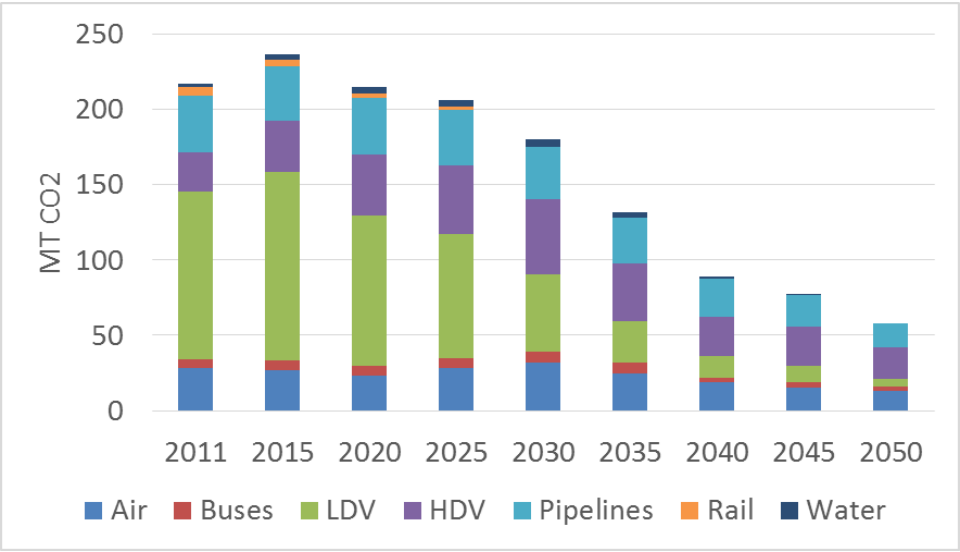
Emissions pathways



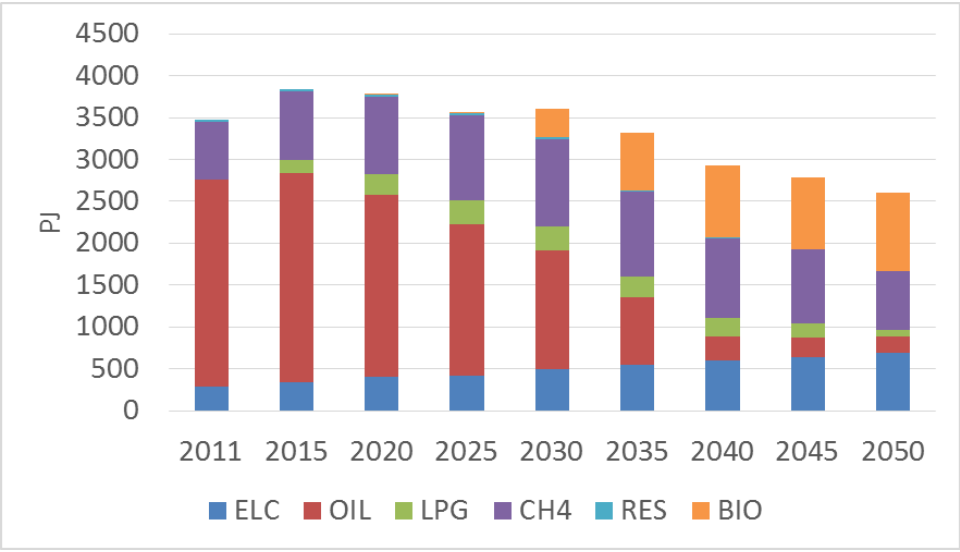
- Deep Decarbonization Pathway Project (DDPP) is UN project which involves 15 countries. The aim is to find ways to reduce global emissions by 80%
- In 2050 methane leakage in DDPP scenario is 80 MT CO2 eq. Without leakage reduction it would be for 114 Mt more
- Even 100% CCS won't let to meet boundaries due to 194 MT CO2 eq. of methane leakages if measures won't be applied

DDPP results

Transport sector emissions

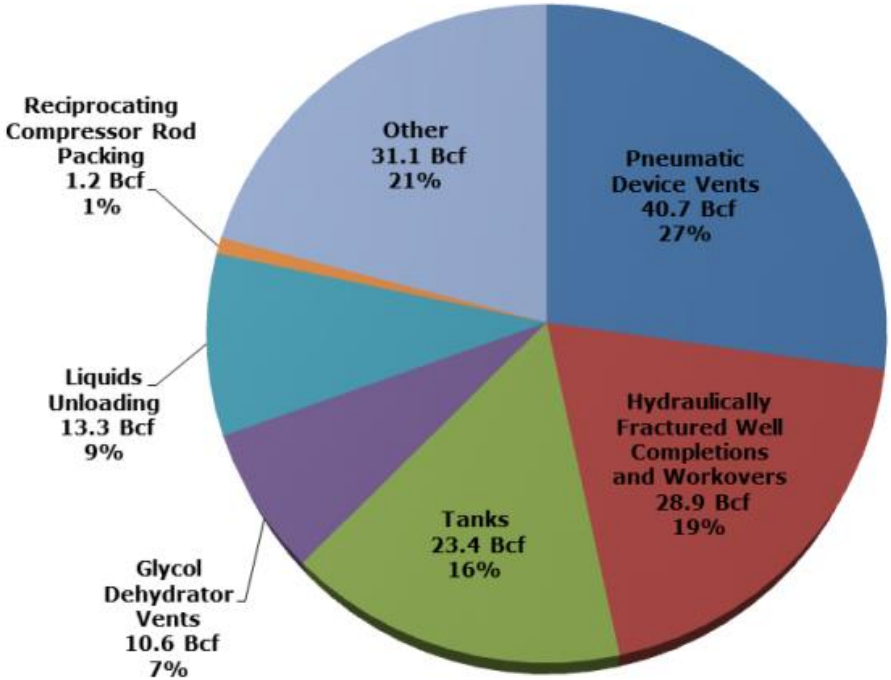


Transport sector energy consumption

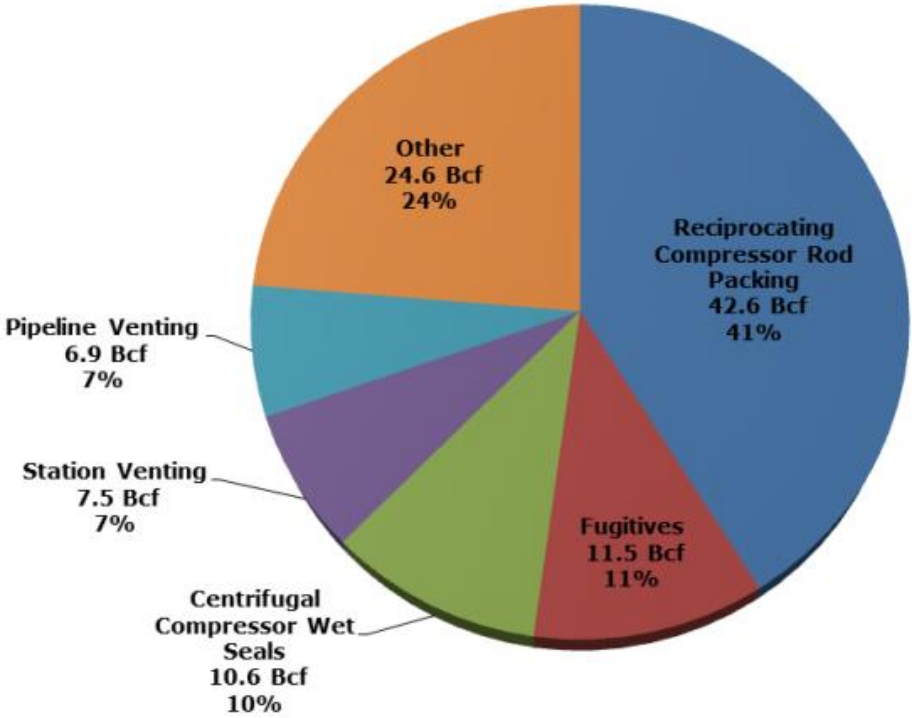


Why do methane leakages exist?

Extraction



Transportation and storage



Source: EPA Gas Star program

Technologies to stop leakages

Economic and Environmental Benefits

Method for Reducing Natural Gas Losses	Volume of Natural Gas Savings (Mcf/ year)	Value of Natural Gas Savings ($/ year)			Implementation Cost ($)	Payback (Months)		
		$3 per Mcf	$5 per Mcf	$7 per Mcf		$3 per Mcf	$5 per Mcf	$7 per Mcf
Economic replacement of rings and rods in compressor rod packing	865[a]	$2,595	$4,325	$6,055	$540[b]	3	2	1

General Assumptions:
[a] Pipeline Research Committee International (1999).
[b] $1,620 cost of ring replacement every three years rather than four years (industry average).

Economic and Environmental Benefits

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Replacement								
Change to low-bleed device at end of life.	50 to 200	$150 to $600	$250 to $1,000	$350 to $1,400	$210 to $340[a]	4 to 27	3 to 17	2 to 12
Early-replacement of high-bleed unit.	260	$780	$1,300	$1,820	$1,850	29	17	13
Retrofit	230	$690	$1,150	$1,610 per year	$675	12	7	5
Maintenance	45 to 260	$135 to $780	$225 to $1,300	$315 to $1,820	Negligible to $500	Immediate to 8	Immediate to 5	Immediate to 4

General Assumptions:
[a] Incremental cost of low-bleed over high-bleed equipment.

Source: EPA Gas Star program

Conclusions

- Growing demand for natural gas increase emissions in exporting countries more than decrease in CO2 emissions due to fuel switch
- Natural gas as transit fuel won't works without leakages reduction
- 50% reduction of methane leakages in natural gas transportation costs ~ $1 billion US
- Reduction leakages less than 0.7% probably unachievable due to leakages at final consumption and malfunctions at pipelines
- Precise analysis of required investments is challenge due to the absence of information in natural gas sector
- Gazprom stakeholders negotiation about methane leakages with more precise evaluation of needed investments

Thank you!

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