

Updates on the RFE Energy Sector and the RFE LEAP model, and Inputs to and Results of RFE Future Energy Paths

Dr. Kalashnikov
Economic Research Institute FEB RAS,

Dr. Ognev
JSC “Power Lines of the East”

Mr. Goulidov
Economic Research Institute FEB RAS

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Presentation Outline (1)

1. Recent trends and events in the RFE energy development

- Oil pipeline**
- Gas Cooperative Initiatives**
- Electricity Trade**

2. Emergency Fuel Stockpiling, Energy Efficiency and District Heating

Presentation Outline (2)

3. *LEAP Activities*

- **Current Accounts Revision**
- **Final Demand Structure**
- **Energy Transformation Structure**
- **Principles of forming modules and module's main features**

Presentation Outline (3)

4. Modeling Future Energy Scenarios for the RFE (key assumptions)

- Business-as-Usual Scenario**
- National Alternative Scenario**
- Regional Alternative Scenario**

5. Selected Draft Results of RFE Energy Paths

The East Siberia – Primoriye Oil Pipeline (1)

- ✓ In December 2004 frame project for construction of “Taishet – Scovorodino – Perevoznaya” Oil Pipeline was approved
- ✓ In April 2005 the directive “On basic phases of construction “Taishet – Scovorodino – Perevoznaya” Oil Pipeline” was issued

The East Siberia – Primoriye Oil Pipeline (2)

- 1st phase includes “Taishet – Scovorodino” section, Period of commission is to be the second half of 2008, The throughput is 30 mln tones of crude oil
- Simultaneously Oil Terminal in Perevoznaya Bay is to be commissioned till second half of 2008, its throughput is intended to be 30 mln tones as well
- 2nd section “Scovorodino – Perevoznaya” is depended upon development of new oil fields in the Eastern Siberia and the Far East

Gas Cooperative Initiatives (1)

- ✓ In February 2005 there was a consideration of the Draft of the Program on "Building gas extraction and transportation system in the Eastern Siberia and the Far East taking into consideration possible gas export into the markets of China and other Asia Pacific countries"
 - The Kovyktinskoye gas Project will be likely re-orientated for domestic gas requirements of the western part of Russia

Gas Cooperative Initiatives (2)

- ✓ In 2004 and 2005 the Exxon Neftegas carries on negotiations on pipeline gas supply to Northeast China. Expected volumes of gas supply can be about 10 BCM
 - It is worth to reappraise important strategic decisions on the plausible configuration of the gas pipeline network in the NEA countries. At the moment would be reasonable to focus on the triangle "Sakhalin shelf – Northeast China – the Korean Peninsula"

Electricity Trade

- ✓ Commercial negotiations on construction of two power lines 220 kV Blagoveschensk (Amurskaya Oblast) – Kheikhe (Northeast China) entered a completion phase. Whole capacity of the lines will be 600 MW, to be commissioned up to 2010.
- ✓ Other possible export routes are strongly depended on policy issues

Emergency Fuel Stockpiling (1)

✓ *Operational Fuel Stocks*

The volumes are depended upon location of power plant or boiler (in power grid / heat network or not), installed load, the remoteness of power plant or boiler from transport lines

✓ *Stocks for Emergency Case*

Under the emergency cases catastrophes, big accidents, acts of God, military operations are regarded. In any other cases this type of stocks is untouchable. The volumes and quotas of the Stocks for Emergency Case are State secret

Emergency Fuel Stockpiling (2)

- ✓ In Russia so far there is no system of stocks for market interventions to smooth fluctuations in the energy markets. Only this year in Federal Government the question on building of such a type of stocks was raised

Energy Efficiency Potential Estimates for the RFE

Stage of Energy Flow and energy resource	%
Electricity Final Consumption	5-15
Heat Final Consumption	15-25
Fuel for production & operation needs	5-15
Engine fuel consumption	5-10
Electricity T&D	5-10
Heat T&D	10-20
Power Generation (TPPS)	4-8
Heat Generation (Boilers)	10-15

Main Energy Efficiency Tendencies

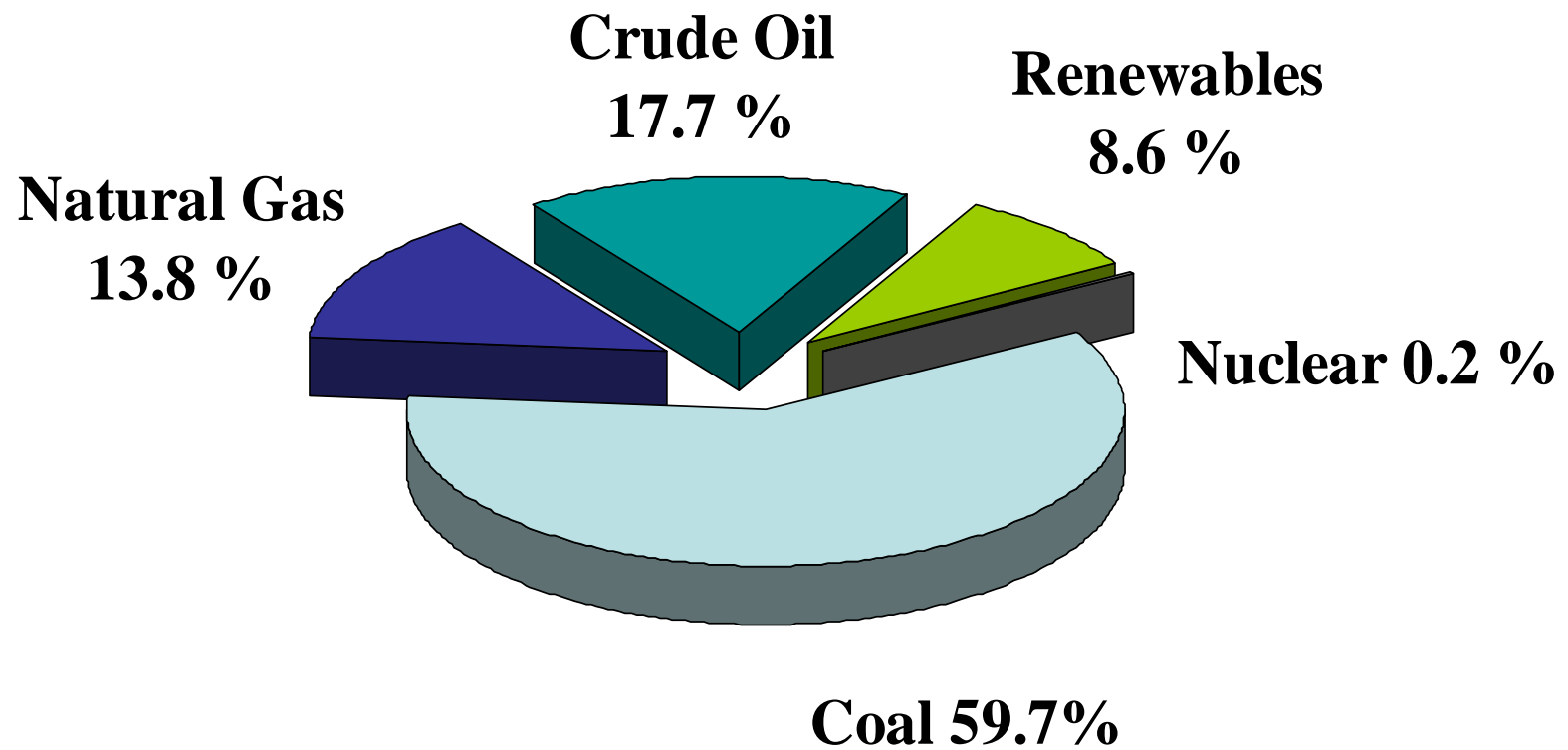
- Russian Government does not pay sufficient real attention to issues of energy efficiency. Though this priority in energy policy are often declared
- Now since economic growth began energy efficiency has been stably declining. But it is associated with achieving optimal production scales and not accompanied with structural and behavioral changes
- Private companies are not interested in introducing energy-efficient measures. In supply side incentives to improve energy efficiency of production and T&D are weak because of the monopolistic (or oligopolistic) structure of markets where power companies operate

District Heating

- ✓ Unique structure of District Heating system with a lot of large CHP, large boilers and long heat T&D lines
- ✓ Now when there have been emerged new heat generation technologies (primarily in the sphere of distributed energy) former district heating structure does not quite meet energy and economic efficiency requirements

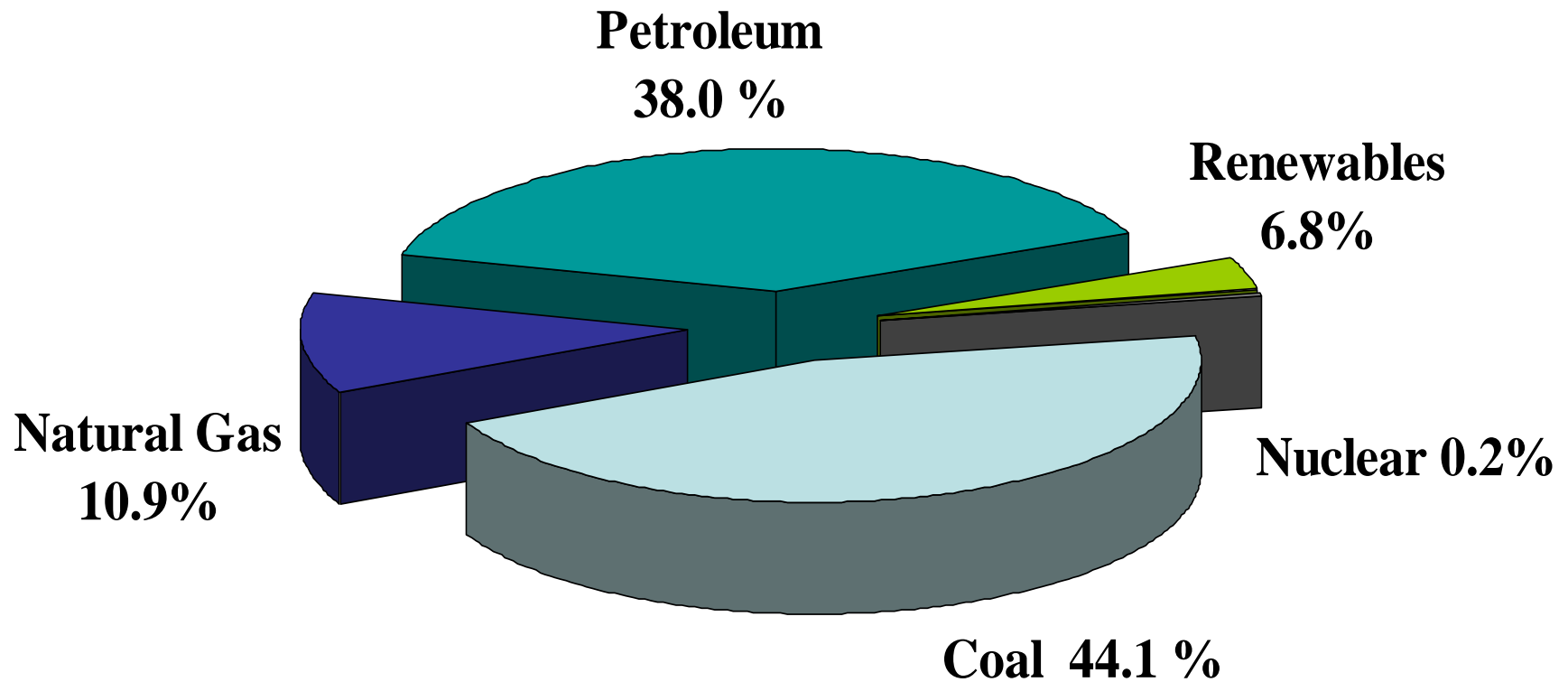
BY2000 Revision (1)

- **Primary Energy Production - 29.7 mln tce**



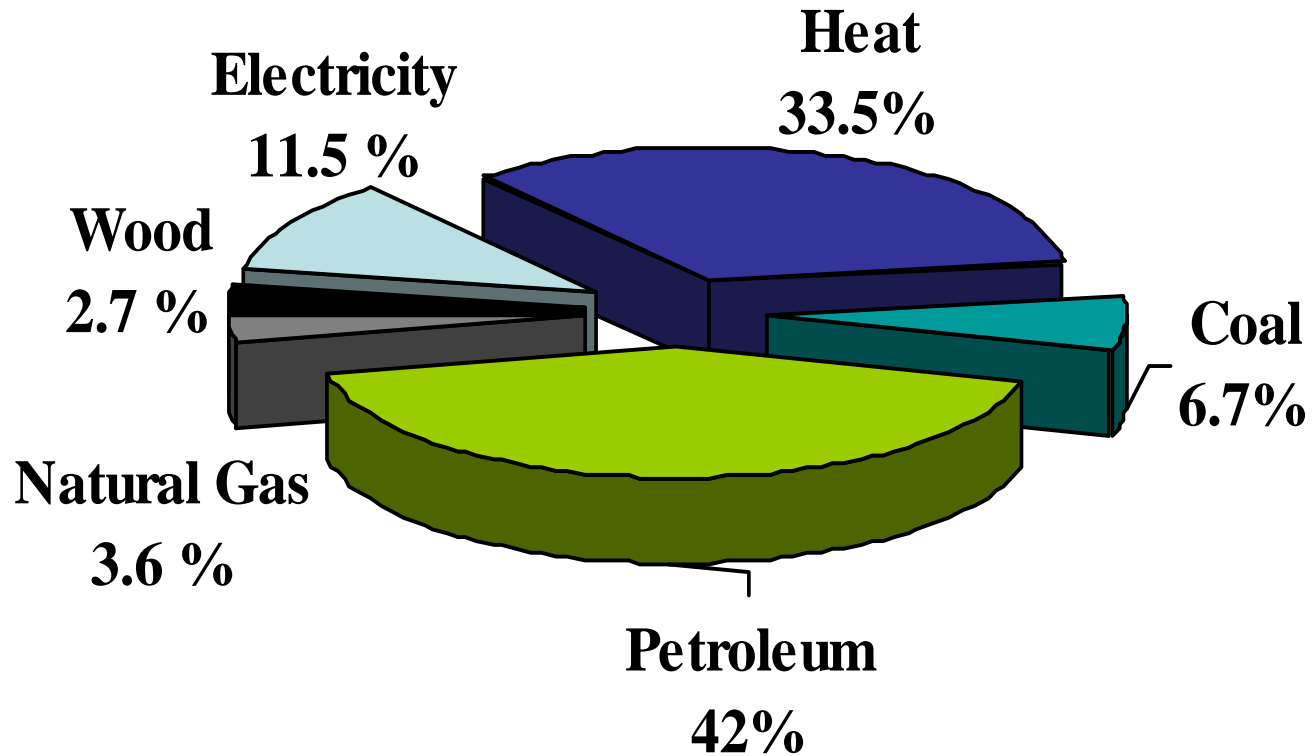
BY2000 Revision (2)

- Total Energy Consumption - 37.6 mln tce



BY2000 Revision (3)

- Final Energy Consumption - 22.5 mln tce



Final Demand Structure

- ✓ Now Final Demand module does not include any sectors, sub-sectors and end-uses
- ✓ It contains 16 energy resources used in final energy consumption within the RFE (hard and lignite coals, diesel, gasoline, electricity, heat, natural gas, etc.), and the perspective trends of their consumption

Energy Transformation Structure

- ✓ The tree structure of the Transformation Sector was dominated with
 - Main mission and major purposes of the AES Project and explicit wishes of the associates of the Nautilus Institute
 - Informational gaps and our possibilities to make reasonable estimates
 - Relatively rigid computational algorithm of the LEAP model

LEAP: RFE_2002_Final_12

Area View Analysis Edit General Tree Chart Help

New Open Save Fuels Effects Units References Help What's this?

Scenario: Current Accounts (2002) Manage Scenarios Expression Builder Time Series Wizard

Branch: Demand

Activity Level

A measure of the social or economic activity for which energy is consumed. [Help on Variable](#)

Name	Current Accounts Expression	Scale	Units
All Final Demand			No data
Energy Processing Ow...			No data
Energy Transportation...			No data
Energy Production			No data

Chart Table Notes

Show: Activity Level

Chart not available

Area: RFE_2002_Final_12 Analysis Registered to: ERI FEB RAS RUSSIA

пущ Beijing_2004 AES2005 Re... ABBYY Lingvo AES_2005 R... Beijing_2004_1 LEAP RU 7:54

Principles of forming modules and module's main features (1)

- ✓ Electricity Generation and Electricity T&D
 - Six modules. One includes power plants from territories covered with the Unified Power Grid of the RFE (Khabarovskiy Krai, Primoriye, Amurskaya oblast, Jewish Autonomous Oblast and the South of Yakutiya Republic)
 - Other five modules are corresponded to the rest administrative territories of the RFE (Sakhalin, Kamchatka, Magadanskaya Oblast, Chukotskiy Autonomous Okrug and the rest part of Yakutiya Republic)

Principles of forming modules and module's main features (2)

- ✓ Export Transmission Lines and Isolated Plant module
 - Five Export Transmission Line modules. One module is for power lines for near-border power trade with Northeast China, second module is for export power lines into China as well. Third and fourth modules are for possible export lines to DPRK and ROK
 - Fifth Export Transmission Line module and Isolated Plant module together simulate activities under conditions of the Russia-Japan energy bridge project:

Principles of forming modules and module's main features (3)

- ✓ Heat Generation and Heat T&D
 - The same structure as that of Electricity Generation. One module includes industrial and municipal boilers from territories covered with the Unified Power Grid of the RFE
 - Other five modules are corresponded to the rest administrative territories of the RFE

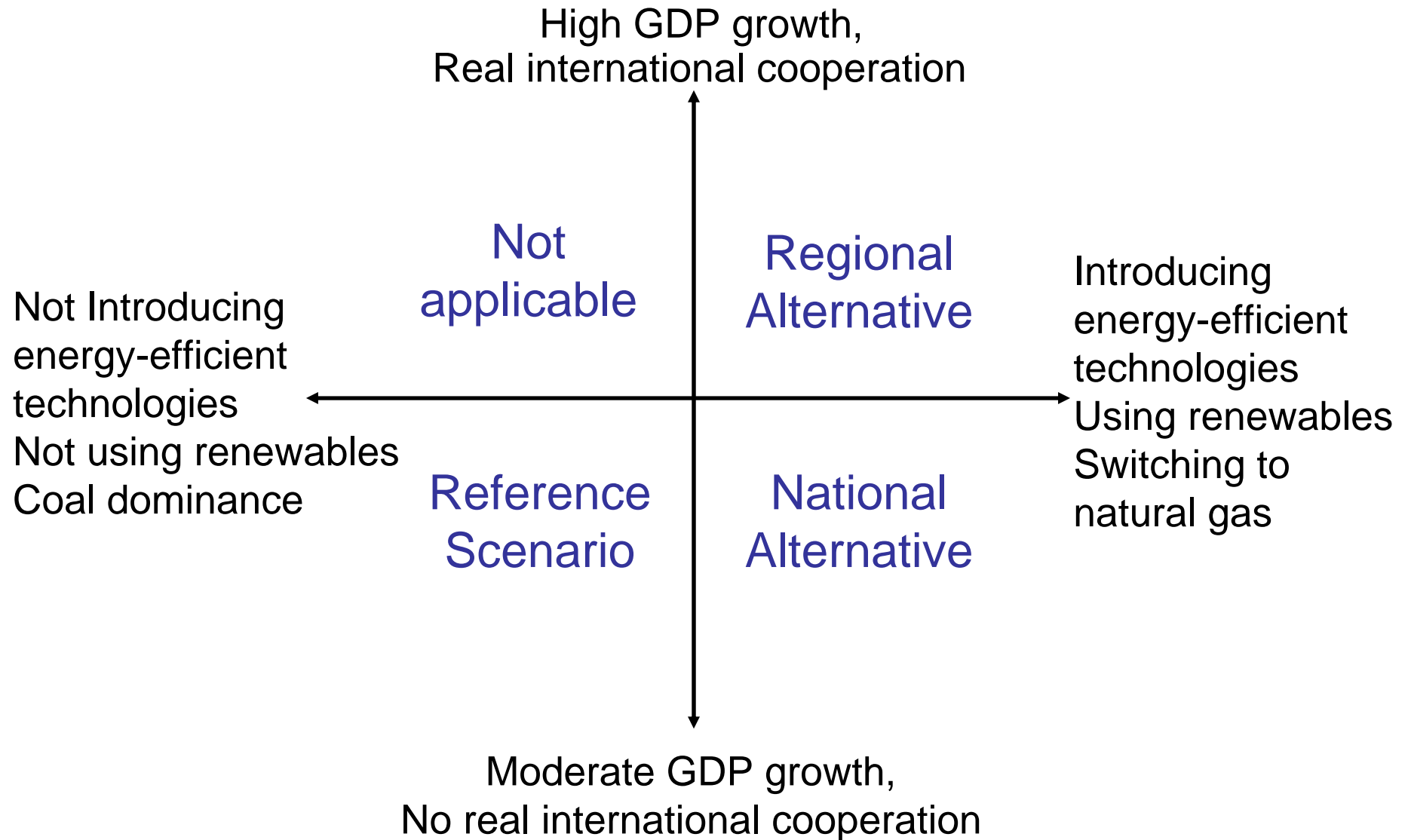
Principles of forming modules and module's main features (4)

- ✓ Oil Refinery, Coal Washing, Gas Processing and LNG Production
 - Four modules for Refineries (one for large oil Refineries, and others for the rest small refineries)
 - Coal Washing module represents the processing of Bituminous Coal in the South of Yakutiya
 - Gas Processing module identifies a prospective project on introducing Fisher-Tropch technology in Central Yakutiya
 - LNG Production module is for natural gas liquefaction plant in Sakhalin which is under construction now

Principles of forming modules and module's main features (5)

- ✓ Pipeline Oil and Gas Export, Natural Gas T&D, Crude Oil Production, Natural Gas Extraction, Bituminous and Lignite Coal Production
 - Pipeline Oil Export and Pipeline Gas Export modules are for prospective international projects on moving oil & gas from the RFE to North East Asia
 - Crude Oil Production and Natural Gas Extraction are in six modules. Two modules are for oil production (Sakhalin and Yakutiya), four modules are for gas extraction (Sakhalin, Yakutiya, Kamchatka and Chukotka)
 - Bituminous Coal Production and Lignite Coal Production modules represent coal producers in the RFE grouping into processes in compliance with territorial affiliation and type of mining

Modeling Future Energy Scenarios for the RFE



Business-as-Usual Scenario

Key Assumptions

- Moderate GDP growth rates (like at present period)
- Stabilization of population (ceasing of decreasing)
- Keeping present ecological standards in the transformation sector
- Keeping present attitude towards usage of renewables
- No effective energy efficiency policy
- No considerable activities on stimulating energy cooperation in NEA
- No active development of international energy projects

Business-as-Usual Scenario

Specifications of Some Key Assumptions

Growth Rates of the Basic Energy and Economy Indicators, %

Energy or Economy Indicator	2002-2005	2005-2010	2010-2015	2015-2020	2021-2030
GDP	5.3	5.0	4.5	4.7	4.4
Primary Energy Intensity	-4.2	-2.4	-1.7	-1.9	-1.7
Primary Energy Consumption	0.9	2.5	2.7	2.7	2.6
Electricity Final Consumption	1.9	2.9	3.1	3.3	2.9
Heat Final Consumption	0.0	1.4	1.8	2.3	2.2

Business-as-Usual Scenario

Some Implications

- The increase in production of primary energy will be associated with the projects of Sakhalin-1, Sakhalin-2. All Crude Oil and LNG will be exported.
- The domestic primary energy demand will be covered mainly with growth of coal production and expansion of coal import from Siberia
- The growth of electricity generation will be supplied with Bureiskaya HPP and in future with new conventional coal units and some retrofitted gas units in Sakhalin and Khabarovskiy Krai
- The lack of financial mechanisms for developing non-traditional renewable resources will restrict installation of small HPPs, wind power
- Growth of heat generation will be provided mainly with conventional coal boilers and coal CP Units in the cities
- Emissions of greenhouse gases and oxides will increase
- The energy consumption diversification index will rise
- Energy dependence of region will grow
- Demand for primary energy will grow

National Alternative Scenario

Key Assumptions

- Moderate GDP growth rates (like at present period)
- Stabilization of population (ceasing of decreasing)
- Ecological standards enhancing in the transformation sector.
- Developing renewable energy for domestic needs (small HPPs, wind power)
- There is effective energy efficiency policy.
- No considerable activities on stimulating energy cooperation in NEA
- No active development of international energy projects

National Alternative Scenario

Specifications of Some Key Assumptions

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Electricity Final Consumption	1.9	2.9	3.1	3.3	2.9
Heat Final Consumption	0.0	1.4	1.8	2.3	2.2

National Alternative Scenario

Some Implications

- The increase in production of primary energy will be associated with the projects of Sakhalin-1,2. All Crude Oil and LNG will be exported.
- Natural Gas from Sakhalin-1 will be directed to Khabarovskiy Krai in large quantities than in BAU.
- The growth of electricity generation will be supplied with Bureiskaya HPP and in future with new HPPs, more active construction of steam-and-gas PP in Sakhalin and Khabarovskiy Krai.
- The efficiency of energy transformation and distribution will grow.
- The renewable energy will be applied in remote districts.
- No increase in coal production is expected. Import of coal from Siberia will decline up to zero.
- Emissions will comparatively be lower.
- The energy consumption diversification index will decline
- The share of renewable energy resources will grow.
- Energy dependence will decrease.
- Demand for primary energy will comparatively decline.

Regional Alternative Scenario

Key Assumptions

- High GDP growth rates
- Stabilization and forthcoming increase of population
- Ecological standards enhancing in the transformation sector
- Developing renewable energy for own needs (small HPPs, wind power)
- There is energy efficiency policy
- Active implementation of cooperative initiatives in the spheres of oil, gas, and electricity infrastructure, energy efficiency policy
- There is clear and explicit federal policy towards energy supply & demand in the RFE

Regional Alternative Scenario

Specifications of Some Key Assumptions

Growth Rates of the Basic Energy and Economy Indicators, %

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Primary Energy Intensity	-4.2	-2.4	-3.6	-3.8	-3.4
Primary Energy Consumption	0.9	2.5	2.9	2.9	1.9
Electricity Final Consumption	1.9	2.9	3.4	4.2	2.7
Heat Final Consumption	0.0	1.4	2.2	2.7	2.5

Regional Alternative Scenario

Some Implications

- The increase in production of primary energy resources will be associated with the projects of Sakhalin-1, 2,3, Talakan in Yakutiya
- The growth in electricity generation will be provided with the completion of Bureiskaya HPP, steam-and-gas units in Khabarovskiy Krai, Sakhalin and Primoriye, new high-capacity hydro-power plants (oriented towards NEA countries)
- The demand for heat generation will be mainly covered with gas and low-sulfur oil-fired boilers. The CP Units' development will decline
- The efficiency of energy transformation and T&D will significantly grow
- The non-traditional renewable energy will be applied in isolated and remote districts (mostly within the Northern region)
- No increase in coal production is expected
- Import of coal from Siberia will decline. Emissions of greenhouse gases and sulfur and other oxides will comparatively decrease
- The energy consumption diversification index will strongly decline
- The share of renewable energy resources will grow
- Energy dependence will strongly decrease

Regional Alternative Scenario

Assumptions of Cooperative Initiatives (1)

✓ Natural Gas Pipelines

	2012	2017	2020	2030
<i>North Sakhalin - China - DPRK - ROK, BCM</i>	10	20	23	30

	2021	2025	2030
<i>North Sakhalin – Japan, BCM</i>	5	8	8

Regional Alternative Scenario

Assumptions of Cooperative Initiatives (2)

✓ Oil Pipelines

	2012	2015	2018	2020
<i>East Siberia – Scovorodino – Primoriye, mln t</i>	-	20	40	50
<i>East Siberia - Scovorodino – Chine, mln t</i>	25	30	30	30
<i>TOTAL, mln t</i>	25	50	70	80

Regional Alternative Scenario

Assumptions of Cooperative Initiatives (3)

✓ Electricity Transmission Interconnections (1)

• <i>China-RFE near-border trade</i>	2010	2015	2020
<i>Electricity, billion kW-hr</i>	3.84	5.14	5.24
<i>Load, MW</i>	600	800	850
• <i>FarEastern HPPs - Northeast China</i>	2022	2025	2030
<i>Electricity, billion kW-hr</i>	8.25	16.5	16.5
<i>Load, MW</i>	1500	3000	3000
• <i>Primorye - DPRK</i>	2012	2015	2018
<i>Electricity, billion kW-hr</i>	1.8	2.4	3
<i>Load, MW</i>	300	400	500

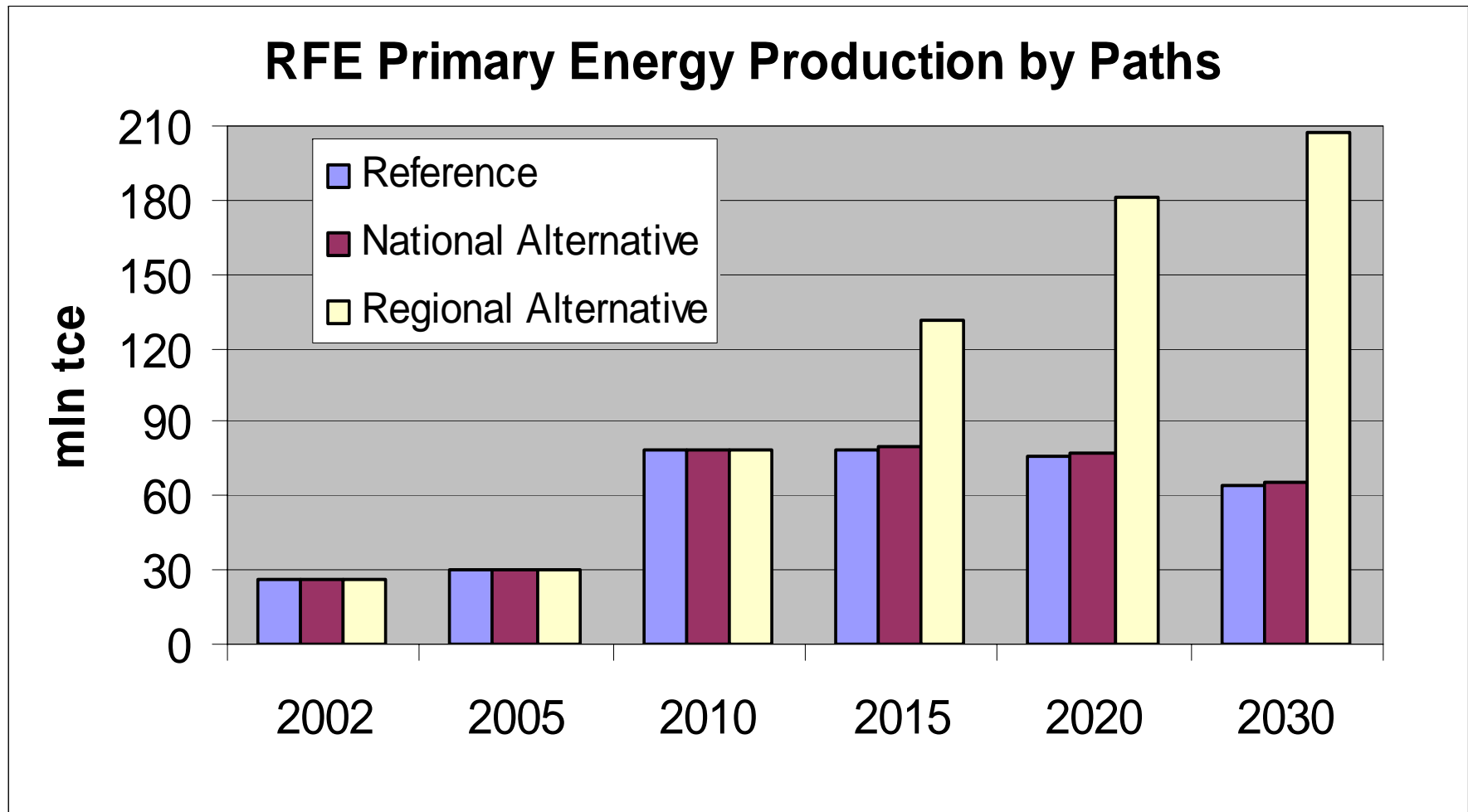
Regional Alternative Scenario

Assumptions of Cooperative Initiatives (3)

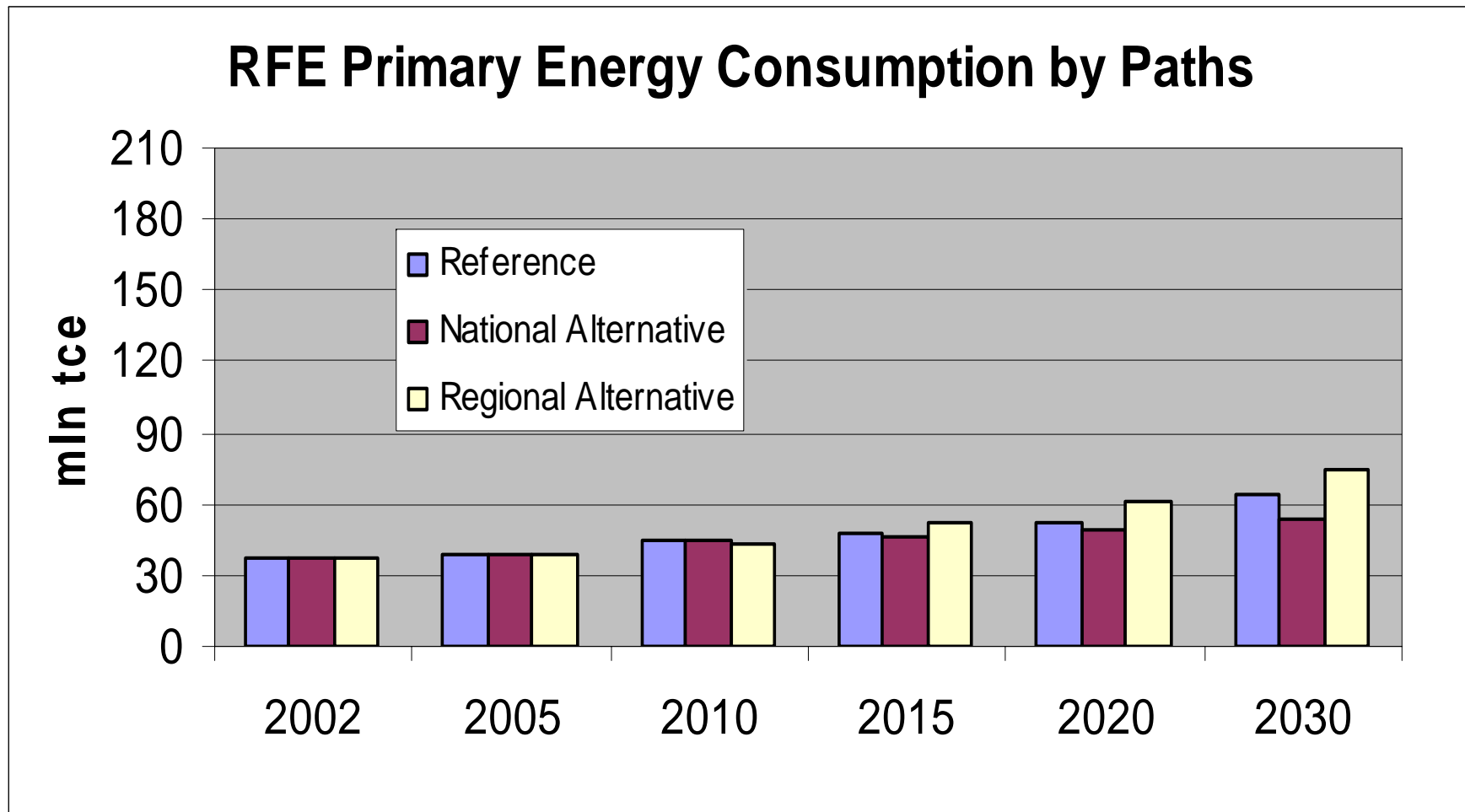
✓ Electricity Transmission Interconnections (2)

• <i>Primorye - ROK</i>	2017	2020	2030
<i>Electricity, billion kW-hr</i>	3	11	16.5
<i>Load, MW</i>	500	2000	3000
• <i>Sakhalin - Japan</i>		2021	2024
<i>Electricity, billion kW-hr</i>		5.5	22.0
<i>Load, MW</i>		1000	4000

Selected Draft Results of RFE Energy Paths (1)

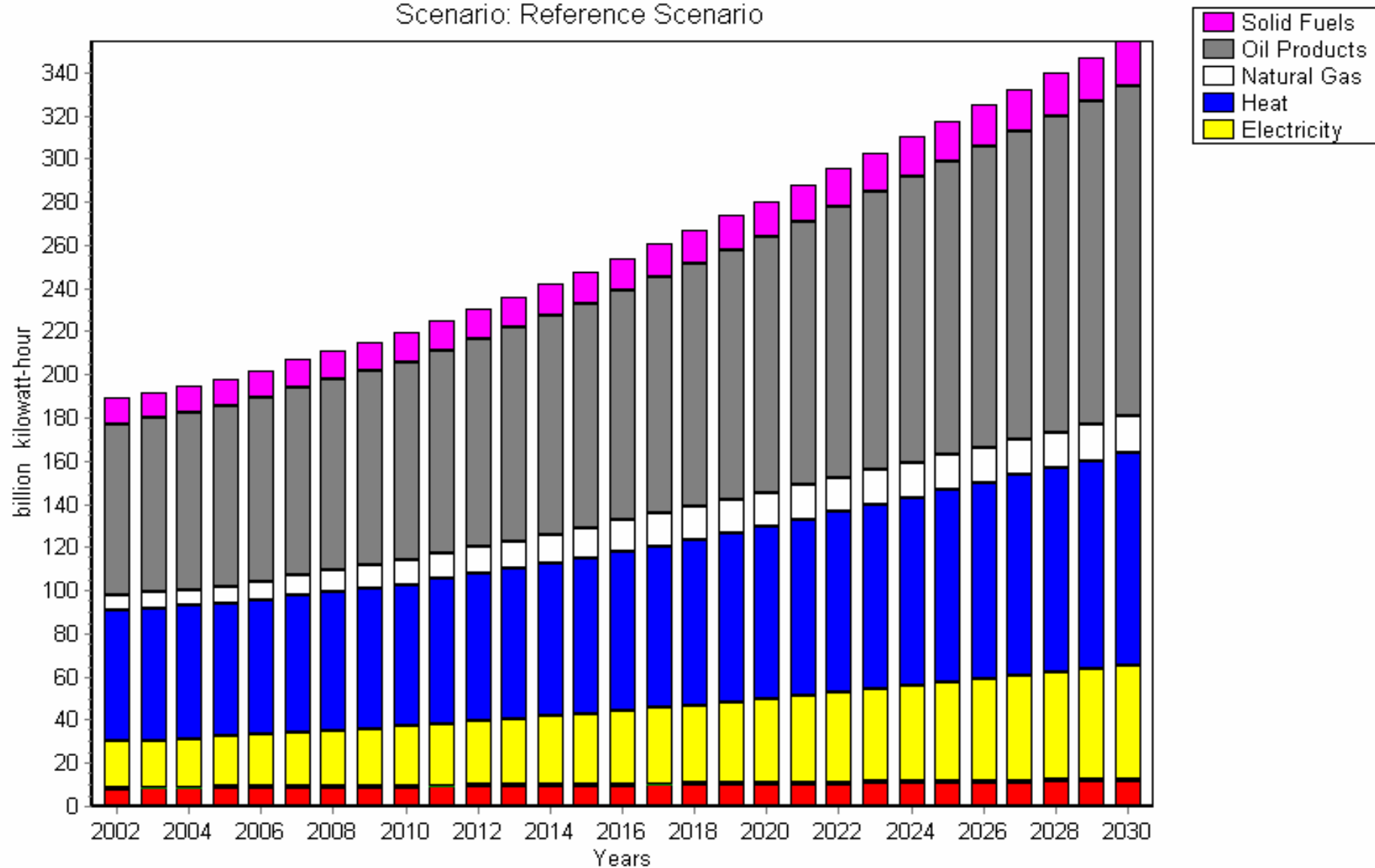


Selected Draft Results of RFE Energy Paths (2)



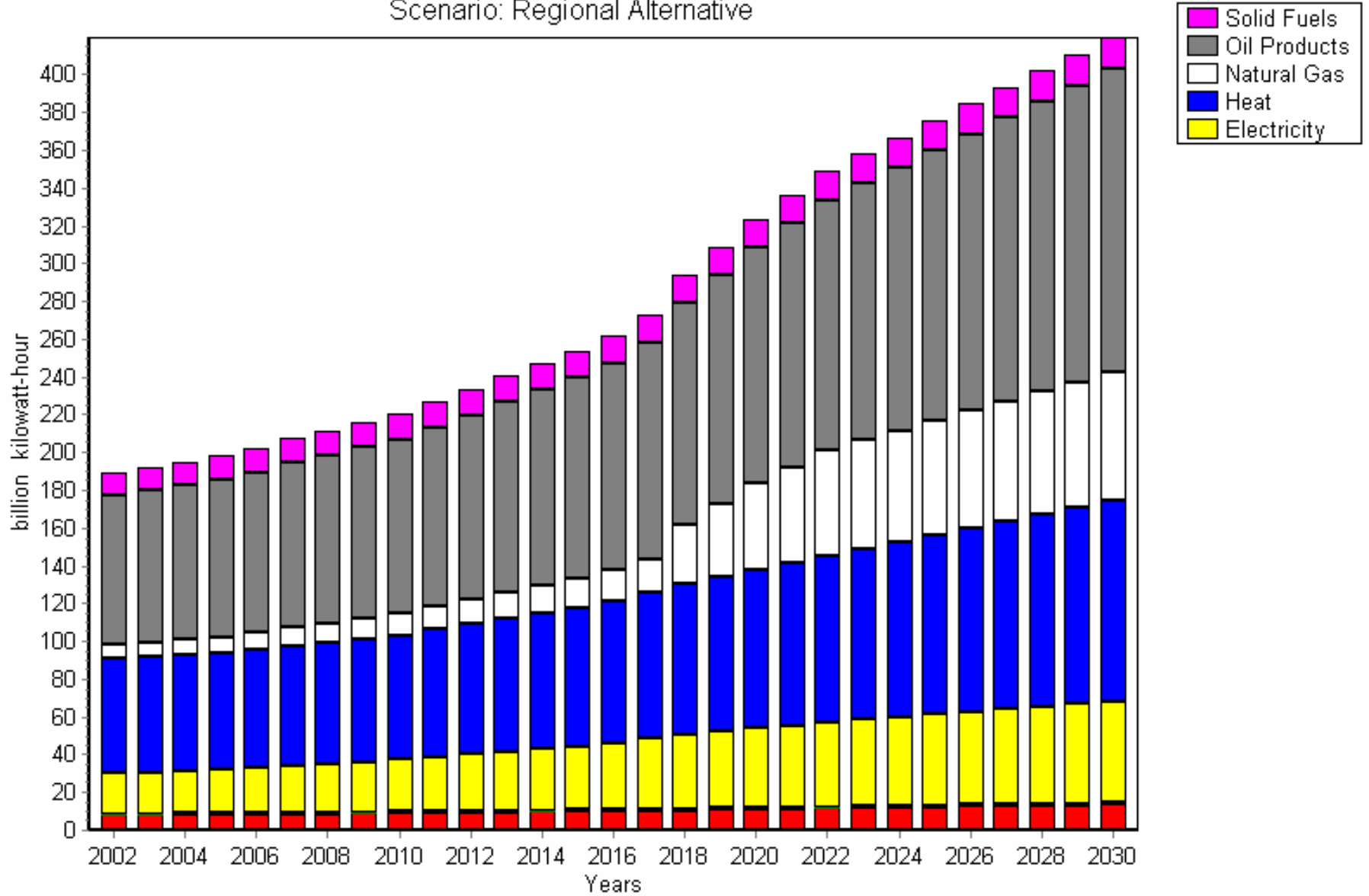
RFE_2002_Final_12: Net final fuel demand (energy + non-energy): demand

Scenario: Reference Scenario



RFE_2002_Final_12: Net final fuel demand (energy + non-energy): demand

Scenario: Regional Alternative



Next Steps to be implemented

- Specifying Cost and Prices
- Final Demand Disaggregation
- Modeling of Energy-Efficient Measures in Final Demand
- Completion of Emission Loadings part

Thank you for attention!