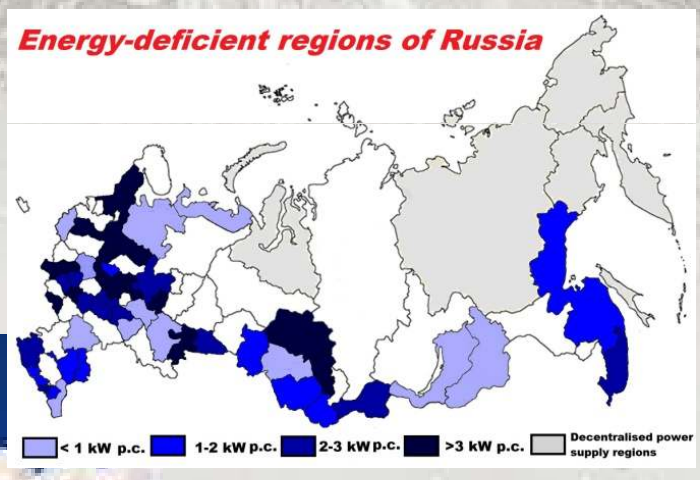
THE 32nd ISTC-KOREA WORKSHOP 2014

SUSTAINABLE ENERGY POLICY THROUGH DIGITAL INNOVATIONS:

SYNERGY OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

RUSSIA-ASIA-KOREA INVESTMENT COOPERATION OPPORTUNITIES IN SUSTAINABLE ENERGY FIELD



| Hosted by | ROK Ministry of science, ICT and future planning

Ministry of Science, ICT and Future Planning

| Organized by | EurasTech Corp

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2014 "Sustainable Energy Policy Through Digital Innovations: Synergy of Energy Efficiency and Renewable Energy" Workshop Programme

NO.	Time	Programme	Speaker	Organization
1	09:00~10:00	Arrival and registration of participants	-	-
2	10:00~10:20	Opening Ceremony	Jong-Hyun RHIE	National Research Foundation of Korea
10:20~12:30		Plenary session 1 & B2B meetings		
Theme 1		Improving Energy Efficiency and Energy Saving Technologies in Russia Moderator		
3	10:20~10:40	Energy efficiency technologies based on IT in the framework of Russian energy saving program for municipal and service institutions till 2020	Anton Tyukov	Volgograd State Technical University
4	10:40~11:00	Modern energy-efficient nanotechnology to improve the efficiency of solar panels	Alexander Gorshkov	Vavilov State Optical institute, SPb
5	11:00~11:15	Coffee-break		
6	11:15~11:35	Intelligent Data Processing in Energy Management Systems: from data to energy savings	Maxim Shcherbakov	Volgograd State Technical University
Theme 2		Technical UniversityRenewable Energy: Solar Energy Policies Designed to Encourage Modernization and Technical Innovation in Russian and CIS Industry		
7	11:35~11:55	Technology priorities in modern renewable energy and Russian technological platforms	Oleg Sinyugin	Lomonosov Moscow State University
8	11:55~12:15	Solar power plants as a key energy resource for public transport in south regions of Russia	Oleg Olshansky	Solar Technologies LLC
9	12:15~12:30	Energy laser-optical system for space-based conversion solar energy based on fullerene-oxygen-iodine laser	Belousova Inna	Vavilov State Optical institute, SPb
12:30~14:00		Business Opening Lunch for Forum's participants		
14:00~16:30		Plenary session 2 & B2B meetings		
10	14:00~14:20	Innovation global geography of traditional and renewable power sources	Mikhail Berezkin	Moscow State University
11	14:20~14:40	Reduce the cost of solar cells based on perovskites at fully printed production	Samarsky Dmitry	Kuban State University Krasnodar
Theme 3		Management of Bio-resources in the Era of Climate Change		
12	14:40~15:00	Estimation of the Carbon Dioxide Formation in Heat-Power Complex of the Central Asia and Prospective of Development of Hydrogen Power Engineering	Inom Normatov	Tajik National University
13	15:00~15:20	Climate change in the south-east of Kazakhstan and perspectives of alternative energy in the region	Anuar Zhukeshov	Kazakh National University named after al-Farabi
Theme 4		Advanced energy materials for Russian energy sector modernization and benefits of increasing investments through SK technologies (Korean technology presentations)		
14	15:20~15:40	Renewable Energy Resource Atlas System	Yong Heack. Kang	KIER
15	15:40~16:00	Clean Fuel Technology Based on Coal Gasification	Ho Won. Ra	KIER
16	16:00~16:15	Strategy for successful Korea-Russia technology transfer in the field of energy	Elizabeth Lee	EurasTech Corp.
17	16:15~16:30	Coffee-break		
18	16:30~17:30	Round table. Q n A session. Closing remarks		
19	16:45~17:00	Special Honourary guest: His Excellency Ulyanovskaya region Governor		
20	17:30~18:30	Cocktail Reception (invitation only).		

Theme 1.

Improving Energy Efficiency and Energy Saving Technologies in Russia

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АО ЕвразТех

Dr. Anton P Tyukov.

Assistant Professor, Department of Automation, Volgograd State Technical University.

Anton holds PhD degree in « system analysis, information processing and control" at Volgograd State Technical University in collaboration with University of Leuven Belgium (2013) and Master's degree in "Innovation Management" (2012). Currently he published more than 30 works on the following topics: energy management systems, data visualization, data quality, scientific computing, control algorithms, influence of weather based energy consumption and production forecasts, modeling on energy consumption etc.

Now he runs a research and software development group, which specializes, on sensor installations, energy data governance, industrial and SCADA software development, big data, data visualization, scientific research (control algorithms, gray box modeling) in collaboration with Porta Capena NV (Belgium), Porta Capena Polska and University of Leuven (Belgium). His group developed his own SCADA system to manage energy consumption in public buildings

The 32nd ISTC-Korea Workshop 2014

Energy efficiency technologies based on IT in the framework of Russian energy saving program for municipal and service institutions till 2020

Anton Tyukov

PhD, Volgograd State Technical University,

Russia

People spend

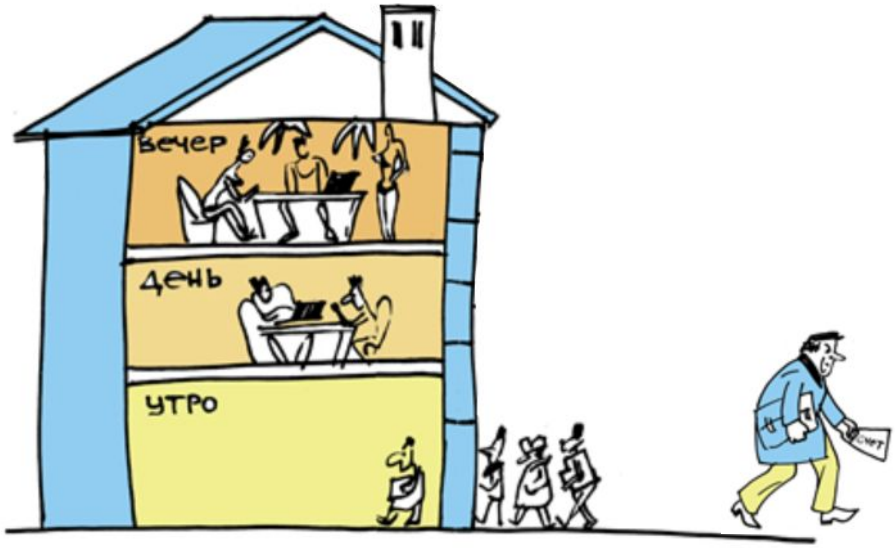
80 %

of their time in buildings

Annual building maintenance cost:
Electricity: $0.3 – 1.5 mln
Gas (For heating): $0.15 – 0.7 mln
Water: $0.1 – 0.4 mln

Russia annually spends on electricity:
$85 000 000 000

Saving potential of each building is around 30%

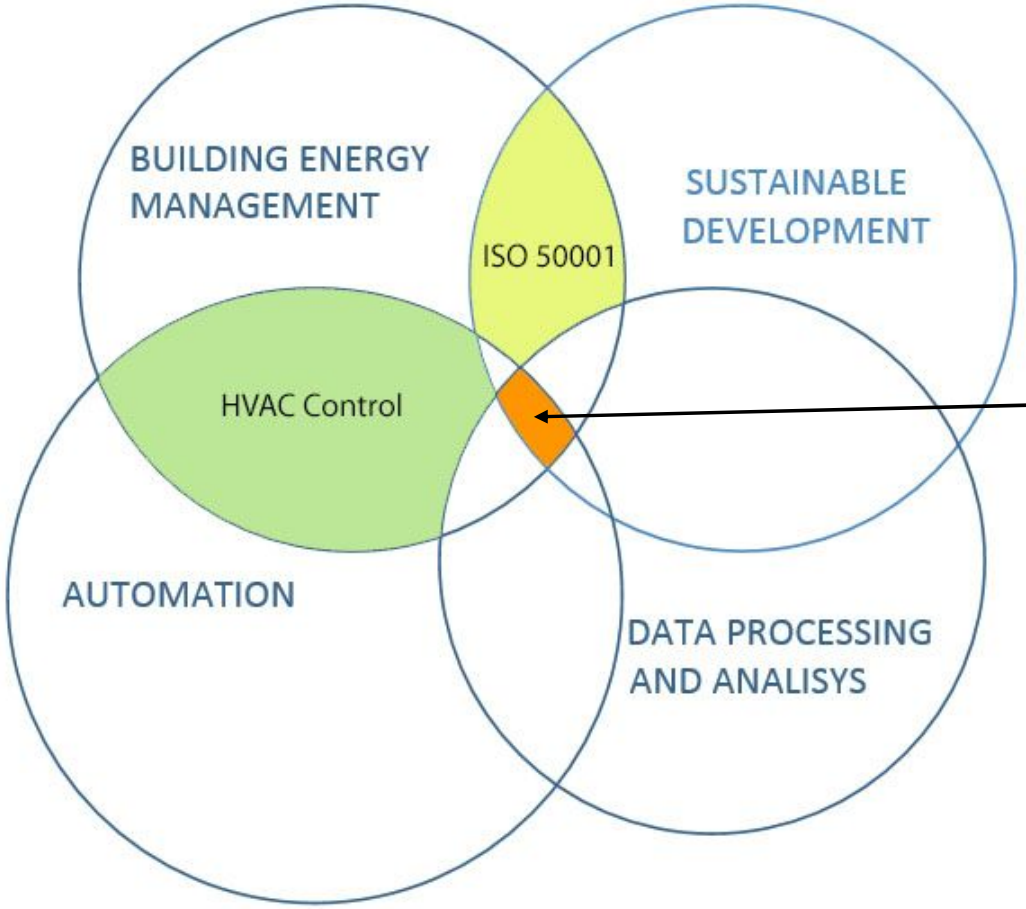


- Building inhabitants cares about comfort
  - Then comfortable, they are productive
  - Their boss pays everything
- Energy managers
  - Have low qualification and not interested in savings
  - Their boss pays everything
- Building
  - Has inefficient energy policy
  - Inefficient use is not stopped in time
  - Has low Investment attractiveness

Goals of Energy Efficiency program till 2020

- Improve efficiency of energy managers
- Reduce energy costs for building maintenance
  - Save 630 bil. kWh on electricity
  - Save 1550 mln. Kal on heating
  - 334 mln. Ton fuel equivalent

  Reduce carbon emissions on 409 mln. tons



Intelligent Energy Management System

Conteptual system design

Effective energy policy through:

1. Real time resources consumption + statistics;
2. Reports (day, week, month, year);
3. Targeting savings;
4. Benchmarking.

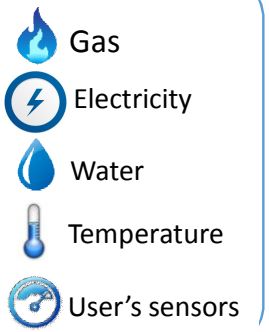
Energy manager

Portable devices

Building general screen

Internet

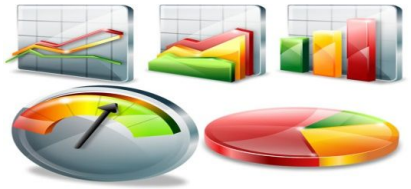
Client's buildings



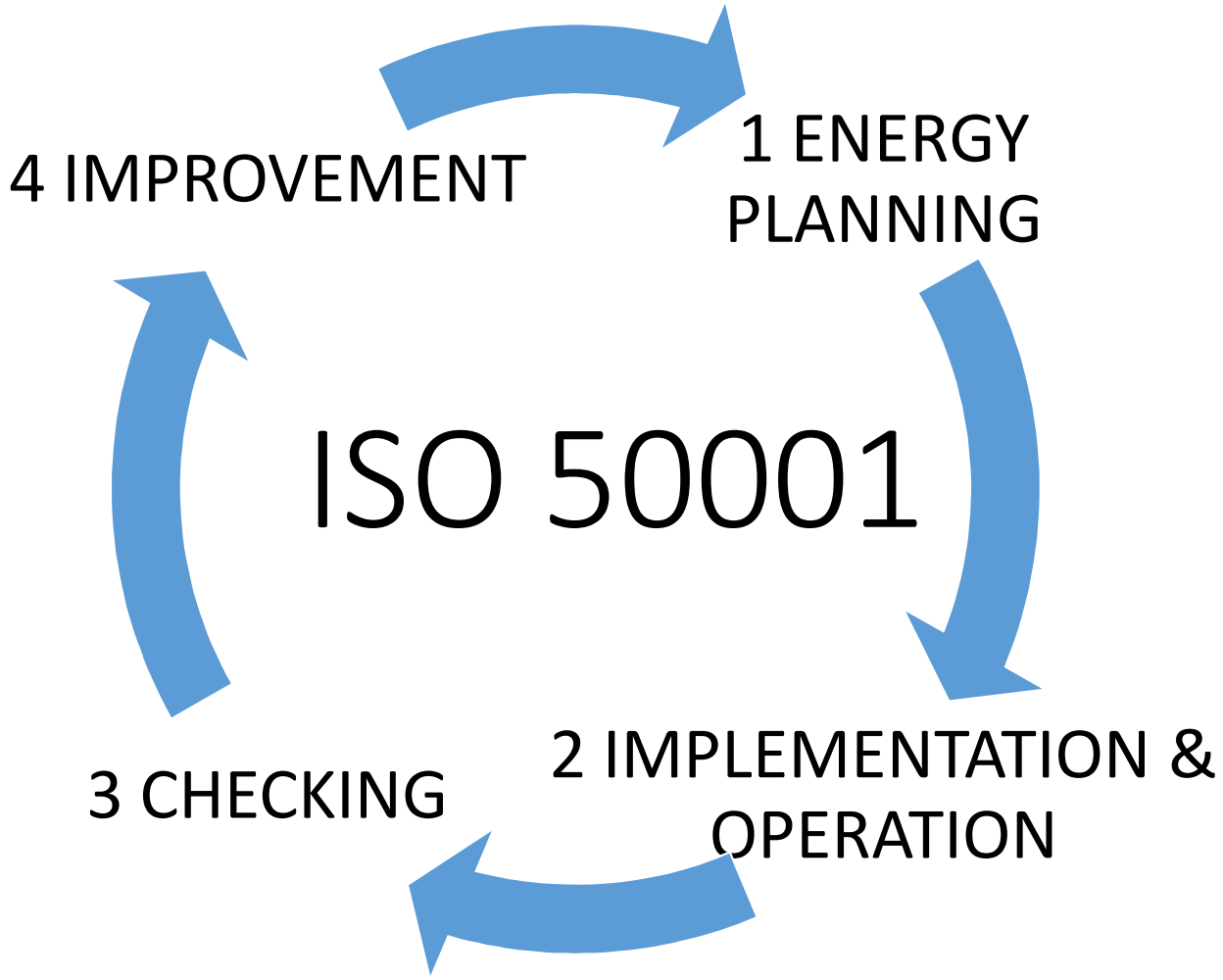
Meters

Internet

FTP, GPRS, Ethernet



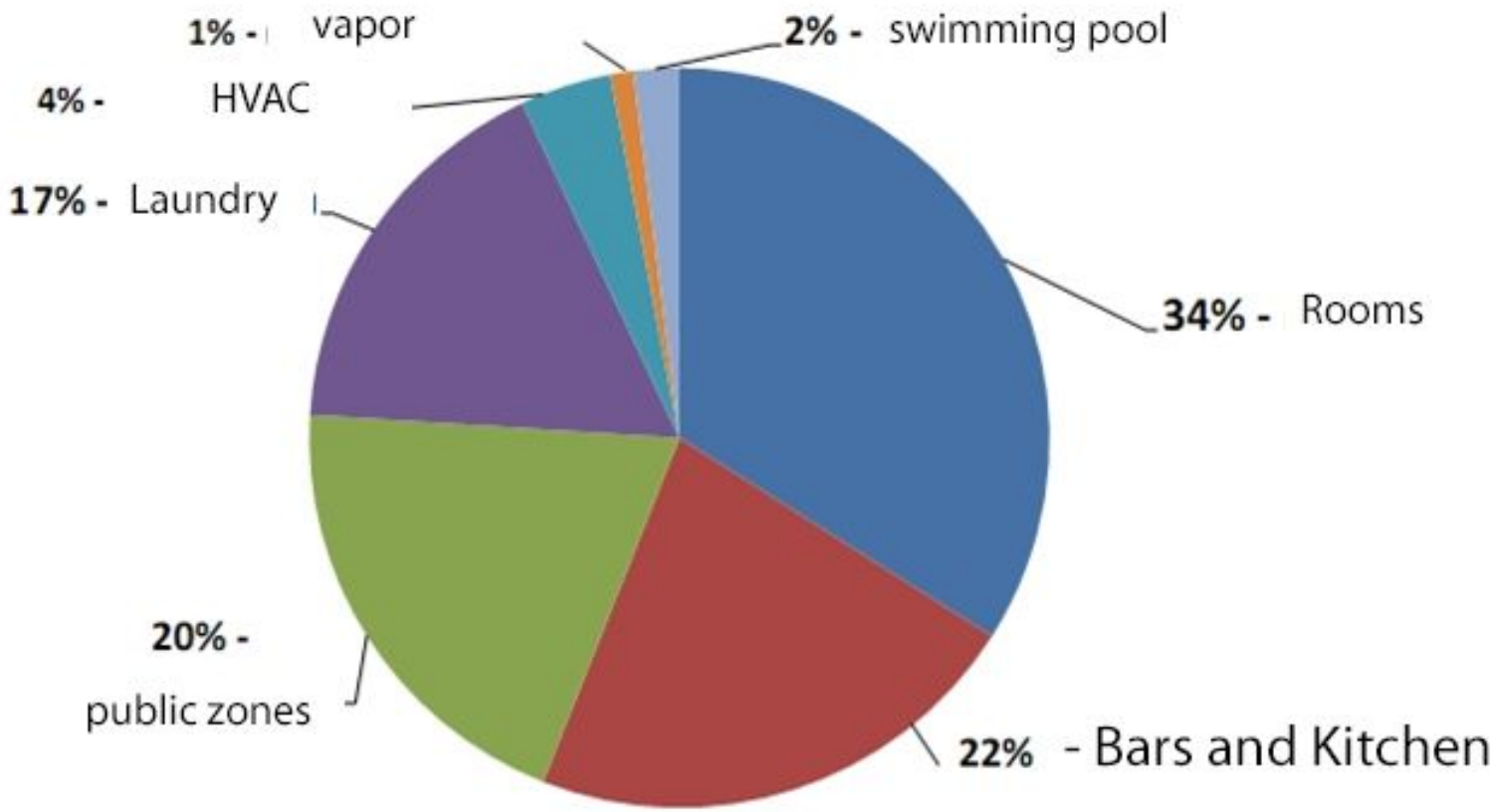
Flexible Interactive Energy Screens (FIES)


ISO 50001
1 ENERGY PLANNING
2 IMPLEMENTATION & OPERATION
3 CHECKING
4 IMPROVEMENT

Step 1: Energy Planning

Example 1: Energy submetering

WATER CONSUMPTION IN A HOTEL



Step 1: Energy Planning

Example 2: Saving of heating system

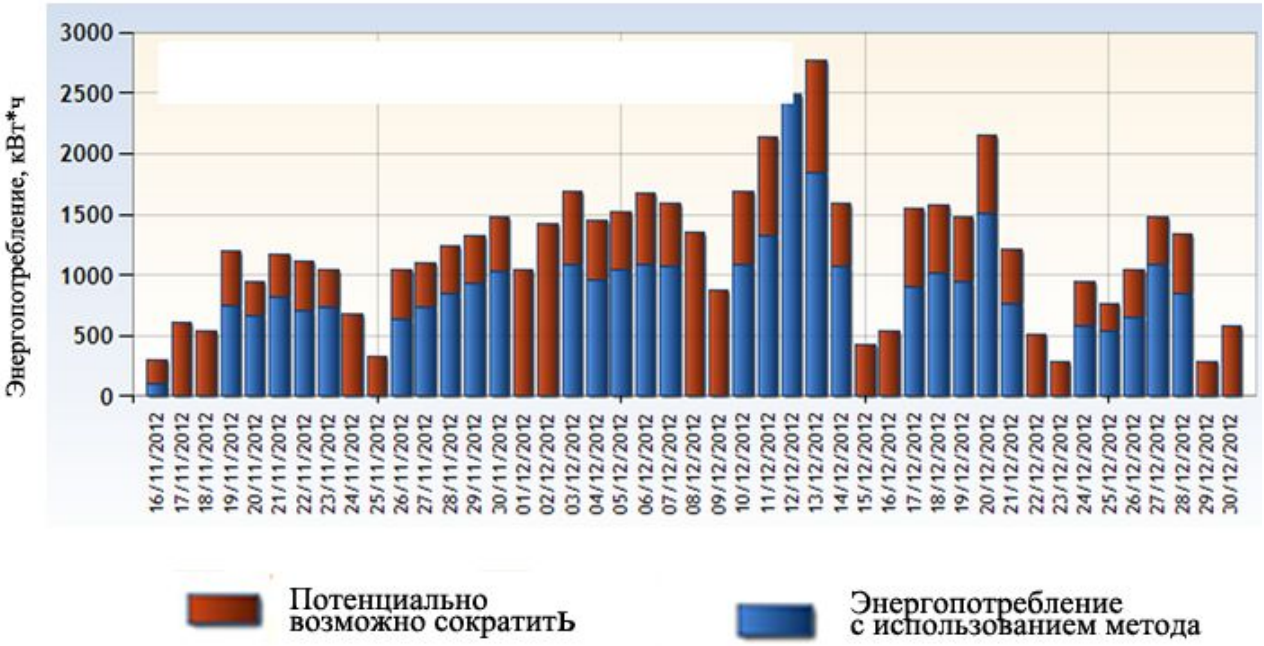


Fig 2 – Gas consumption in a building

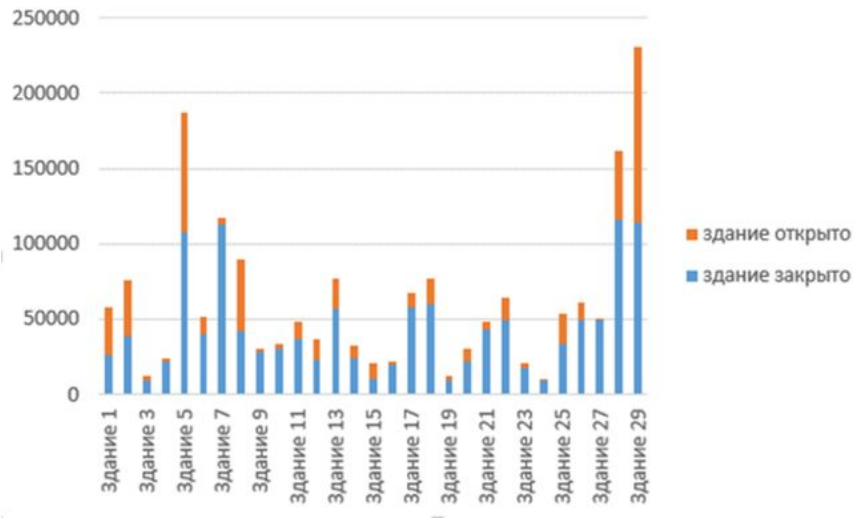


Fig 3 – Saving potential for 30 buildings

Total energy consumption: **53 621 kWh**
Potential economy: **23 754 kWh** (44%)

Step 1: Energy Planning

Example 3: Comparing objects

Fig 4 - Energy consumption of different periods

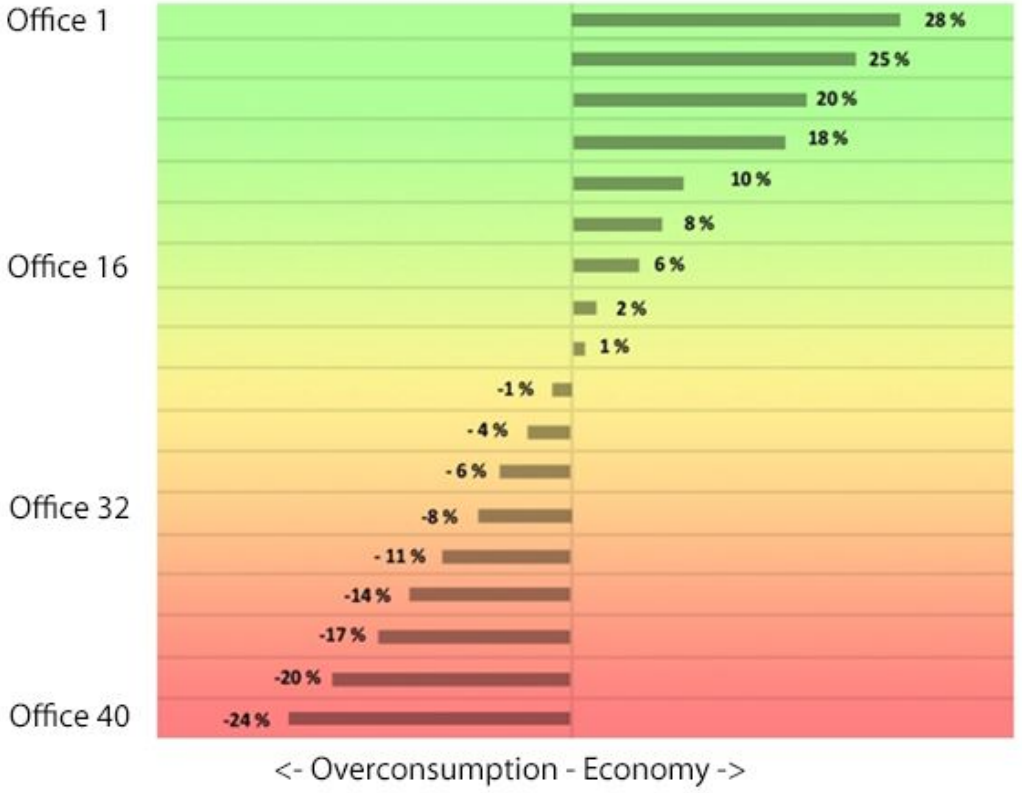


Fig 5 - Comparing energy consumption of different buildings

Step 1: Energy Planning

Example 3: Measuring internal comfort and productivity

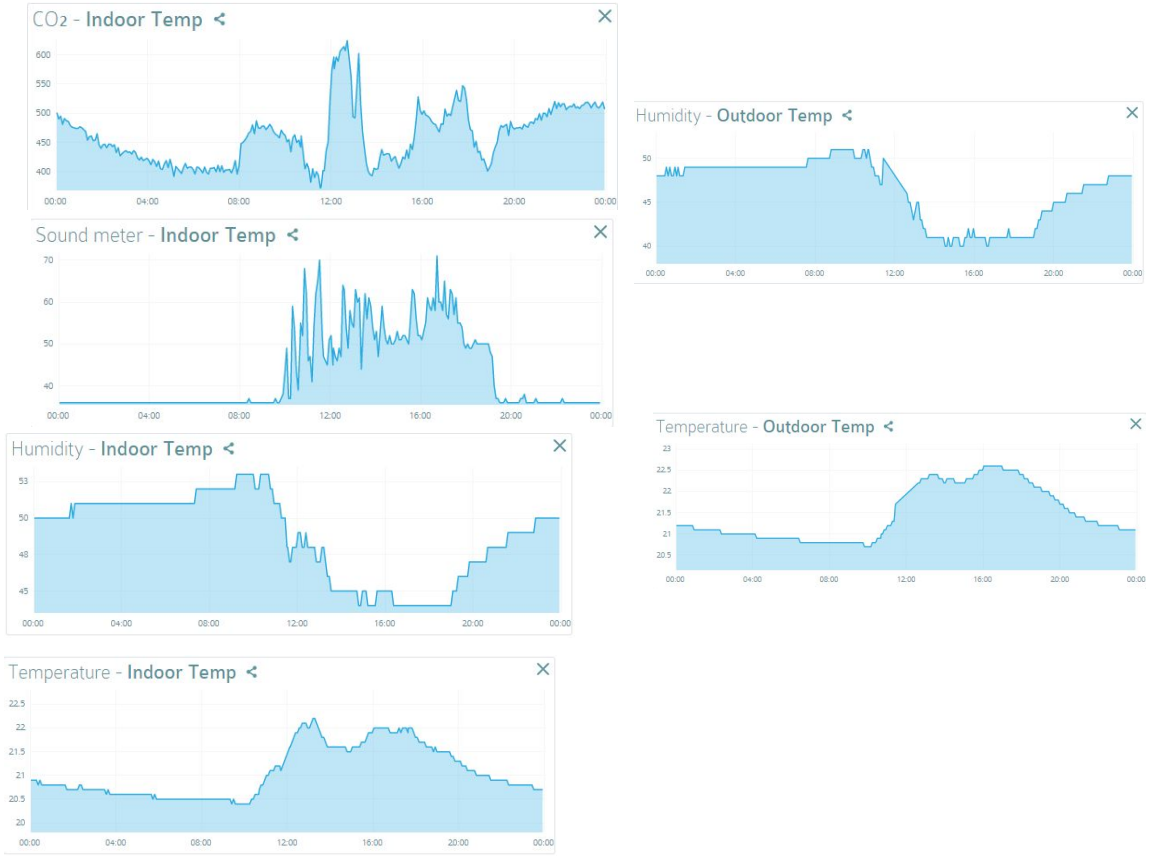


Fig 6 - Measuring comfort

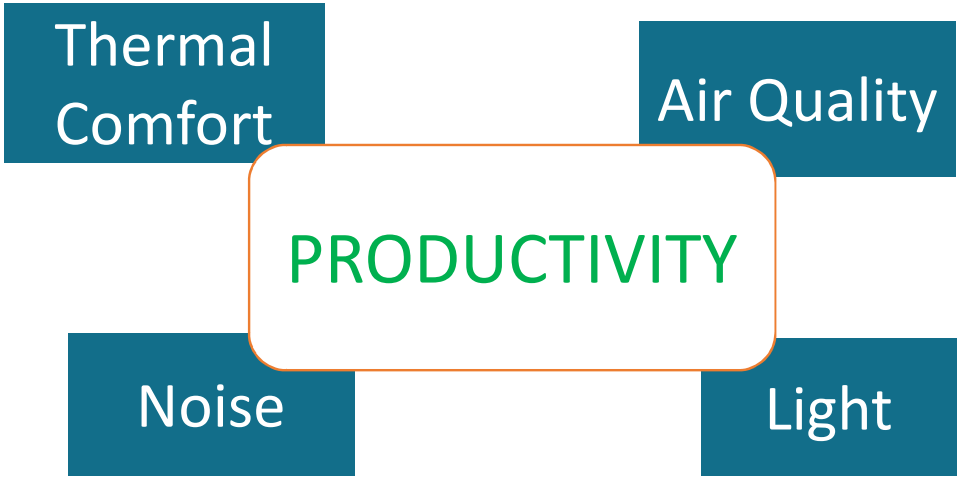


Fig 7 - Calculating productivity

Step 2 - Implementation and operation

Anomalies detection

- Hardware malfunction
- Leakages and inefficient use of Energy
- Low comfort
- Too early HVAC startup detection (with weather information)
- Excessive air conditioning detection
- Anomaly detection during holidays and weekends

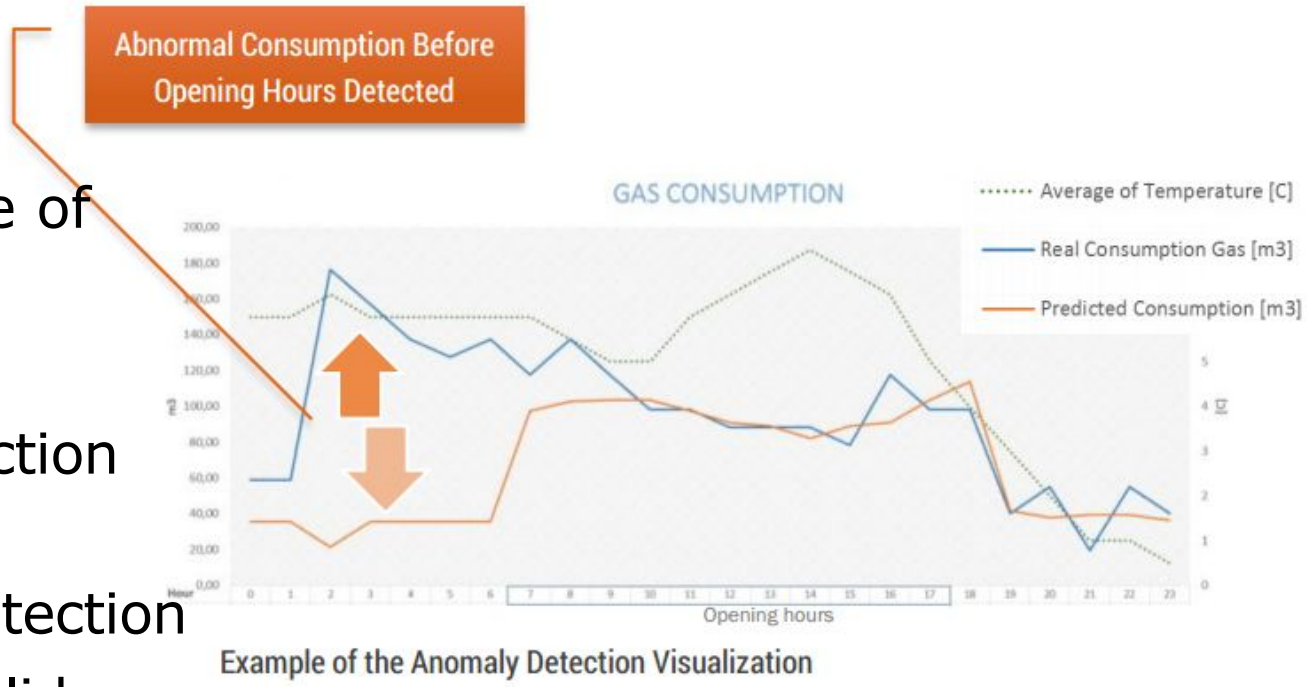


Fig 8 – Example of the Anomaly detection Visualization

Step: 2 Implementation and operation

Example 2: Anomalies examples

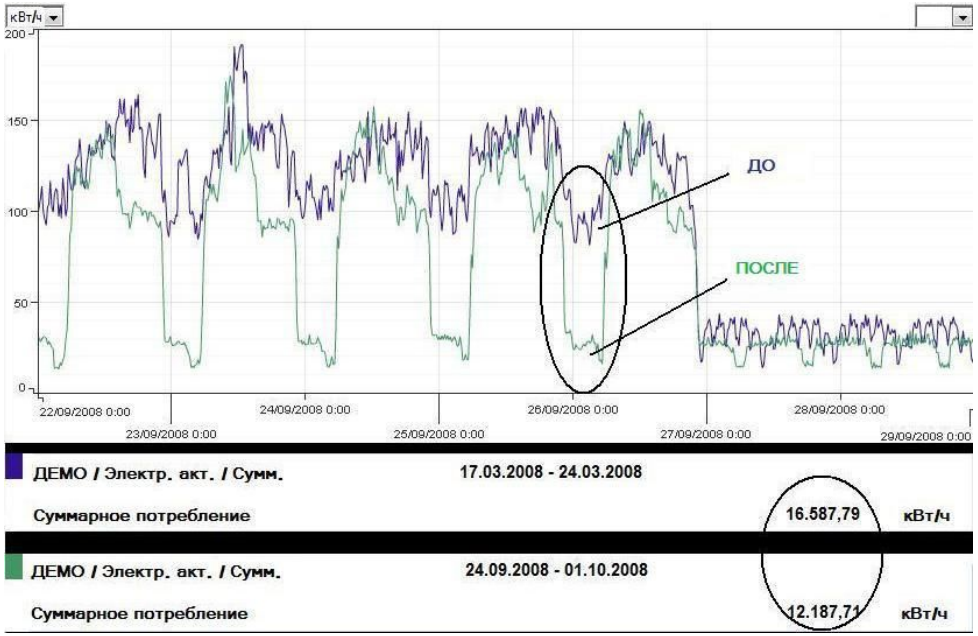


Fig 9 - Annual economy on electricity is $31 000

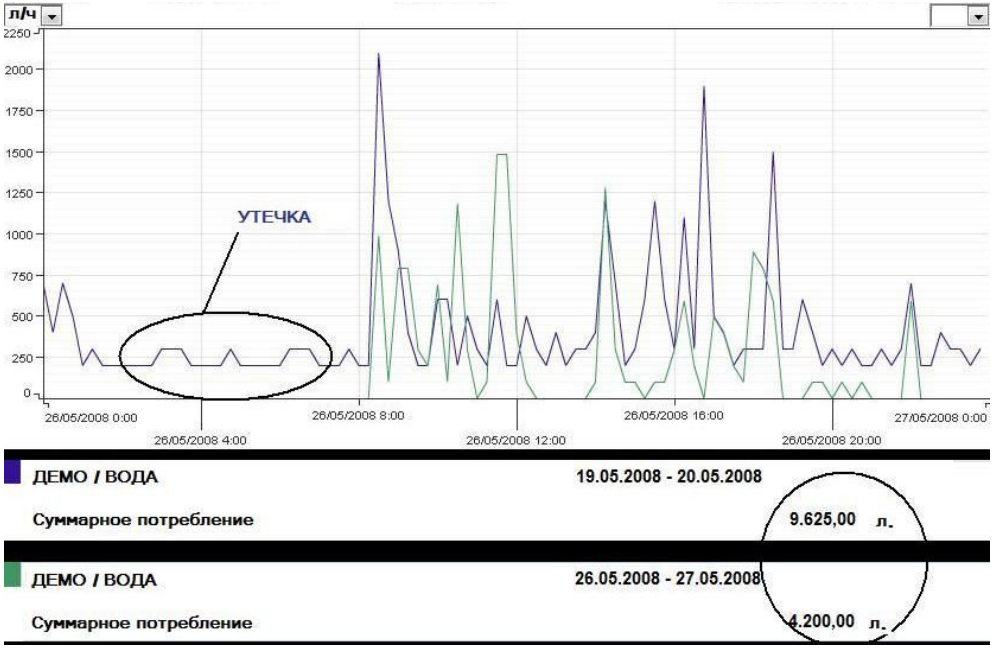


Fig 10 - Annual economy on water - $4 000

Step 2 - Implementation and operation

Example 1: Analyzing anomalies

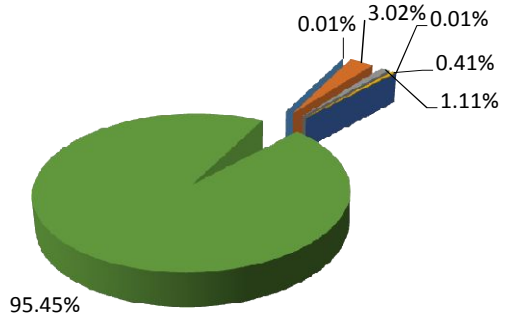
SAVINGS PROGNOSES

Understanding and reduction of energy costs

Identification of areas of potential energy savings

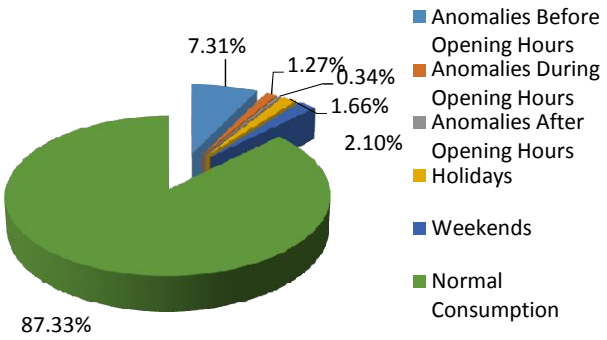
Highlights of opportunities for energy management improvements

Electricity Anomalies



ANOMALY TYPE	Electricity Lost [kWh]	% of Total Consumption	Money lost
Anomalies Before Opening Hours	19,4	0,01%	2 EUR
Anomalies During Opening Hours	5.327,1	3,02%	639 EUR
Anomalies After Opening Hours	1.950,6	1,11%	234 EUR
Anomalies During Holidays	720,3	0,41%	86 EUR
Anomalies During Weekends	10,0	0,01%	1 EUR
TOTAL	8027,4	4,55%	963 EUR

Gas Anomalies



ANOMALY TYPE	Gas Lost [m3]	% of Total Consumption	Money lost
Anomalies Before Opening Hours	4.974,2	7,31%	1.244 EUR
Anomalies During Opening Hours	865,3	1,27%	216 EUR
Anomalies After Opening Hours	229,1	0,34%	57 EUR
Anomalies During Holidays	6.068,6	1,66%	1.517 EUR
Anomalies During Weekends	1.128,5	2,10%	282 EUR
TOTAL	13265,6	12,67%	3.316 EUR

Step 2 - Implementation and operation

Example 2: HVAC SYSTEM PERFORMANCE

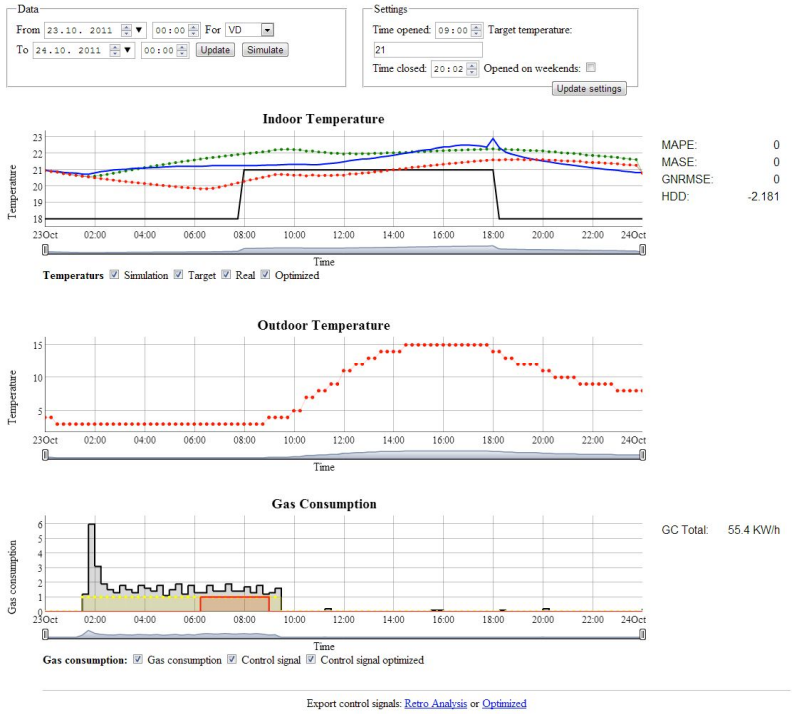


Fig 11 - HVAC system supervisory control

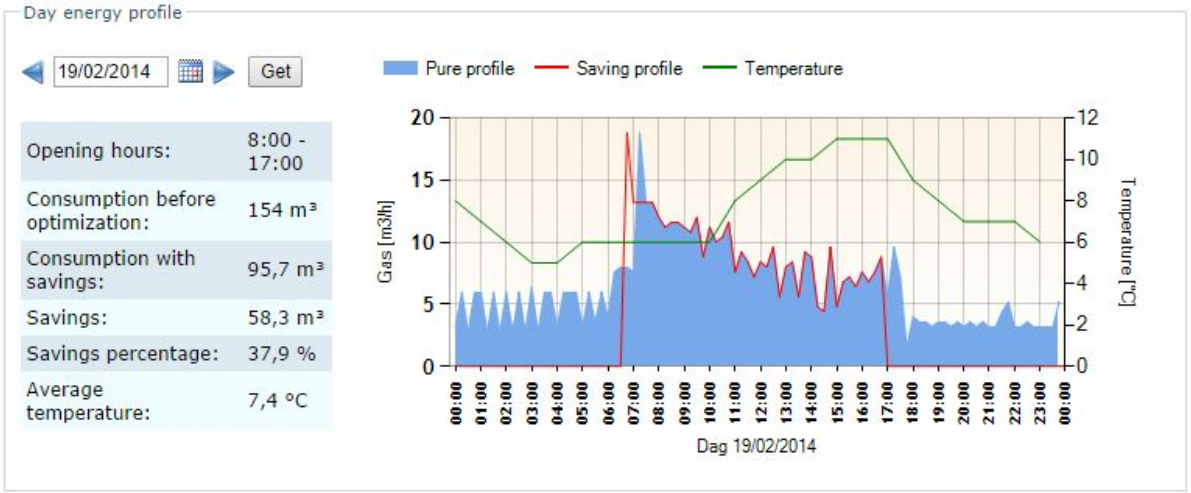


Fig 12 – Energy savings of heating system

Step 3: Monitoring the Progress

Fig 13 - Monitoring the progress

Step 4: Improvement

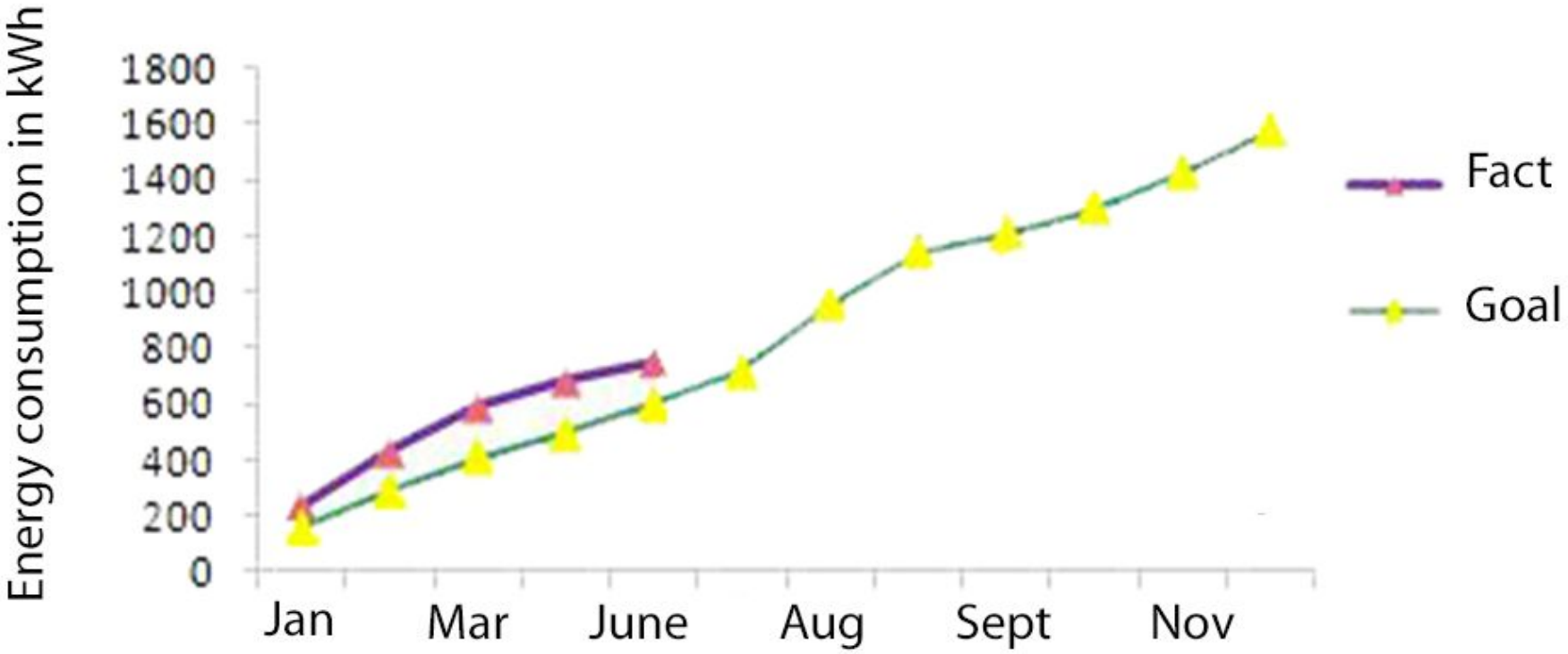
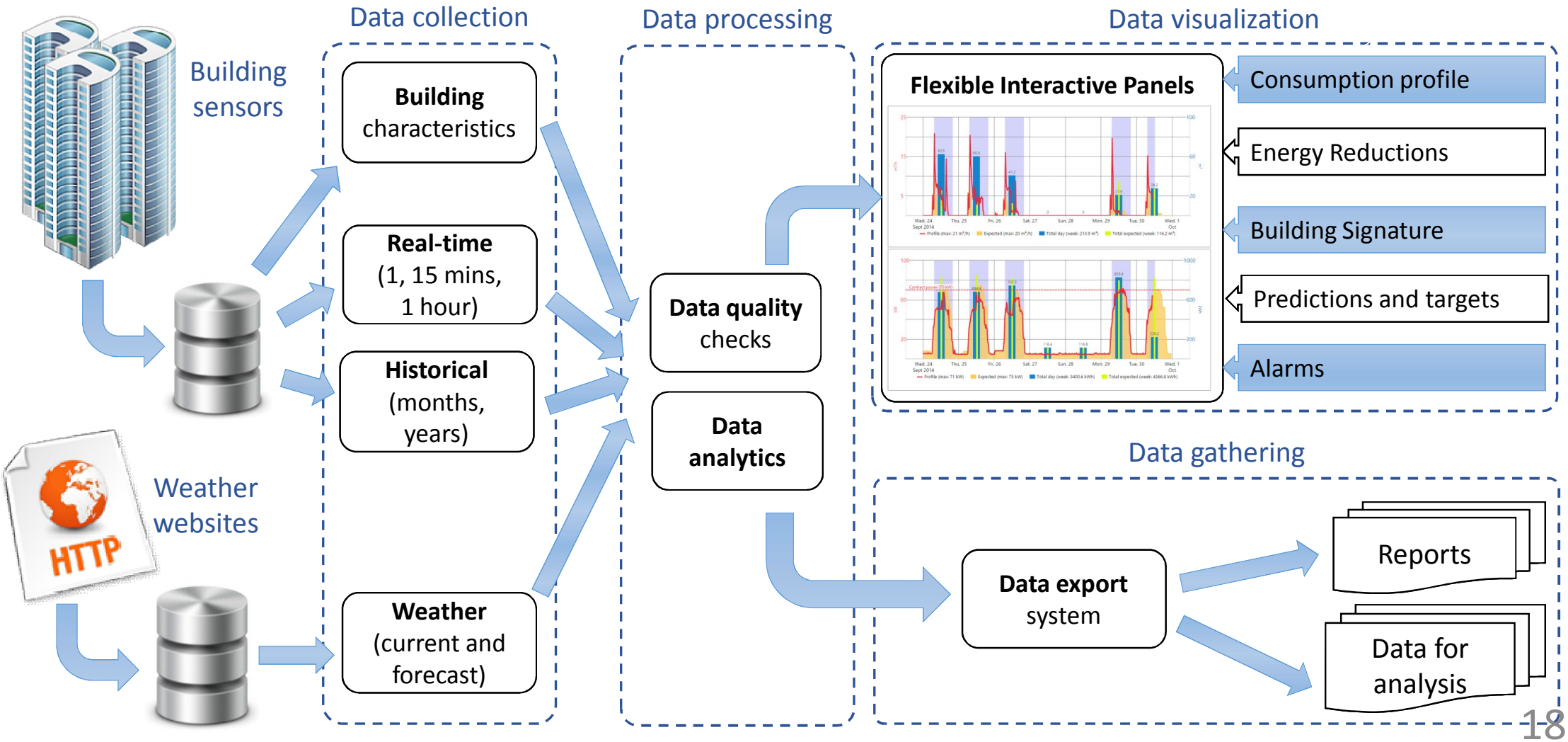


Fig 14 - Distribution of energy usage

Technical system design: general overview



Technical system design: sensors

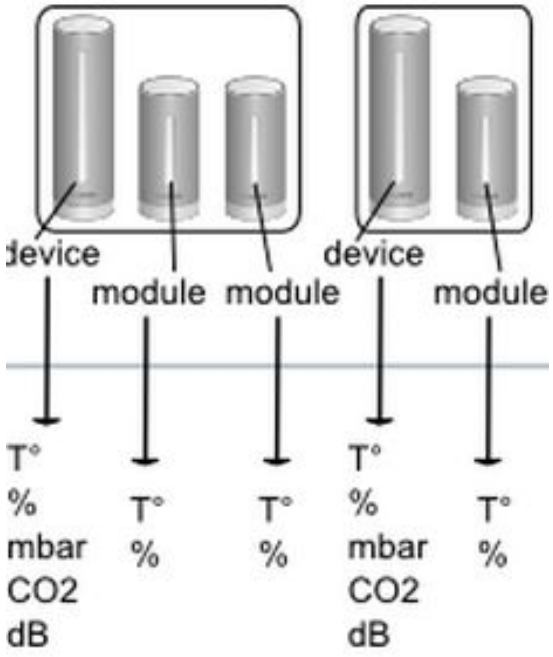


Fig 15 - Plug&Play sensors

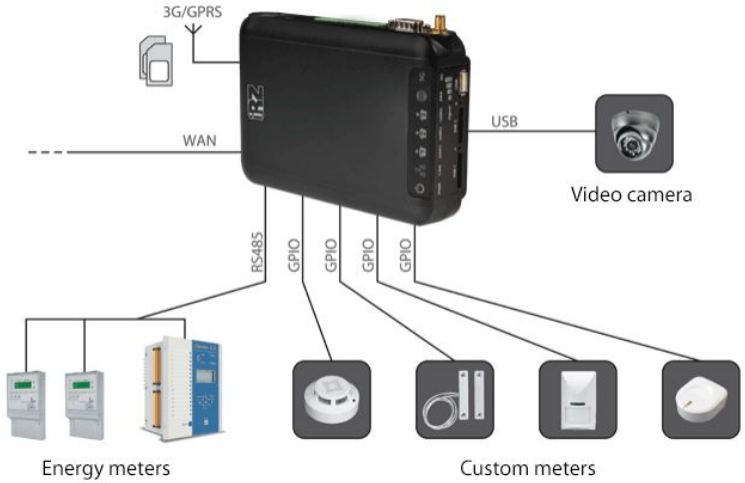


Fig 16 - Building automation

Fig 17 - Custom solutions

Technical system design: data from meteorological institutes

- Collection method
  - API
  - Parsing html pages
- Types:
  - Historical
  - Current
  - Forecast
- 10 + features collected

Technical system design: Digital Information screens

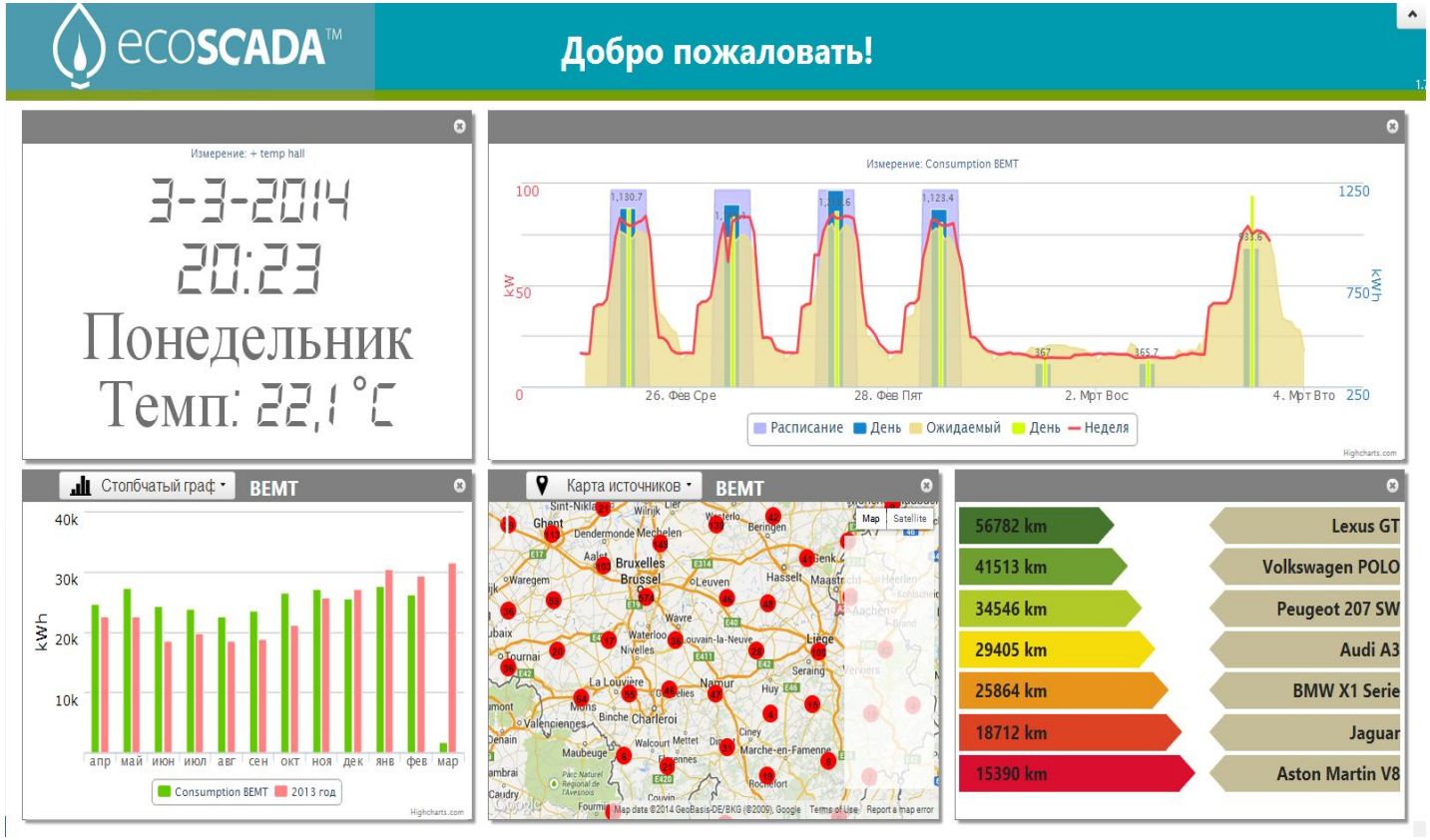


Fig 18 – Example of digital information screen

Fig 19 – Example of installtion

Technical system design: Data Export for researchers

reduced time on data preparation

- Information fusion
  - Sensor information
  - Weather conditions
- Data exported for
  - R
  - Weka
  - Excel
  - Octave
  - Matlab
- Data Quality Certificate

Conclusions

1) Social Effect
2) Automatization
3) Building Investment attractiveness
4) Real Energy Savings

Thank you. Write to Anton.tyukov@gmail.com

- Anton Tyukov Ph.D, Volgograd State Technical University
  - Anton.tyukov @gmail.com
  - +79050642601

- Research and Software development team
  - 50 + publications
  - Partners from EU
  - Key specialties: Software development, data visualization, information fusion, data analysis, big data

Dr. Alexander Gorshkov.

Vavilov State Optical institute, St.Petersburg , General Director Assistant.

He got Ph.D. degree at Vavilov State Optical Institute St-Petersburg, Russia in Optics, laser physics and techniques (Dissertation Title: High Precision Laser Interferometer for Geophysical Applications,1987) and master's degree in Optics and Spectroscopy at Leningrad State University. In 2003 Dr. Gorshkov received Honorary memorable medal from Russian goverment- 300 years of Saint-Petersburg foundation and in 2005 - an Honor Diploma for Contribution to Development of Laser technique, Vavilov State Optical institute.

During 2001-2005 r. Gorshkov's scientific activity in Russia was concerned of special applications. Papers and reports contain a confidential information and published in the restricted publications. From Oct 2005 till now all obtained results are regarded to technological issues and belong to Samsung Electronics (SEC).

ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ “РОСТЕХНОЛОГИИ”

ОТКРЫТОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО
“ГОСУДАРСТВЕННЫЙ ОПТИЧЕСКИЙ ИНСТИТУТ
им. С.И. ВАВИЛОВА”

ГОИ

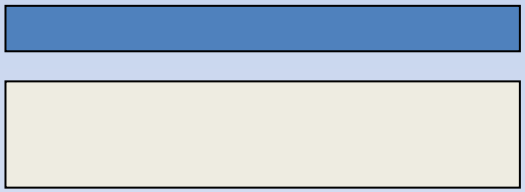
Modern energy-efficient nanotechnology to improve the efficiency of solar panels

Gorshkov A.S., PhD, Michailov A.V., PhD

СОЮЗ МАШИНОСТРОИТЕЛЕЙ РОССИИ

Russia Saint-Petersburg

Design of conventional solar panels



← *Protective screen glass*

← *Silicon solar cell*

Loss of solar radiation due to reflection:

on the screen ~ 8.5-9.0%

on a silicon solar cell ~ 32.5 %

Proposed ways of increasing the efficiency of solar cells by applying an antireflection nanocomposite coatings

Conventional approach:

1. **The reduction of reflection losses of silicon solar cell is about 25 to 28 % by the method of vacuum deposition**

Proposed ways of increasing the efficiency of solar cells by applying an antireflection nanocomposite coatings

Proposed approach:

2. **The reduction of reflection losses of the protective screen for 4-5 % due to the method of chemical deposition from all sides of the screen**

Proposed ways of increasing the efficiency of solar cells by applying an antireflection nanocomposite coatings

τ_1

3. Improvement of performance characteristics of solar cells 2-3 times by applying a protective hydrophobic water-repellent coatings

The total increase in the transmittance of the solar battery at 31-33 %

Increase the efficiency of the battery by 5-7 %

Such a protective hydrophobic coating for insulators of transmission lines allow to reduce losses from leakage of electricity 50-100 times

Vavilov state optical institute

Leading Russian research organization in the field of opto-electronic devices and systems for special and general purposes

Vavilov State optical institute developed a method of creating a surface film by etching the silicate glass of water solutions of acids

Formed by etching (leaching) of the glass layer silica possesses a porous structure, whereby the refractive index of such a surface reaches 1.22-1.27, which consequently reduces the reflection of light from such a surface

This process showed wide opportunities to increase transparency (transmittance) of optical systems, in which there are large losses of light due to the reflection

Bit of theory

It is well known that reflection of incident light to surface is equal zero when:

$$n_{coating} = \sqrt{n_{substrate}}$$

Most popular coating materials such as SiO_2 and MgF_2

have a refractive indexes 1.46 and 1.39 correspondently

Dense materials with a refractive index of 1.1 or 1.2 does not exist in nature

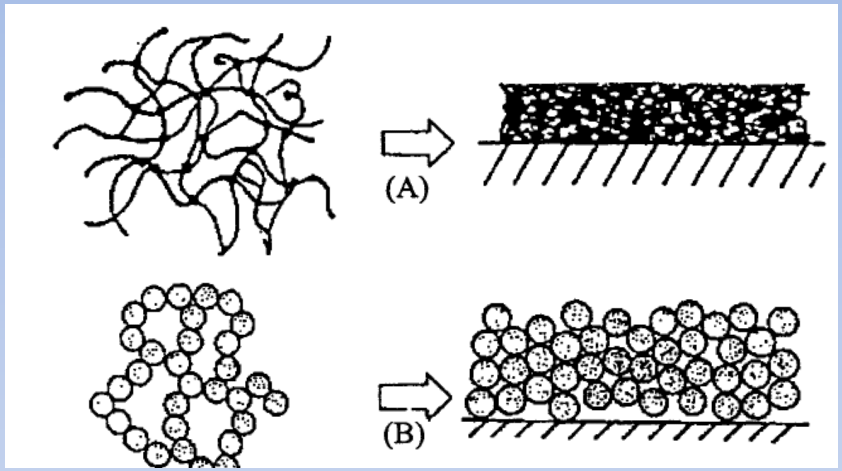
For many tasks such materials are extremely essential

In particular the creation of a broadband antireflection coatings

Bit of theory

- Fraunhofer, Germany and Lord Rayleigh, Great Britain almost a century ago found that chemical treatment of the glass surface reduces the reflection from its surface
- It was later proposed a method to obtain an antireflection film by treating the surface of the glass in acid
- Since the refractive index of the material is related to its density, the refractive index can be reduced by creating a **porous structure**
- It is necessary that the pore size was significantly smaller than the wavelength of the incident radiation, and their distribution was uniform

How can do it



A – conventional dense coating material
B – proposed porouos coating

Creating a gradient of porosity in the surface layer of the glass is possible in various ways

Such porous layers can be obtained by chemical leaching of glass with multiple phases or treatment in a neutral solution

Both of these techniques are applicable only for a glass of special composition

- Vavilov optical institute based on experience since the 30-ies of the last century proposed technology of creating porouos coatings from polymer solutions

- **The advantage of this method is that the coating does not depend on the substrate material and porosity may be controlled**

Method of extrusion

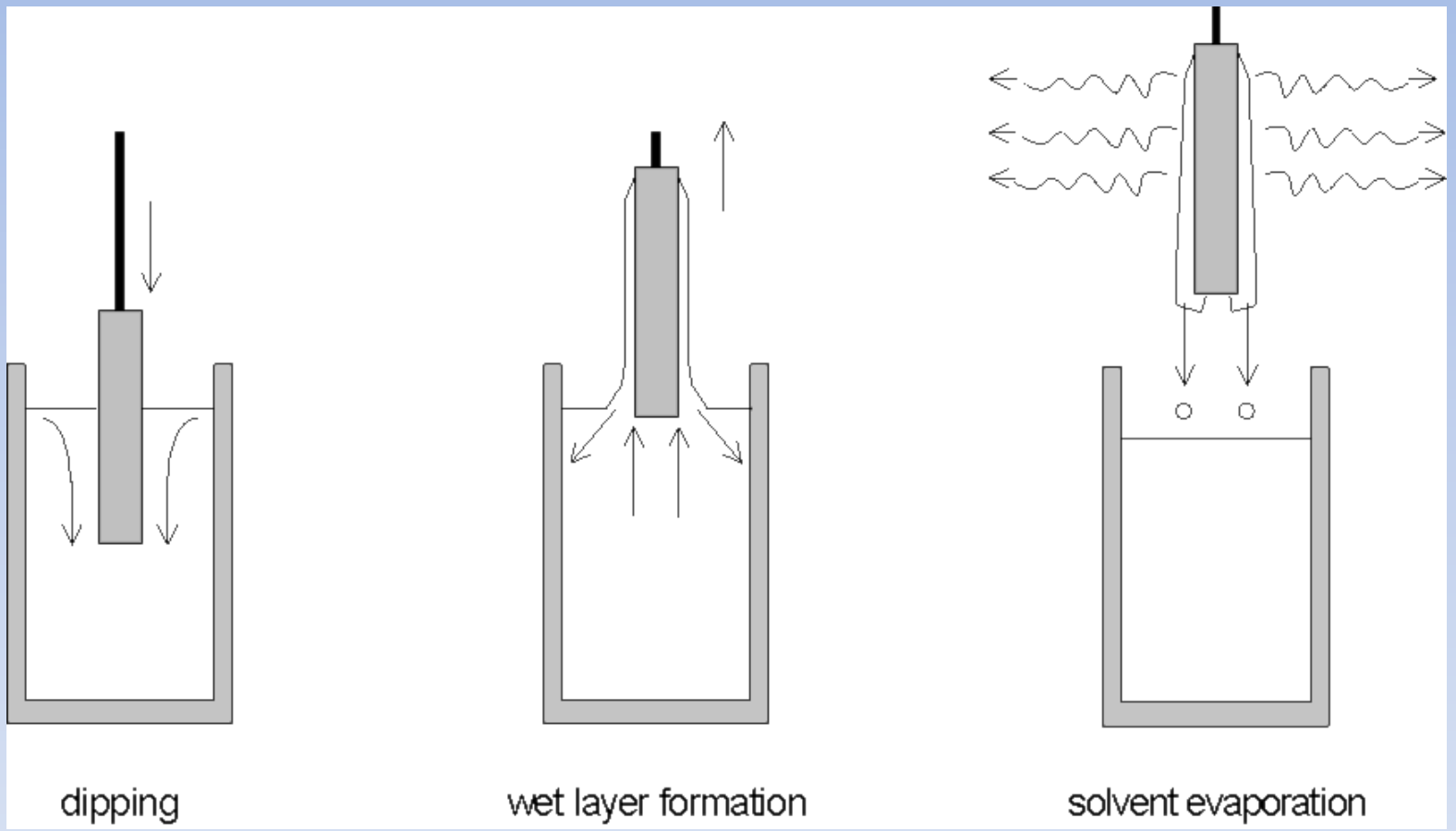
- The extrusion method can be described as a process in which the substrate is immersed in the liquid, and then removed at a certain speed at a certain temperature and atmospheric conditions

- This method can be used for coating on an area the size of several square meters in continuous or group modes

- This method can be divided into five stages:
  - immersion
  - extraction
  - precipitation
  - runoff
  - evaporation

- Simple method with a relatively low cost

Method of extrusion



Stages of deposition of the coating by the method of extrusion
Immersion in the film-forming solution, the formation of the layer by pulling the substrate and gelation in the film when the solvent evaporates

Method of extrusion

Advantages:

- The extrusion method is the most common and simple method of applying a film on a substrate
- Perhaps the coating on one or both sides
- The substrates may be flat panels, cylinders or parts of complex geometry
- The method allows optimal adjustment of the parameters of coverage due to a change in chemical composition
- This method can be used for coating on an area the size of several square meters in continuous or group modes

Disadvantages:

- The need for a large number of solution in the tank, especially for substrates of large size
- It is inconvenient, if the solution is expensive or unstable
- The method is not suitable for multi-layer coatings

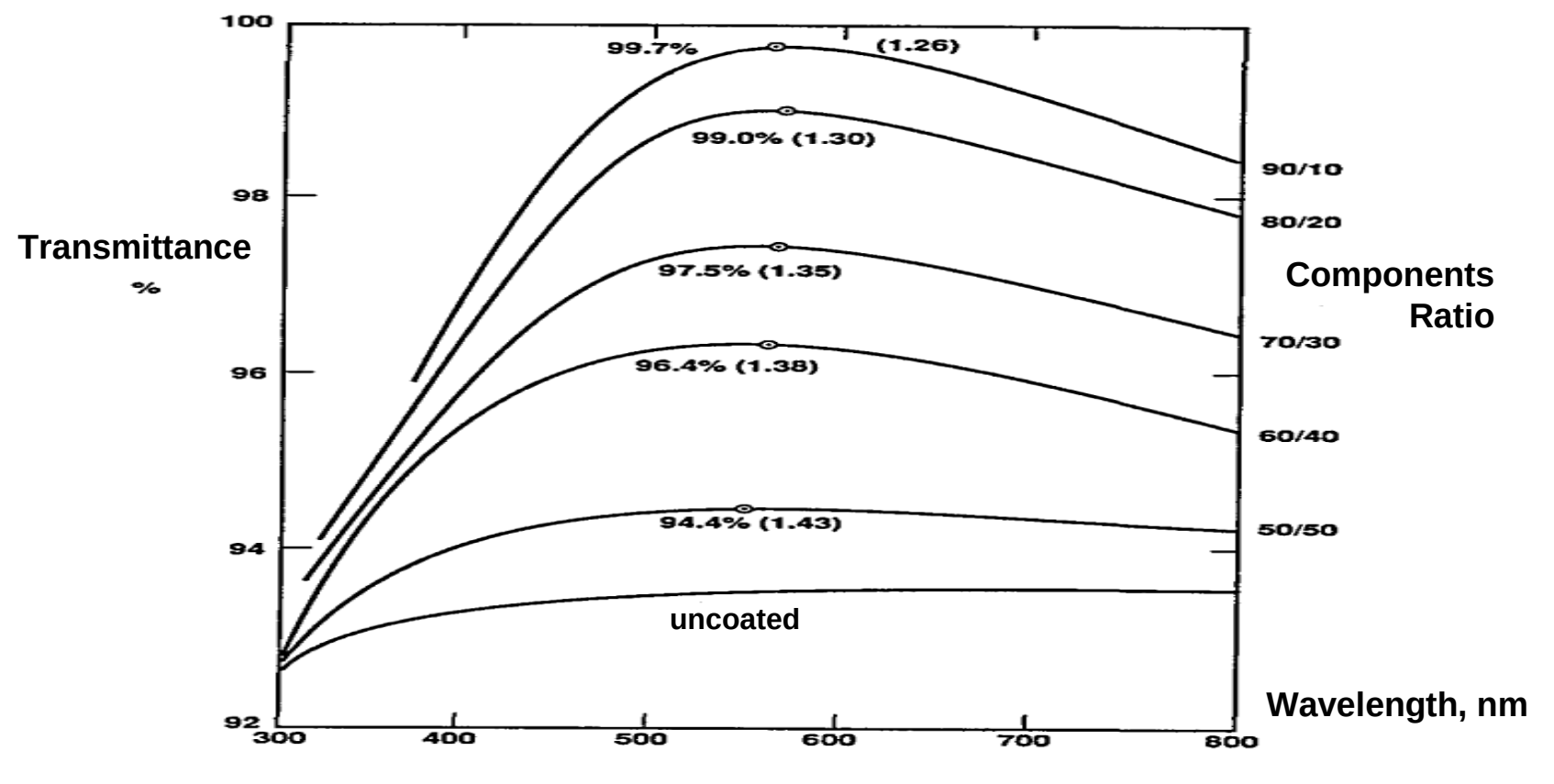
Method of extrusion

In a first approximation,
the film thickness is determined by the following ratio:

$$\text{Film thickness} = \left[\frac{(vis\cos ity)\cdot(speed)}{\text{liquid density}} \right]^{1/2}$$

If the viscosity and density remain constant, the film thickness is proportional to the square root of the rate of withdrawal

Experimental results: transmittance as a function of parameters



The dependence of the transmittance and refractive index on wavelength and the ratio of the component constituting the coating

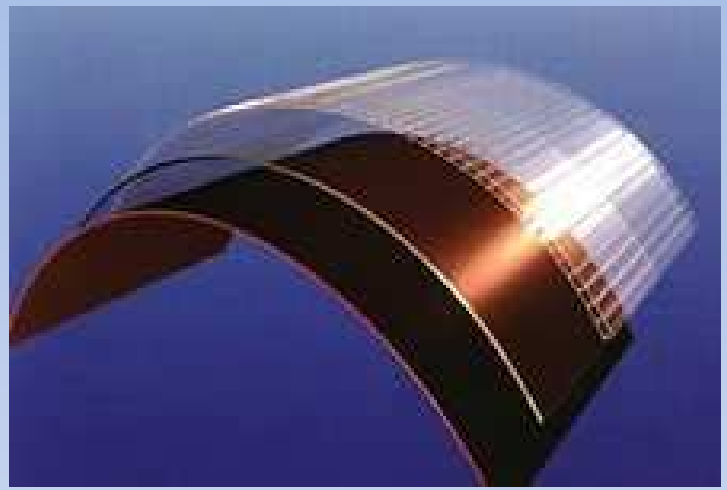
Obtained in the coating ensures the transmission of more than 95 % in the spectral range 350-800 nm

Stages of technology

Production by applying antireflection coatings using technology for protective screens solar panels of different sizes comprises the following process steps:

- section for the preparation of solutions
- cleaning phase of the glass before coating
- part of the application antireflection coatings
- heat treatment of coatings
- section for the application of protective,water repellent coatings
- testing

Polycarbonate as the material for protective screen



Note promising applications as a protective screen of a material such as polycarbonate

Its advantages over glass:

- **lack of brittleness**
- **low weight, flexibility**
- **the ability to take the set forms**
- **ability to be covered by the developed anti reflex coating, including the internal structure**
- **low cost**

We have an experience to use this material as a protective screen for solar panels

Main results

Vavilov state optical institute has elaborated a technology for increasing the efficiency of existing conventional solar sells

The total increase in the transmittance of the solar battery at 31-33 %

Increase the efficiency of the battery by 5-7 %

Protective hydrophobic coating for insulators of transmission lines allow to reduce losses from leakage of electricity 50-100 times

Vavilov state optical institute invites to cooperate in the field of described technology all interested organizations

Thank you very much
for you attention !

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Dr. Maxim Shcherbakov

Dr. Maxim Shcherbakov is an Assistant Professor and Research Scientist at Volgograd State Technical University. Head of Intelligent Energy Management group which focuses on developing data analytics techniques in the framework of building energy management system (BEMS). He received his PhD degree in System and Control Theory from Volgograd State Technical University in 2004.
In-depth 10+ years expertise in strongly analytical environments including predictive analytics, data mining, machine learning techniques. Solid understanding of how to do step-by-step data science research in energy management field with hands-on development: from energy data to solutions and benefits. Experienced as a business owner in software development in a cross-functional environment. Thorough understanding of business needs of complete development lifecycle allowed to ship more than 20 software products on time and provide IT service (2006-2013). An author and co-author of more than 40 research papers, 3 patents and 2 university courses; IEEE and ACM member.

The 32nd ISTC-Korea Workshop 2014

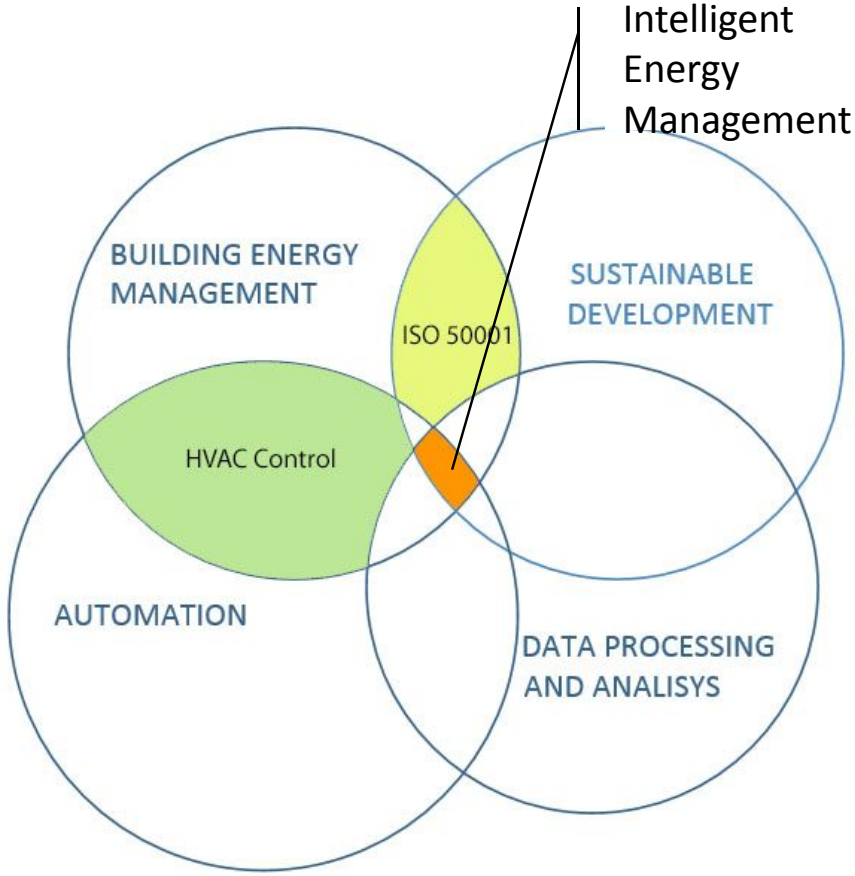
SMARTERDAM:2

Intelligent Data Processing in Energy Management Systems: from data to energy savings

Maxim Shcherbakov,
PhD, Volgograd State Technical University,
Russia

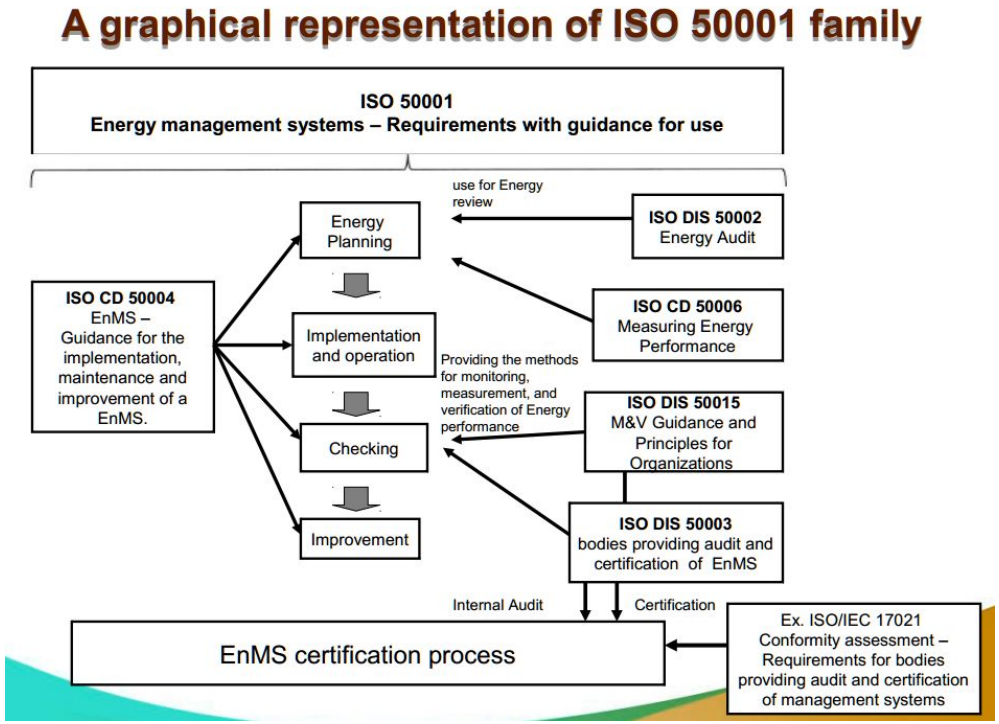
Outline

1. Energy Management System: how to save using data processing?
2. Cases
   1. Energy Data Quality Analysis.
   2. Intelligent data-driven algorithms for anomaly detection.
   3. Forecasting based analysis.
3. Technological Stack
4. Conclusion



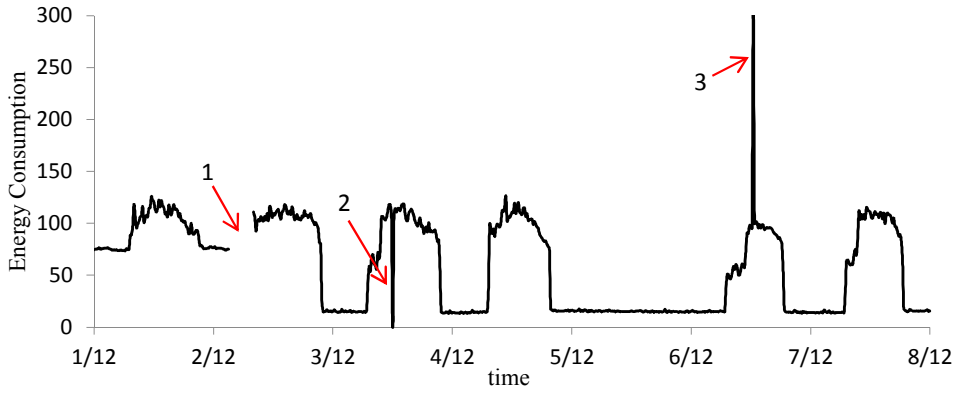
Energy Management Systems

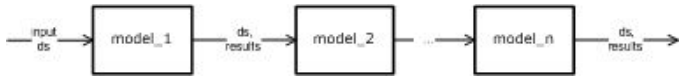
- Based on ISO 50001 & other standards: achieves energy performance according energy savings policy
- Energy management system based on continual improvement cycle “plan-do-check-act(improve)”
- 3 types of decisions:
  - corrective action
  - proactative actions
  - automation actions
- Getting data is an essential step in energy management
- Question: How data processing helps to improve energy performance?

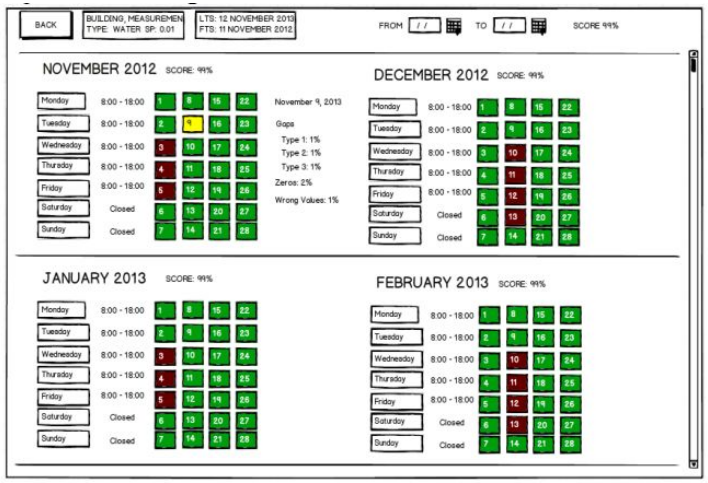


Energy Data Quality Analysis

1. Need to be sure: decisions are made based on right data
2. Issues:
   1. loss data, corruption in data, incorrect data
   2. Task: gaps detection
3. Data Quality Criteria: structured, semantic, pragmatic, timewise
4. Solutions for real time data quality analysis based on data-driven pipeline concept
   1. rules based monitoring: user specified conditions for data quality estimation
   2. statistics & machine learning algorithms for quality estimation and data improvement
5. Data Quality Certificate: & SLA (data owner)
6. Value:
   1. Reduce risks make up wrong decision based on “bad” data
   2. Speed up fixing the devises failures

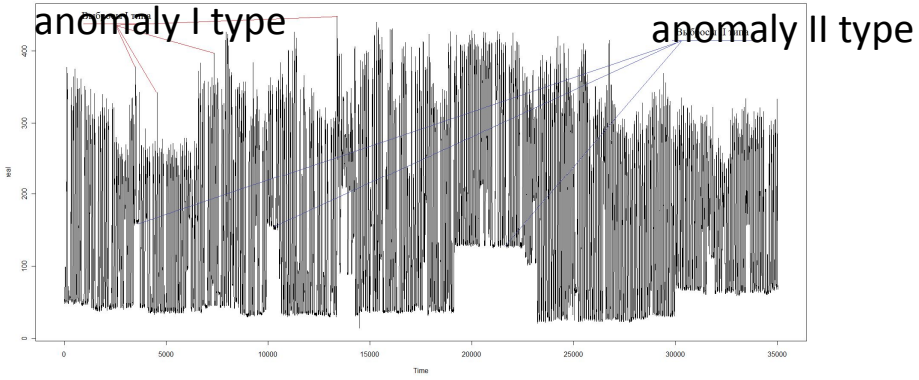


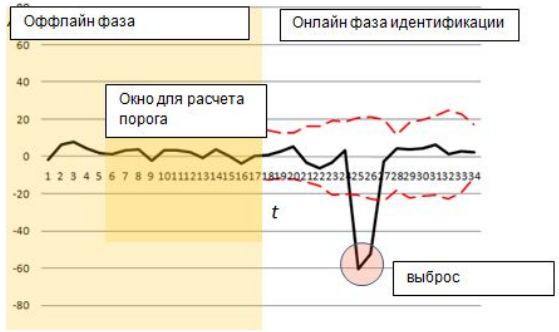


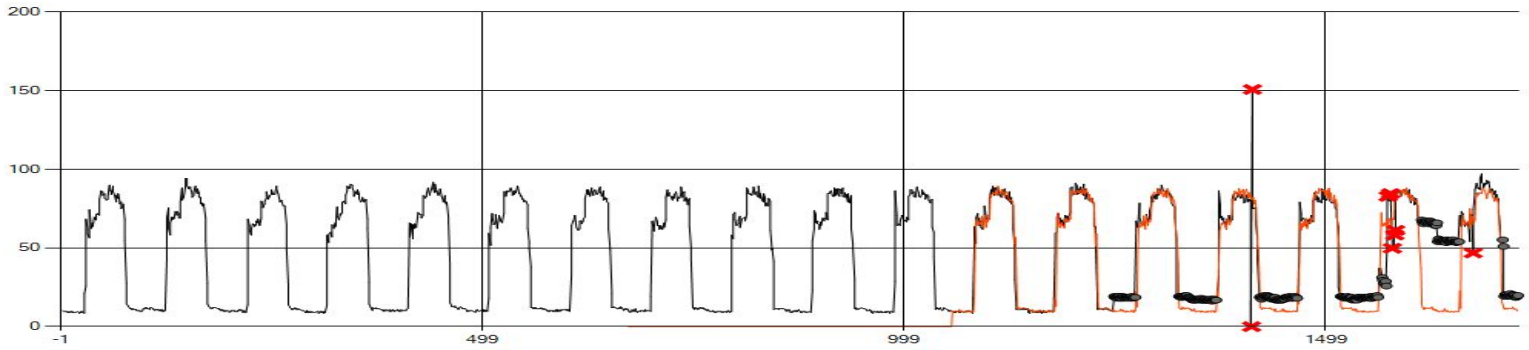


Intelligent data-driven algorithms for anomaly detection

- Different types of anomalies:
  - devices faults (I type)
  - changes in behavior (II type)
- Methods:
  - Rule based detection
  - Forecast based detection
  - Clustering based detection
- Results
  - abnormal energy consumption detection
  - devices failures detection
  - increasing reliability of management

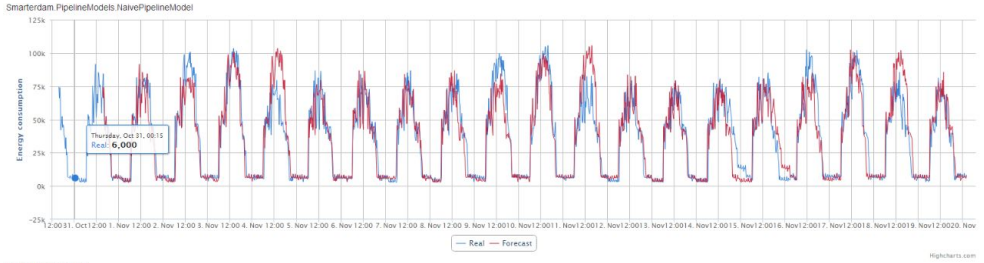


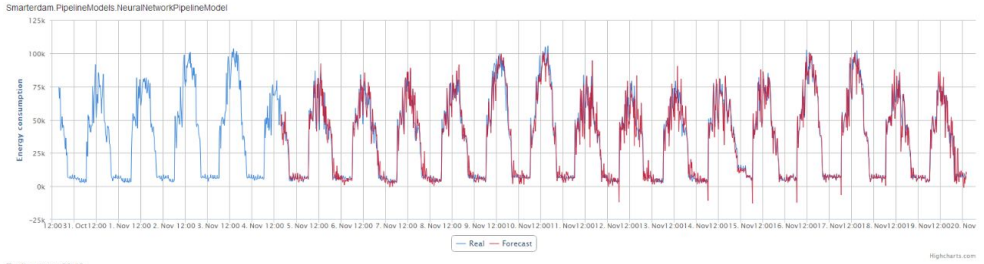


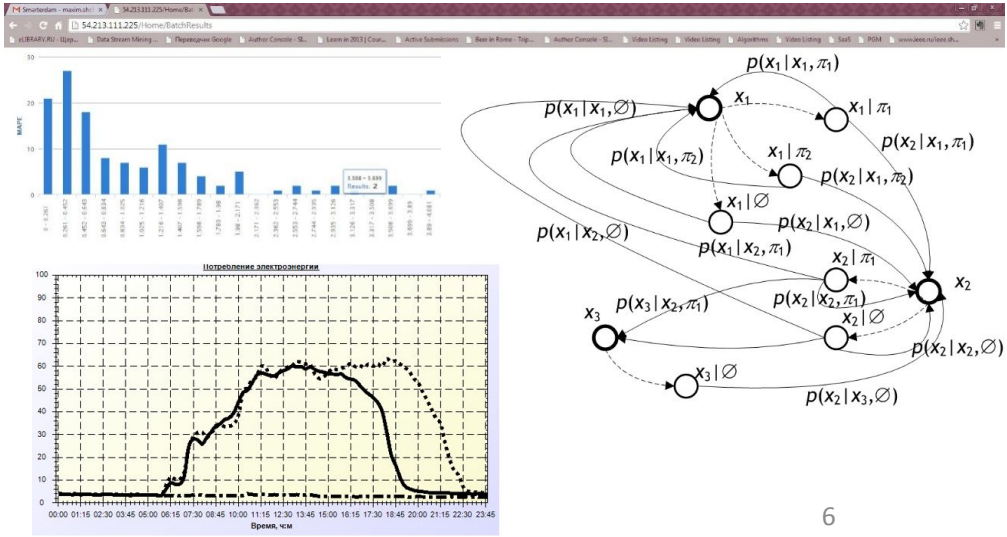


Forecasting based analysis

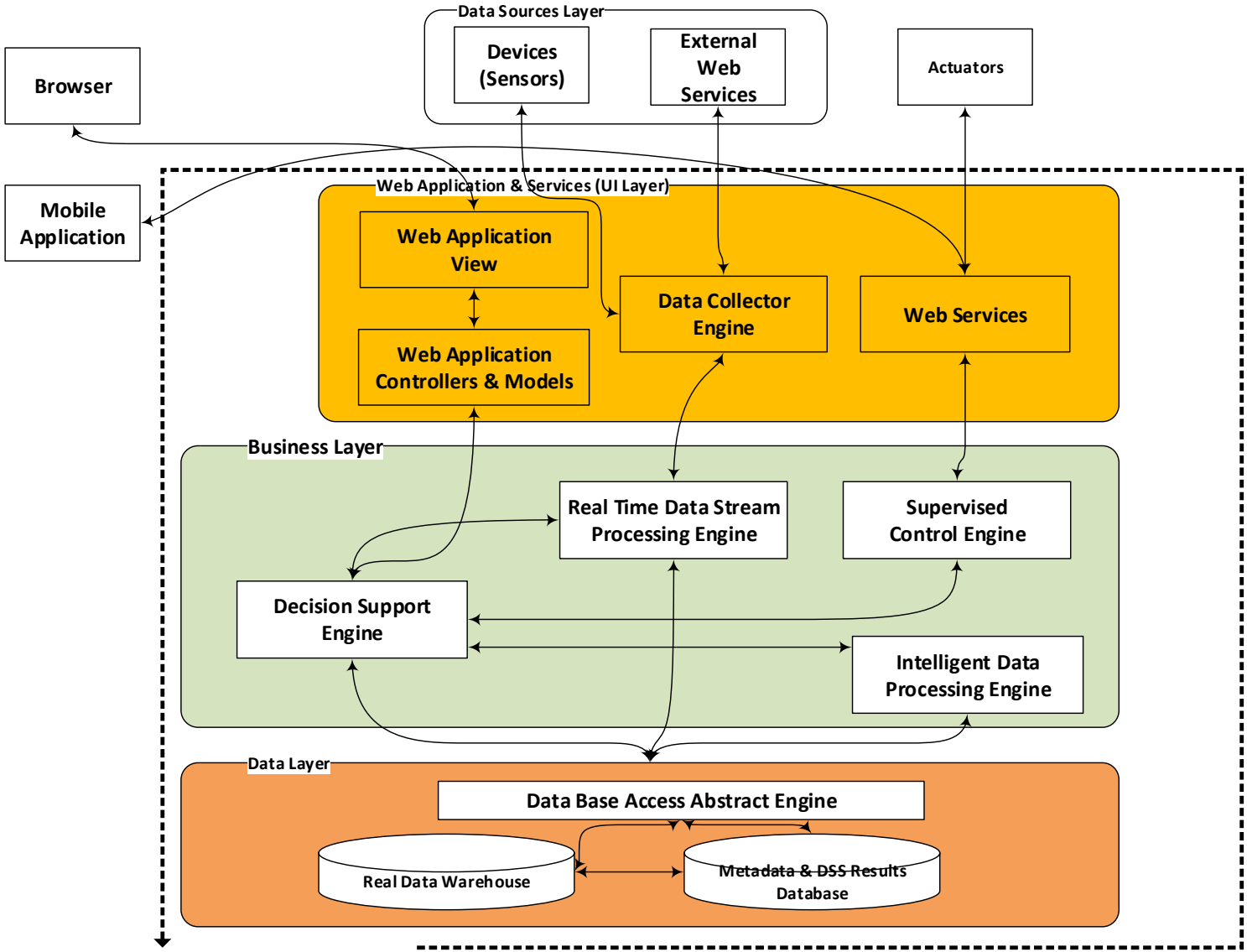
- Different methods and models: but how they good at automation forecasting:
  - multiple buildings (>3000)
  - many-step-ahead forecasting
  - lot of data for analysis
- Solutions:
  - Brute force based on domain knowledge
  - State space forecasting
- Interpretation
  - need to have white box: or linear regression or decision tree
  - prescriptive analysis
- Value:
  - ROI calculation
  - detect proactive patterns & make proactive decisions
  - energy demand orders
  - MPC
  - PV forecasting: hybrid energy systems





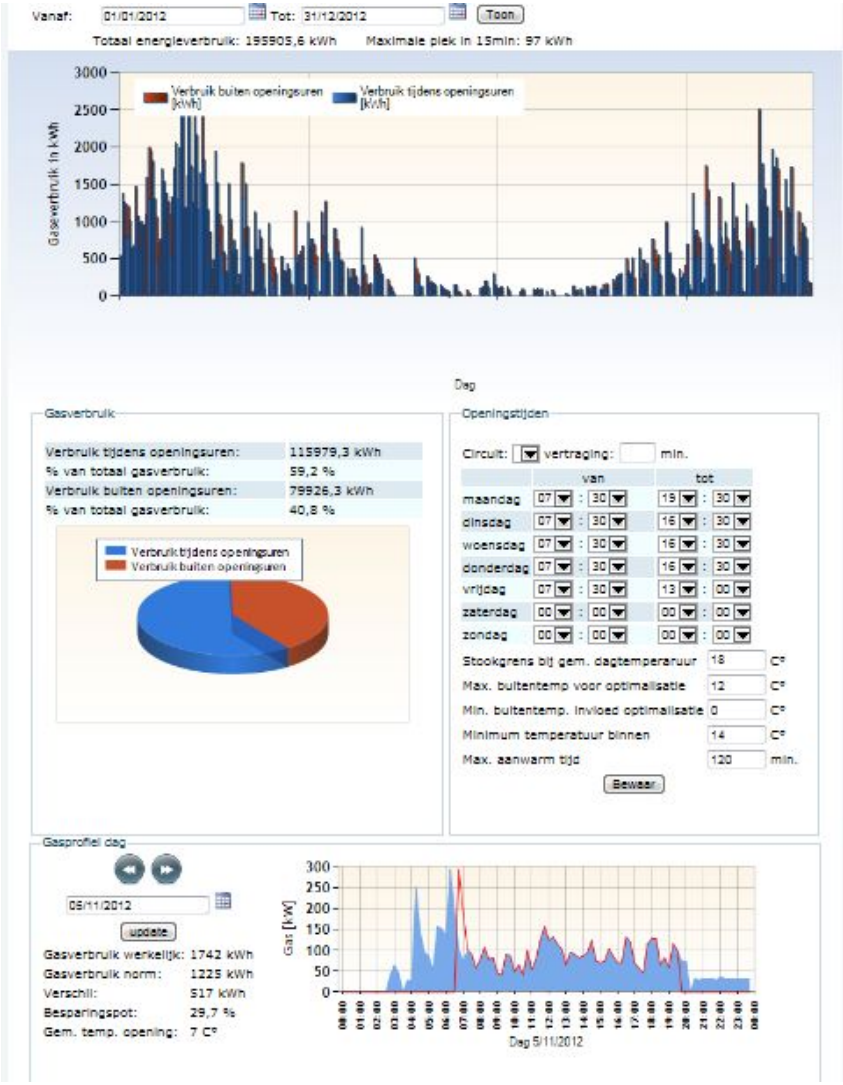


Technological Stack



Conclusion

- Data acquisition is very first step in energy management
- Estimation of data quality:
  - is this data appropriate for decision making?
  - Is it possible to improve data quality?
- Anomaly detection: mismanagement and identification of “abnormal” consumption
- Predictive analytics:
  - predictive based decision support is able to make proactive decision and reduce risks.
  - forecasting in automation mode: reduce the cost of analysis



Thank you

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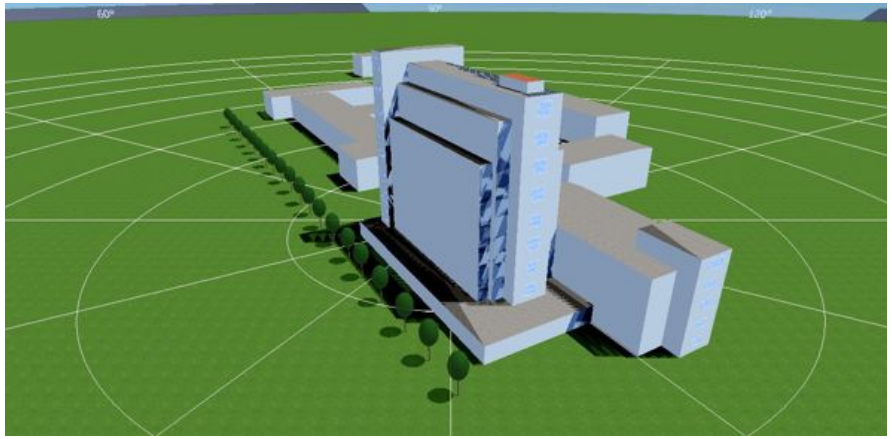
  - Anton Tyukov
  - Valery Kamaev



Theme 2.

Renewable Energy: Solar Energy Policies Designed to Encourage Modernization and Technical Innovation in Russian and CIS Industry

EURASTECH ㈜유라스텍
АО ЕвразТех

Dr. Oleg Sinyugin.

M.V. Lomonosov Moscow State University, Senior Researcher

Energy economist with significant international experience, have been working in Latin America, Europe and Asia-Pacific. Graduated from M.V.Lomonosov Moscow State University in 1985.

Obtained Ph.D. in economics from the System Analysis Institute, Russian Academy of Sciences in 1994. At present work as a senior researcher in laboratory for renewable sources of energy, geography department, M.V.Lomonosov Moscow State University.

Author/co-author of 90 publications in the field of energy, economic development and environment

Technology priorities in modern renewable energy and Russian technological platforms

by Oleg Sinyugin, Ph.D.(econ.)
Senior researcher, Geography department
M.V.Lomonosov Moscow State University

Workshop "Sustainable Energy Policy Through Digital Innovations: Synergy of Energy Efficiency and Renewable Energy", Seoul, Korea, October, 2014

Research and Development (R&D)

- According to Organisation for Economic Cooperation and Development (OECD, 2012) the world spending on Research and Development (R&D) totals 1200 billion dollars US annually.
- National figures vary widely, for instance the R&D sum for Russia is 1% GDP, while it is 2.7% GDP for Republic of Korea.
- About 10 billion dollars US – 0.8% of total – are directed into renewable energy R&D.
- In order to channel these funds effectively, both commercially and through the government budget, technology priorities in renewable energy should be identified.
- Here we discuss global technological foresight ideas in 6 areas: bioenergy, hydropower, geothermal, wind energy, solar energy and marine energy.

Russian technological platforms

- Starting in 2010-11, Russia has established 34 technological platforms in key areas:
- Medicine and biotechnologies, information and communication technologies (ICT), photonics, aerospace, nuclear technologies, energy, transport, new materials and metallurgy, natural resource extraction, manufacturing technologies and ecology.

- Technological platform is an instrument of state scientific and innovation policy, aimed to establish government-private partnerships for commercialization of perspective technologies
- Although being initiated in difficult post-crisis time, they represent roadmaps for enhanced development in the context of Russia's economy up to 2030.

Tech platforms in renewable energy

- Among these directions 4 are dealing with renewable energy:

1) ‘Bioenergy’,
2) ‘Perspective renewable energy technologies’,
3) ‘Small scale distributed energy systems’, and
4) ‘Ocean resources’.

- Renewable energy (RE) is a real high technology sector with double-digit annual growth rates, attracting domestic and international investment, so it is a window of opportunity in potentially vast Russian market.
- The main issue here is whether the Russian technological platforms match global trends in RE advance.

Global hydropower R&D

- No major improvements in machinery
- Computer automatisation in monitoring, diagnostics, protection and control technologies
- maximize the energy produced from existing projects through modernisation
- New sites for small hydro projects
- hybrid systems wing-hydro and hydrogen production
- Pumped storage and grid balancing
- Improvements in efficiency. Reductions in equipment costs. Reductions in operating and maintenance costs. Improvements in reliability and availability

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- Investment cost – 1000-3500 USD/kWh. Installed capacity – 810 + 180 GW. Electricity cost > 2 centsUS/kWh

Global wind R&D

- Large-scale integration of wind turbines into electric grids
- Forecasting power performance, decrease uncertainty in power output
- Extreme environmental conditions, safety, power performance and noise
- Storage techniques
- More efficient generators and converters from electronics industry
- Electric load control and improved power quality

- Investment cost – 900-1700 USD/kWh. Installed capacity – 283 GW. Electricity cost > 4 centsUS/kWh

Global solar thermal R&D

- Parabolic trough technology using high temperature fluid (HTF) or direct steam generation (DSG).
- Central Receiver Systems (CRS) using: molten salt, pressurised air receiver and dish Stirling systems.
- improvement of modular components - concentrators, heliostats or modular receivers
- storage systems for high pressure steam and pressurised, high temperature air - significant drop in electricity costs
- Energy / exergy loss optimisation

- Investment cost – 3000-4000 USD/kWh. Installed capacity – 3 GW. Electricity cost > 17 centsUS/kWh

Global photovoltaic (PV) R&D

1.Target - very low cost (while optimising efficiency):

•Improved oxide cells.

•Organic solar cells.

•Nano-structured materials.

2.Target - very high efficiency (while optimising cost):

•Multi-junction cells for use in concentrators

•New conversion mechanism concepts

•New resource for crystal silicon production

•Cost reduction in thin-film technologies

•Long-term stability up to 25 years lifetime

•R&D in materials science, device physics and chemistry, electronics, robotics, building technologies, electrical transmission systems and storage

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•Investment cost – 1500-2500 USD/kWh. Installed capacity – 100 GW. Electricity cost > 9 centsUS/kWh

Global bioenergy R&D

- Develop biorefinery concept for biomass feedstocks
- Biological conversion for ethanol, biogas
- Anaerobic digestion for biogas
- Municipal solid waste incineration - electricity and heat
- Production of bioethanol and biodiesel from sugar, oil-based crops and lignocellulosics.
- Biohydrogen
- Availability of cheap feedstocks: short rotation forestry, grasses, straw, sewage
- Increase the energy density by pelletising.
- Improvement of the efficiency of conversion processes while reducing their costs

---

- Investment cost – 800-4500 USD/kWh. Installed capacity – 83 Gwe. Electricity cost > 5 centsUS/kWh

Global geothermal R&D

- Development of deep (>3,000 m) geothermal resources
- Development of hot dry rock formations
- Increased geothermal co-generation of power and heat
- Reduction of costs of geothermal well drilling, logging and completion
- Direct geothermal systems, including geothermal heat pumps and space heating
- Life-cycle analysis, sustainability of geothermal power generation
- Improved conversion efficiency cycles, exergy optimisation
- Induced seismicity on geothermal sites

- Investment cost – 1000-2500 USD/kWh. Installed capacity – 12 Gwe. Electricity cost > 7 centsUS/kWh

Global ocean/marine energy R&D

- Tidal stream current systems based on underwater turbines (transfer of turbines and rotors from shipbuilding industries).
- Salinity gradient (efficient membranes).
- Ocean thermal energy conversion (OTEC)

- Resource potential assessment and monitoring
- Wave energy systems
- Improvement of power take-off systems.

- Investment cost – 2000-5000 USD/kWh. Installed capacity – 0.5 GW. Electricity cost > 20 centsUS/kWh

National RE targets in Russia

- First national target indicators for renewable energy were established in 2009.
- According to federal program “Energy Efficiency and Energy Sector Development” 6.2 GW of new generation capacity based on renewable sources should be installed in Russia by 2020

- Thus RE share in national energy balance could reach 2.5%, comparing to 0.8% at present
- Deployment of 6.2 GW renewable energy capacity corresponds to annual investment of $2 billion/yr
- Average figure for RE investment in Russia in 2005-2013 is estimated at $200 million/yr – that is 10 times less the announced level

#3. Bioenergy

- Target: Formulate development concept and implementation roadmap for national bioenergy sector
- Coordinator: Federal research center “Kurchatov Institute”

- Adaptation and integration of bioenergy into the context of existing energy sector
- Technologies for non-food biomass production on industrial scale
- CO2 capture and transformation to biomass
- Utilization of agricultural, industrial and urban organic waste
- Fermentation of non-food biomass to biogas
- Catalysis processing of biomass into liquid fuels, alcohool and biodiesel
- Species selection and bioengineering

#9. Small-scale distributed energy systems

- Transition from centralized power supply to combination of diversified energy systems tailored to consumer demand and local conditions
- Target: develop typical equipment modules and design small-scale distributed energy supply systems
- Combine standard generation units, local grids, control and automatisation, storage
- Minimize deployment and dissemination costs, reduce manufacturing expenditures
- Formulate roadmap for market, institutional and scientific ambient conditions
- Formulate strategic plan for R&D and innovation implementation in the field of small-scale energy systems
- Coordinators: “Agency for power balance forecasting”, “Inter RAO ES” company

#18. Ocean resources

- Large mineral, bio- and energy resource potential in 3 oceans. 5 million km2 - national exclusive economic zone in Pacific Ocean
- Target: develop the set of breakthrough technologies to exploit marine resources
- Connect government-private partnerships and scientific research
- Present focus on gas and oil extraction on sea shelf
- Robotic systems for surface and submarine applications
- Ship-based energy supply facilities for coastal urban areas (including nuclear energy)
- Special opportunities for tidal energy development in Okhotsk Sea (Tugur project, 20 GW)
- Coordinator: Federal scientific center “Concern MPO Hydrodevice”

19. Perspective renewable energy technologies

- Target: Accelerate deployment of power and heat generation technologies, based on renewable energy (RE) sources

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- Coordinator: “Rushydro” joint-stock company
- Develop strategic research program. Coordinate technology platform members activity.

- Facilitate operation of RE generators in existing power grid
- Approval of “green energy” tariffs for RE generation

- Standardization for equipment, construction and operation
- Life-cycle monitoring and management for RE projects
- International cooperation in RE development. Russia joined IRENA in September 2014

Dr. Oleg Olshansky.

Solar Technologies LLC., Technical Director; Infodate Co., Ltd, Co-Founder, Director

Website:

PIR. (Industrial Research and Development) - Director of Economics. Business Partners in EU **SRO Linteh CZ-**Contract supplies of equipment and projects for solar power, - **SROKriner, SRO B64**-consulting services in the implementation of engineering projects with that firms and partnership with solar energy projects.

MONTECHGMBH(Germany) and **PIR**(RF) - collaborative design and manufacture of measuring equipment.

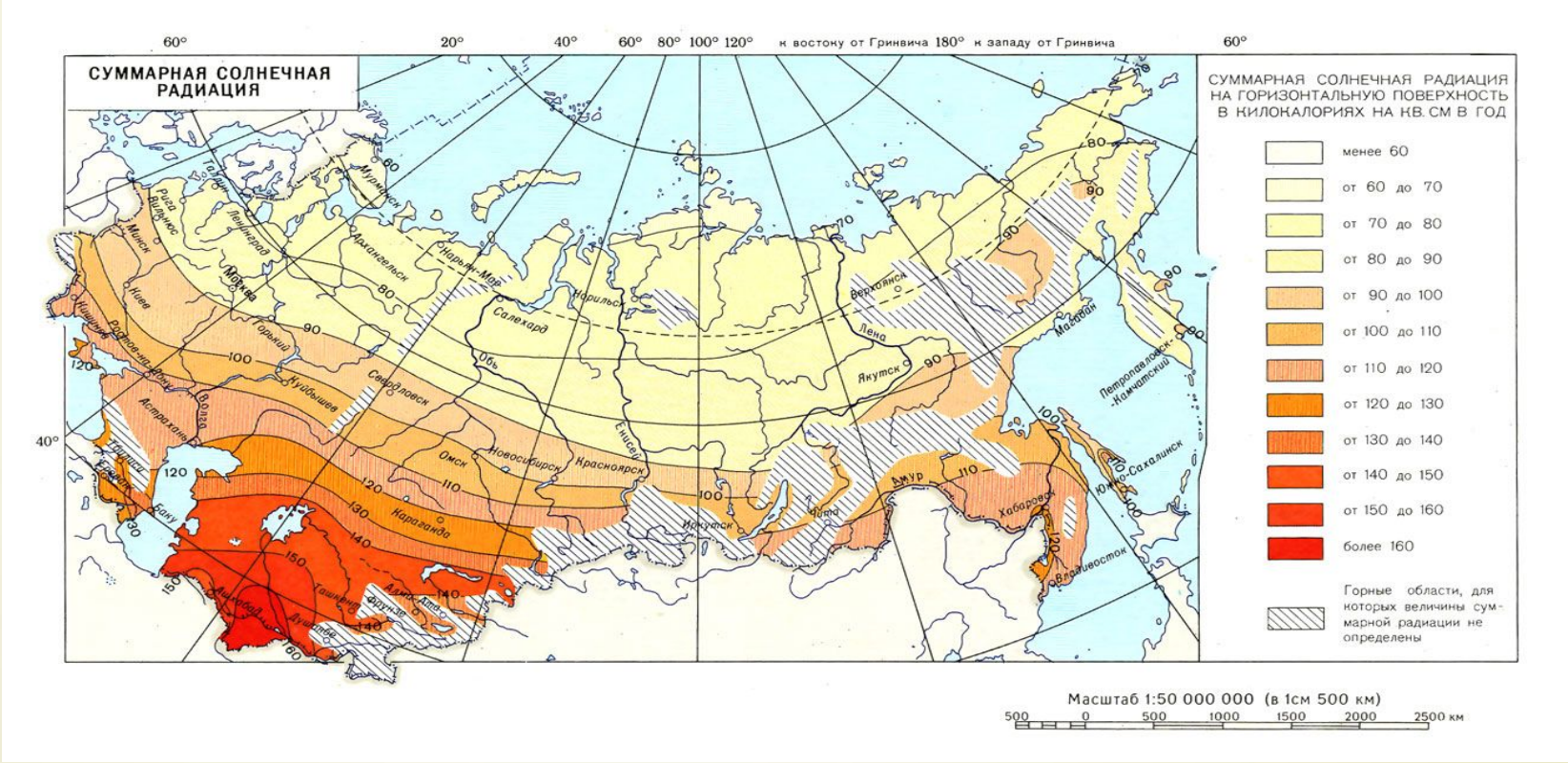
Practicing Engineer in the field of alternative energy, the main direction - the practice and theory of technical devices in the generation of solar, thermal and electrical energy. Author of 3 books and 7 patents. **Key specialties**: design and implementation of alternative energy plants, electro-mechanical engineering, automation, power generation, transportation and industrial energy, preparation of business plans, CAD/CAE design.

Oleg Olshansky

LLC Solar Technology
(http://solartechnologies.ru/), Russia

Solar power plants as a key energy resource for public transport in south regions of Russia

Solar Map for RF



Current problems and solutions.

- Environmental problems of urban transport - as a major factor introducing solar power.
- Development of electric transport and energy supply from SPP provided stability the growth of the cost of tickets for the urban residents.
- The use of existing networks of power to the trams, trolleybuses without additional investment.
- Construction of ecological power as SPP with optimal price to reduce the cost of operating electric and stability prices of tickets.
- Transport technologies based on electric transport and the expansion of public transport facilities - electric buses and Electrical cars as taxis.

Purpose of the project

- Create a pilot project for urban electric transport to address environmental and cost problems with on basement of solar power generation

Network Structure

- Energy generated by solar power plants can be used to cover electricity demands and develop of modern city transport, providing stable source of sustainable energy

Technical means

- Scale solar power plant 20 MW.
- Solar Power Plant and the existing city electric networks for electric vehicles.
- New economical electric buses and electric city cars as urban taxi

The financial model

- The total cost of the design, construction and commissioning
- of 61.000.000 USD.
- The volume of electricity produced per year 51,100,000 kWh.
- Value of production of 1 KW. Hour, the power generated will be the basis
- of 25 years of power per kilowatt in hour only 0.044 USD
- In this case, the expected return on investment 7 years
- The total income from the operation of SPP can bring investors
- 194,400,000. USD.

Electro Autobus SOR from CZ

German Electro Car & Tesla model S

TATA City Electro Bus

Economical Zero Emissions Vehicle for on the go city driving

Dr. Belousova Inna.

Doctor of Physical and Mathematical Sciences, Professor, Honored Science Worker of the Russian Federation, Laureate of the State Prize of the USSR, Section head - Chief scientific researcher of Nanophotonics Section of «Vavilov State Optical Institute», JSC, Professor of Laser Optics Department of ITMO University. Scientific areas: Laser Physics and Technology, Nonlinear Optics, Nanophotonics, Atomic and Molecular Spectroscopy. The author of over 250 scientific papers in the field of Laser Physics, Laser Photonics and Nanophotonics. Head of major works on state contracts, grants of the Russian Foundation for Basic Research (RFBR).. Project supervisor of the International Science and Technology Center.Dissertation Board Member in Saint Petersburg State University, and Dissertation Board Member and Member of Science&Technology Council in «Vavilov State Optical Institute», JSC, Scientific Secretary of Science&Technology Council in S&R Institute of Laser Physics of «Vavilov State Optical Institute», JSC. 15 candidates of physical and mathematical sciences were trained under scientific supervision of I.M. Belousova. I.M. Belousov is the Head of Nanophotonics and Biophotonics Section at the International Laser Optics Conference.

ЭНЕРГЕТИЧЕСКАЯ ЛАЗЕРНО-ОПТИЧЕСКАЯ СИСТЕМА КОСМИЧЕСКОГО БАЗИРОВАНИЯ НА ОСНОВЕ ФУЛЛЕРЕН-КИСЛОРОД-ЙОДНОГО ЛАЗЕРА

И.М.БЕЛОУСОВА, О.Б.ДАНИЛОВ, В.М.КИСЕЛЕВ, А.А.МАК

ГОИ
SOI

Институт лазерной физики
ГОИ им.С.И.Вавилова

ГОСУДАРСТВЕННЫЙ ОПТИЧЕСКИЙ ИНСТИТУТ ИМ.С.И.ВАВИЛОВА

СОЛНЕЧНАЯ ЭНЕРГЕТИКА – ЭТО ОДНО ИЗ ГЛАВНЫХ НАПРАВЛЕНИЙ АЛЬТЕРНАТИВНОЙ ЭНЕРГЕТИКИ XXI ВЕКА

Существующие направления:

- ⇨ солнечные термальные установки - *для нагрева воды и обогрева зданий*
- ⇨ солнечные фотоэлектрические системы - *для производства электроэнергии*

Годовой объем инвестиций в традиционную солнечную энергетику составляет около **38 миллиардов долларов.**

Вклад солнечной энергетики в альтернативную энергетику составляет в настоящее время **25%.**

Установленная мощность фотоэлектрических систем составляет **16 ГВт.**

НЕДОСТАТКИ ТРАДИЦИОННЫХ СОЛНЕЧНЫХ ЭЛЕКТРОСТАНЦИЙ

- Территории с серьезным энергетическим потенциалом расположены далеко от потребителей
- Зависимость от погодных условий. Значительные (до 60-90%) потери энергии при прохождении атмосферы
- Значительные площади, занимаемые солнечными электростанциями большой мощности
- Невозможность использования в ночное и вечернее время, снижающая КПД системы в несколько раз

ЭНЕРГЕТИЧЕСКАЯ ЛАЗЕРНО-ОПТИЧЕСКАЯ СИСТЕМА КОСМИЧЕСКОГО БАЗИРОВАНИЯ НА ОСНОВЕ ФУЛЛЕРЕН-КИСЛОРОД-ЙОДНОГО ЛАЗЕРА.
ПРИНЦИПИАЛЬНАЯ СХЕМА.

ХИМИЧЕСКИЙ КИСЛОРОД-ЙОДНЫЙ ЛАЗЕР, ИСПОЛЬЗУЕМЫЙ В ВОЕННЫХ СИСТЕМАХ США, НЕ МОЖЕТ БЫТЬ ПРИМЕНЕН ДЛЯ ОРБИТАЛЬНЫХ ЭЛЕКТРОСТАНЦИЙ

Принцип действия:

Образование синглетного кислорода в химической реакции

⇩

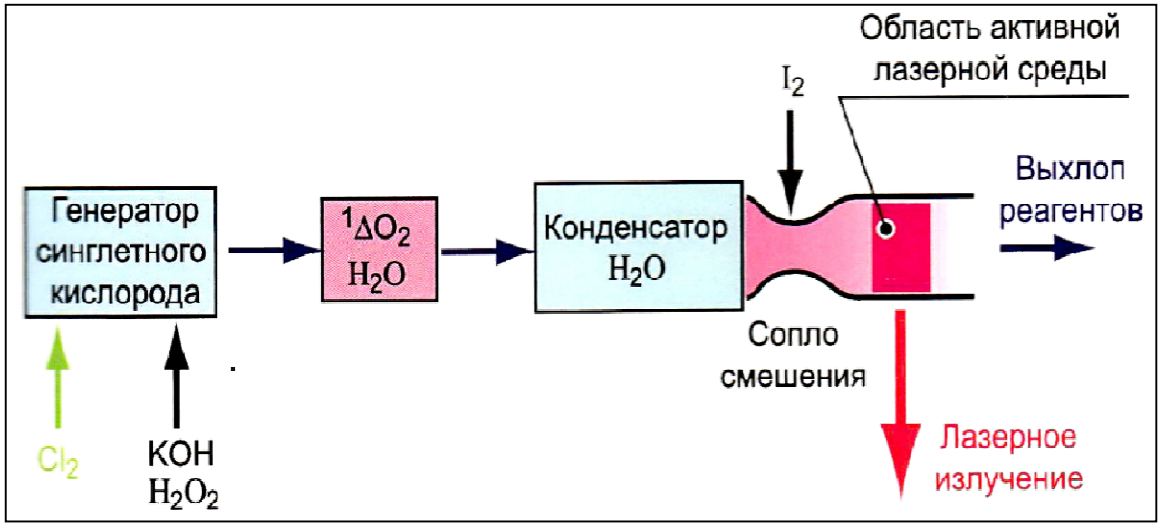
Передача энергии возбуждения атомам йода

⇩

Усиление

⇩

Генерация

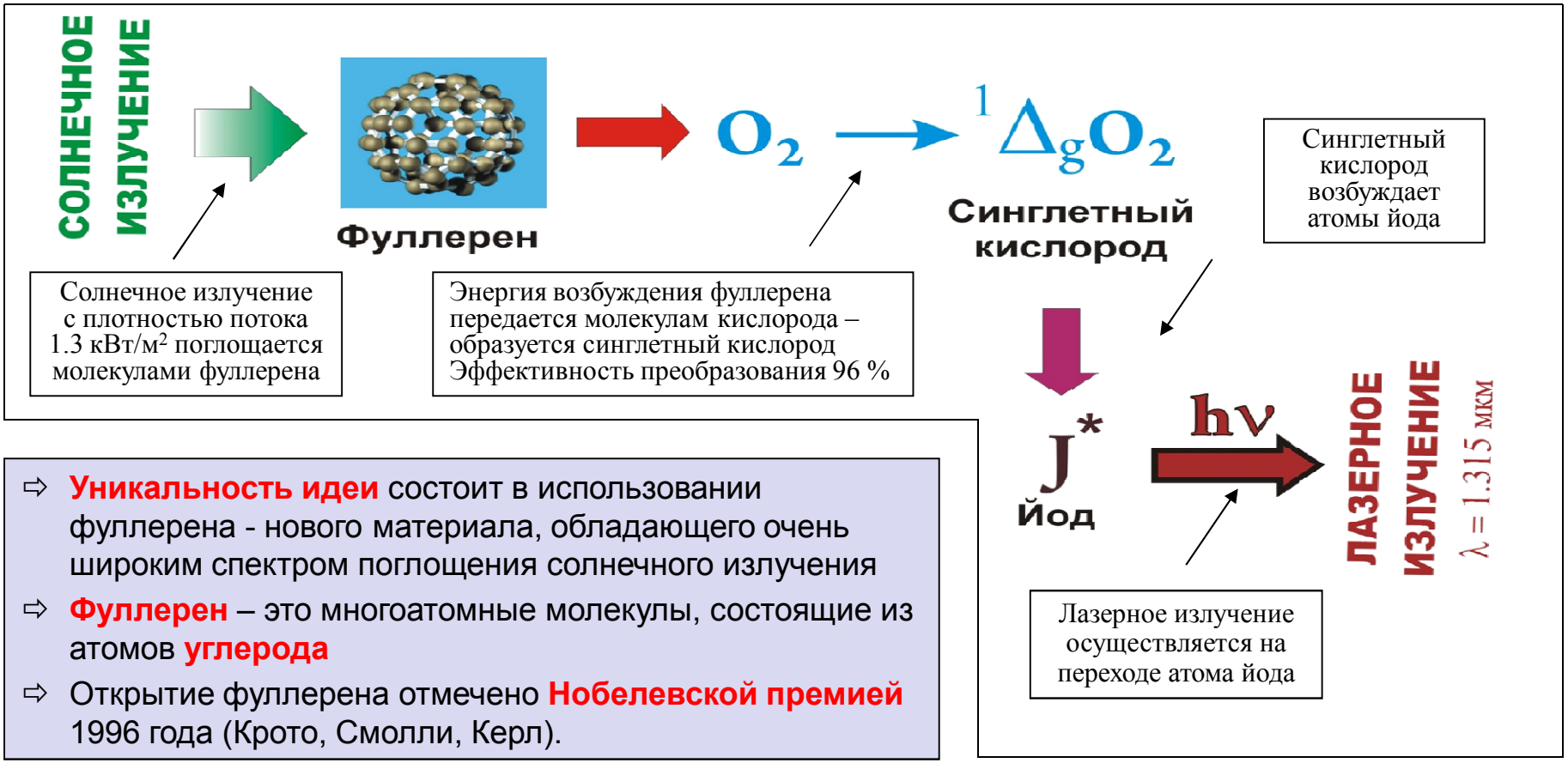


Недостатки:

- ⇨ **Отсутствие замкнутого цикла, расход химических реагентов, короткий цикл работы.**
- ⇨ **Плохая экология при промышленном применении (объемные цистерны для Cl_2)**
- ⇨ **Невозможность космического базировании жидкостных систем в невесомости.**
- ⇨ **Невозможность непосредственного преобразования Солнечной энергии в лазерный луч.**

НОВЫЙ ПРОЕКТ СОЗДАНИЯ ОРБИТАЛЬНОЙ ЭЛЕКТРОСТАНЦИИ

Это НОВАЯ ИДЕОЛОГИЯ, основанная на применении прямой оптической, в том числе, солнечной, накачки. Для её реализации впервые предложен фуллерен-кислород-йодный лазер (ФОИЛ).

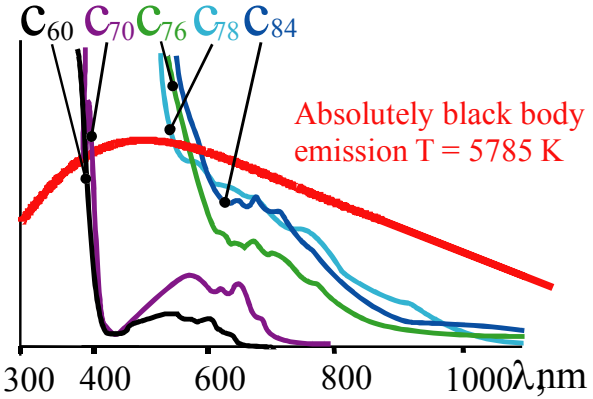


- **Уникальность идеи** состоит в использовании фуллерена - нового материала, обладающего очень широким спектром поглощения солнечного излучения
- **Фуллерен** – это многоатомные молекулы, состоящие из атомов **углерода**
- Открытие фуллерена отмечено **Нобелевской премией** 1996 года (Крото, Смолли, Керл).

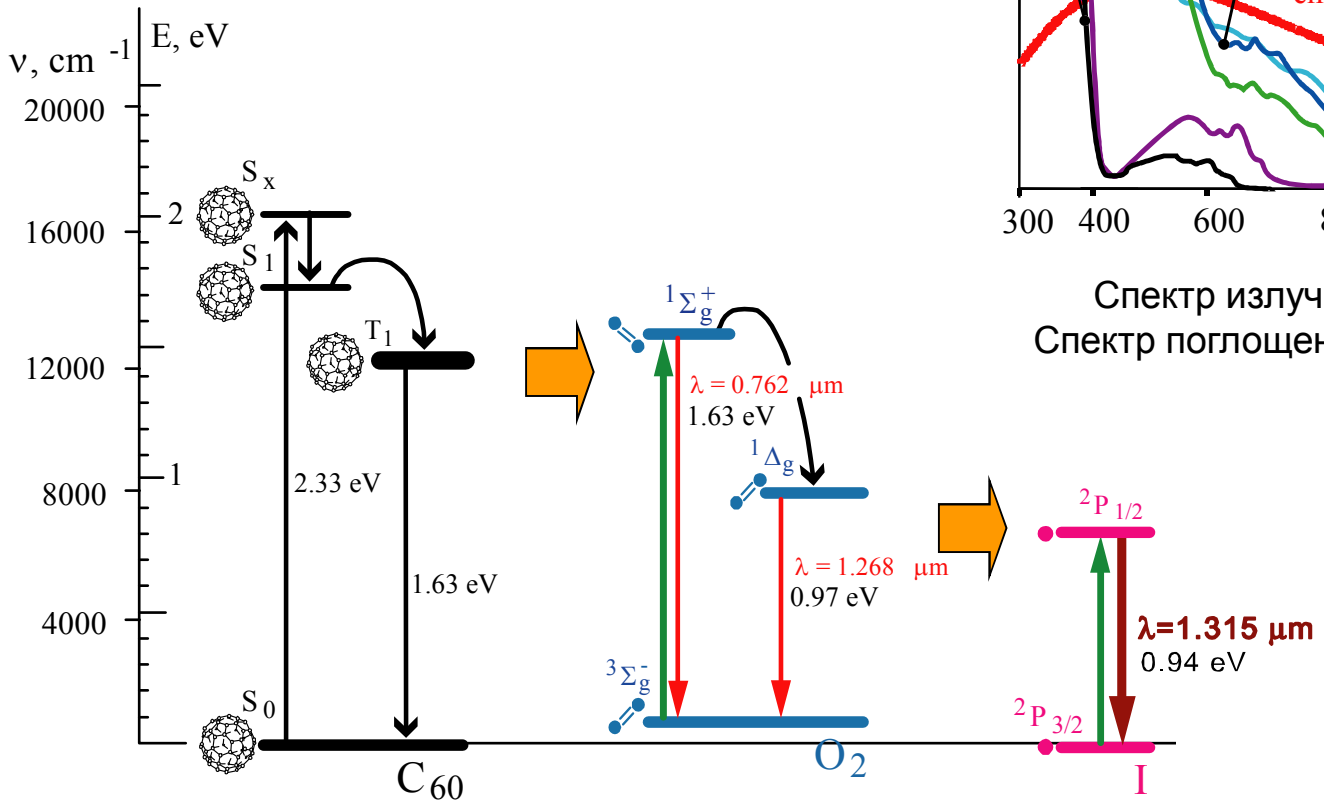
КИНЕТИЧЕСКАЯ СХЕМА ФУЛЛЕРЕН-КИСЛОРОД-ЙОДНОГО ЛАЗЕРА

Физическая эффективность= 40%

С учетом эффективности поглощения солнечной энергии ~ 30%



Спектр излучения солнца
Спектр поглощения фуллеренов

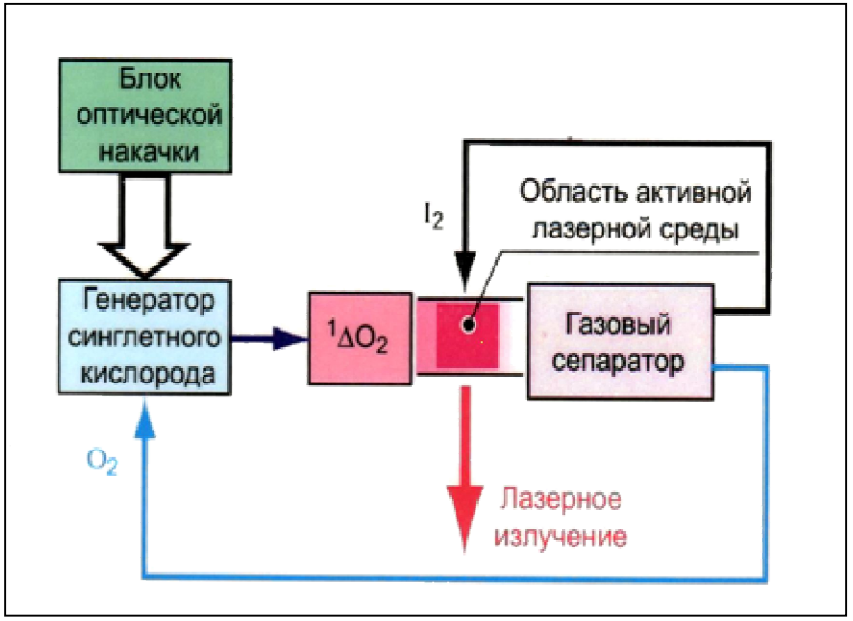


$\Delta\Phi\ (^1\Delta_g O_2) = 0.96 \pm 0.04\ (\lambda = 532\ \text{нм})$

НОВЫЙ ПРОЕКТ СОЗДАНИЯ ОРБИТАЛЬНОЙ ЭЛЕКТРОСТАНЦИИ

Преимущества:

- ⇨ Прямая солнечная накачка позволяет использовать значительную часть энергии Солнца. Выдающаяся эффективность преобразования солнечной энергии в лазерный луч
- ⇨ Лазер замкнутого цикла – нет расхода реагентов на орбите
- ⇨ Непрерывный, неограниченный цикл работы
- ⇨ Экологически безопасная доставка энергии на Землю – в отличие от американского и японского проектов



Создание кислород-йодного лазера с реактором синглетного кислорода на основе фуллеренов является принципиально новым в лазерной технике применительно к прямому преобразованию солнечной энергии в лазерное излучение

Разработка защищена патентом.
Патент РФ Института Лазерной физики ГОИ им.С.И.Вавилова № 2181224 от 20.06.2000 г.
Способ получения генерации стимулированного излучения на атомах йода
Авторы: А.А. Мак, О.Б. Данилов, И.М. Белоусова.

КОМПОНЕНТЫ ОРБИТАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ СИСТЕМЫ:

ЛАЗЕРНО-ОПТИЧЕСКАЯ СИСТЕМА ФОКУСИРОВКИ И СВЕРХТОЧНОГО НАВЕДЕНИЯ ЛАЗЕРНОГО ЛУЧА

Мембранное зеркало формирует изображение с искажениями, которые необходимо корректировать.

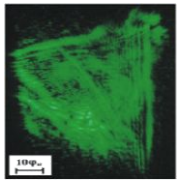
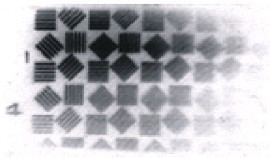
Специалистами Государственного Оптического Института им.С.И.Вавилова лазерной физики разработана собственная технология нелинейно-оптической коррекции изображения при помощи линейной адаптивной системы и нелинейно-оптического искажения волнового фронта

Для проверки эффективности новой российской технологии были проведены испытания телескопа с мембранным зеркалом с нелинейно-оптической коррекцией изображения

Параметры

- Мембранное главное зеркало диаметром 300 мм
- Материал пленки – лавсан толщиной 20 мкм,
- *F*- number (*F/D*) - 6,
- Перепад давлений 2.5·10-4 МПа,
- Расчетное качество $\theta 0.8 = 100\ \theta dif$
- Экспериментально достигнутое качество зеркала $\theta 0.8 = 125\ \theta dif$
- Наименьшая собственная частота колебаний 30 Гц

Результаты

Искаженное изображение	Скорректированное изображение
	
	

КОМПОНЕНТЫ ОРБИТАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ СИСТЕМЫ:

НАЗЕМНАЯ СТАНЦИЯ ПРИЕМА И ПРЕОБРАЗОВАНИЯ ЛАЗЕРНОГО ЛУЧА В ЭЛЕКТРИЧЕСКУЮ ЭНЕРГИЮ

Предназначена для генерации электроэнергии и передачи её сетевым компаниям для дальнейшей продажи домовладельцам и бизнесу.

Основной вариант:

- ⇨ Преобразование лазерного излучения фотовольтаической системой на основе гетероструктур на базе GaSb.
- ⇨ Квантовая эффективность на длине волны λ = 1.315 мкм составляет 90 %
- ⇨ Перспективный КПД более 70 %
- ⇨ Удельная мощность 100 Вт/см2
- ⇨ Размер приемной антенны ∅ 40 м

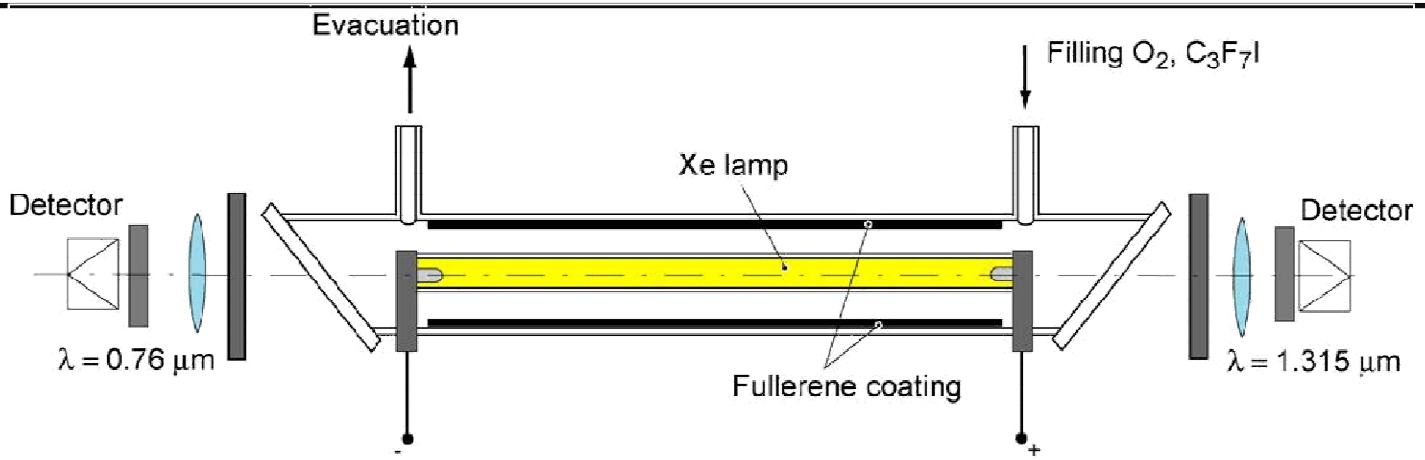
Гетероструктуры на основе GaSb, имеющие высокую эффективность преобразования солнечной энергии, активно разрабатываются научно-технологическим коллективом под руководством Ж.И.Алферова.

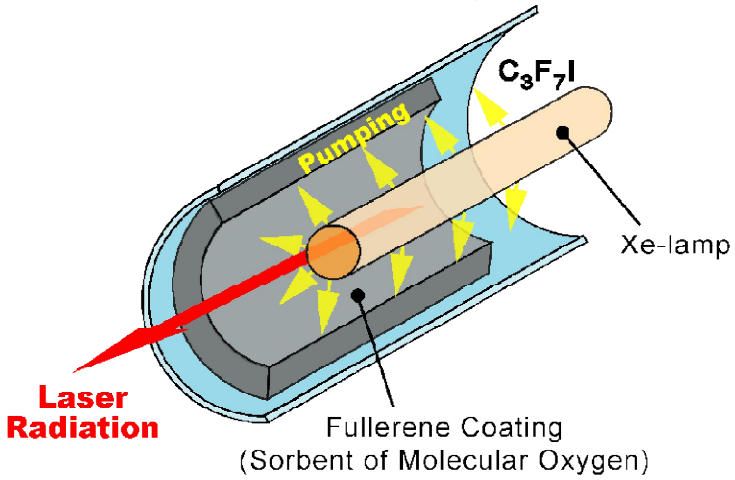
Перспективный вариант:

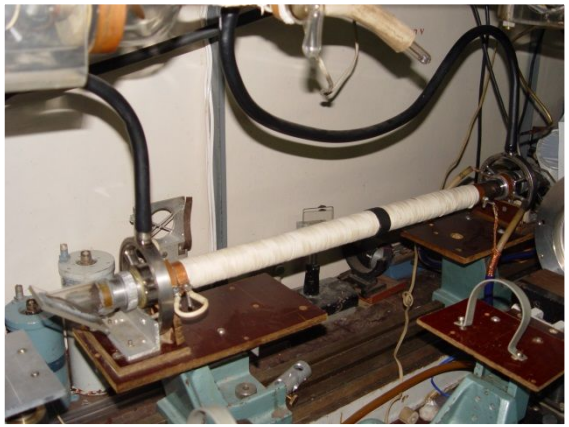
Приземление лазерного луча в резервуар с водой с прямым получением водорода и его использования в водородной энергетике.

КОМПОНЕНТЫ ОРБИТАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ СИСТЕМЫ:

ФОИЛ С НАКАЧКОЙ КСЕНОНОВОЙ ЛАМПЫ







Энергия генерации 1.8 Дж. Удельная энергия ~ 5 Дж/л, мощность ~ 45 КВт

Физическая эффективность ~ 1÷2 %

КОМПОНЕНТЫ ОРБИТАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ СИСТЕМЫ:

ФУЛЛЕРЕН-КИСЛОРОД-ЙОДНЫЙ ЛАЗЕР С ПРЯМОЙ СОЛНЕЧНОЙ НАКАЧКОЙ

Экспериментальный стенд с фуллерен-кислород-йодным лазером с накачкой имитатором солнечного излучения

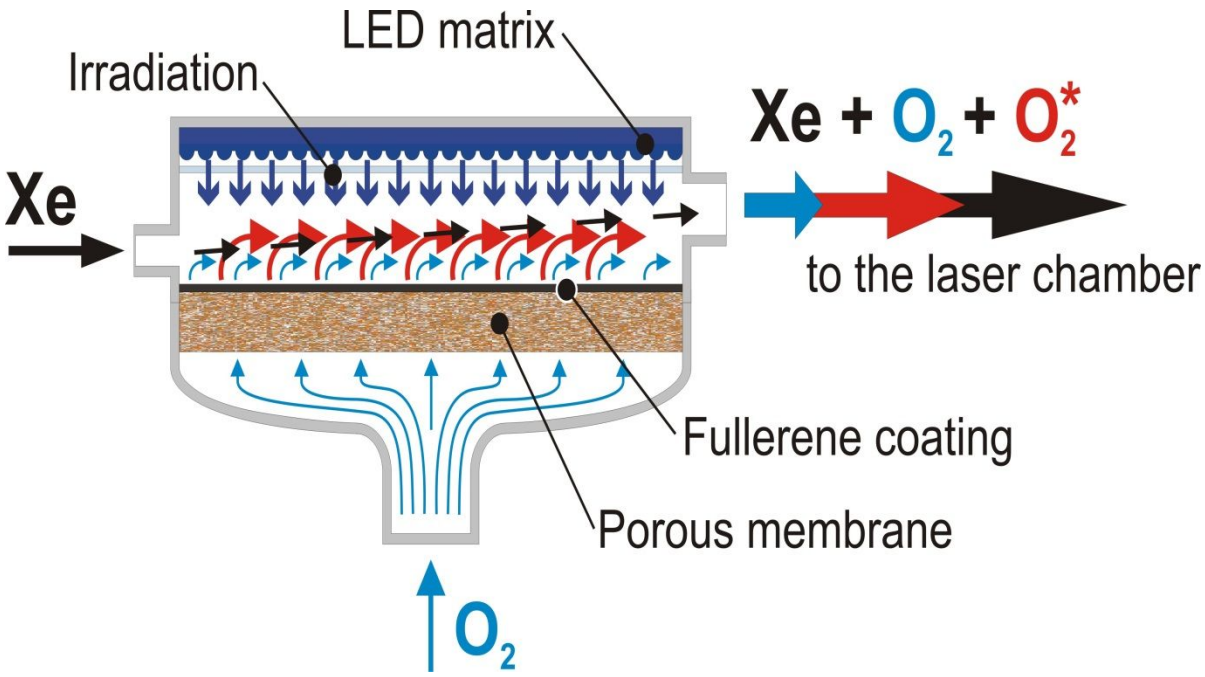
Параметры:

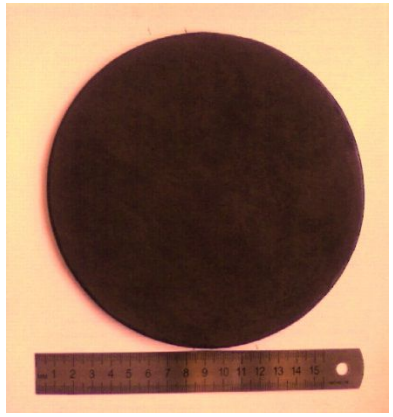
- ⇨ Пиковая мощность – 40 кВт;
- ⇨ Средняя мощность излучения – 30 Вт;
- ⇨ Частота повторения импульсов – 10 Гц;
- ⇨ Рабочий цикл – 30 сек.
- ⇨ Ближайшая перспектива – лазер с пиковой мощностью 1 МВт и со средней мощностью несколько киловатт.
- ⇨ Лазеры киловаттного уровня имеют хорошие рыночные перспективы для промышленного применения различных областях.

КОМПОНЕНТЫ ОРБИТАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ СИСТЕМЫ:

МОДЕЛЬ ГЕНЕРАТОРА СИНГЛЕТНОГО КИСЛОРОДА НА БАЗЕ ФУЛЛЕРЕНОВОЙ МЕМБРАНЫ

P=0.15 Вт/см^2



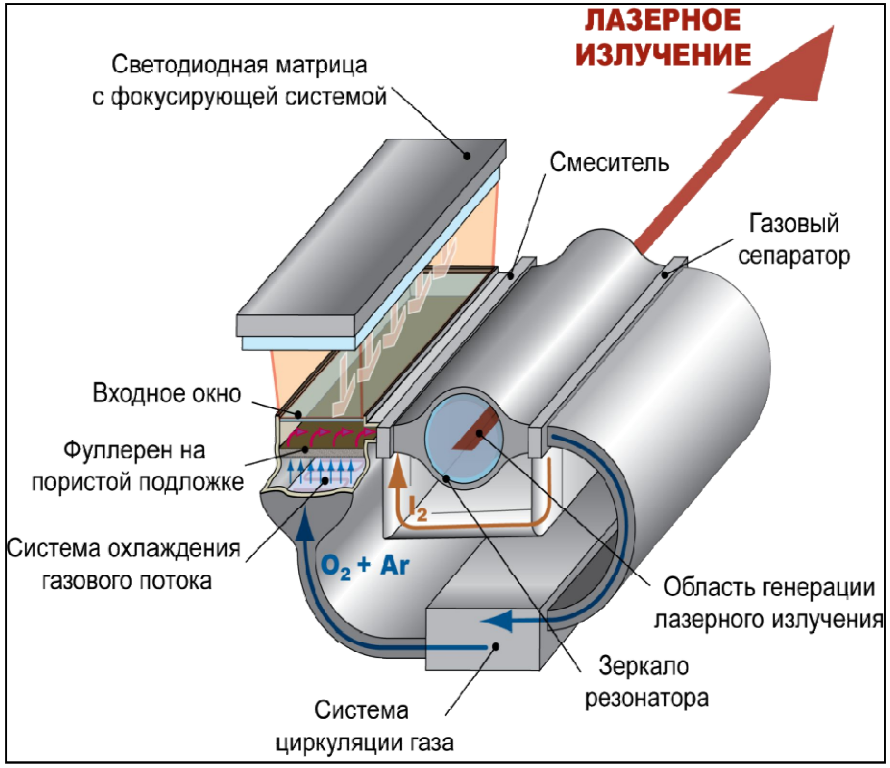


Генератор синглетного кислорода с потоком кислорода через пористую мембрану при непрерывном облучении поверхности мембраны светодиодами.

КОМПОНЕНТЫ ОРБИТАЛЬНОЙ ЭНЕРГЕТИЧЕСКОЙ СИСТЕМЫ:

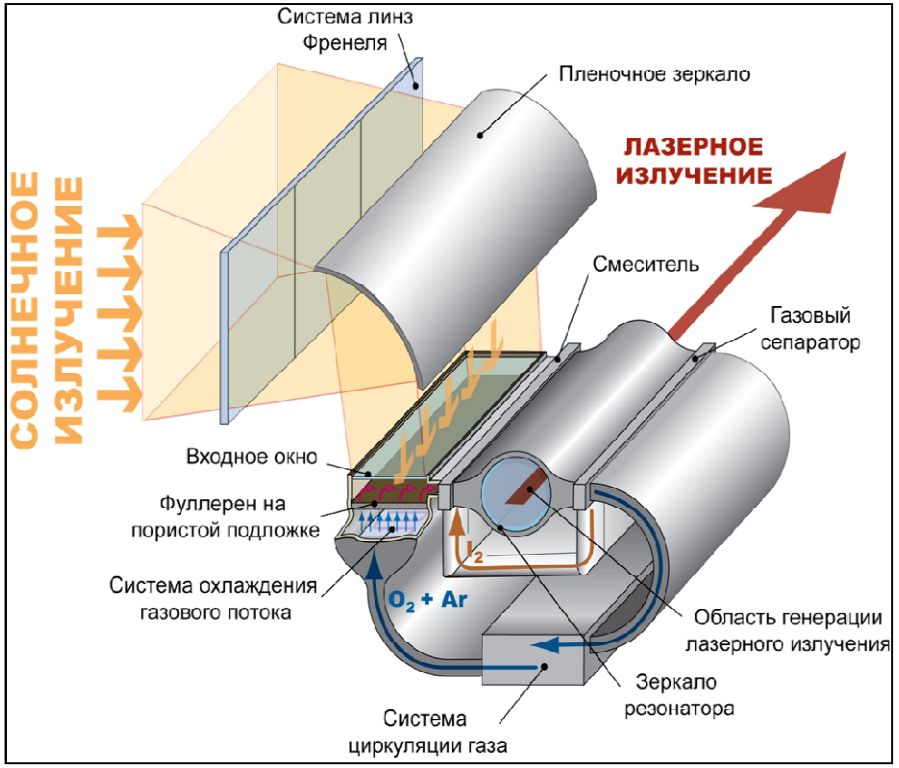
ФУЛЛЕРЕН-КИСЛОРОД-ЙОДНЫЙ ЛАЗЕР С ПРЯМОЙ СОЛНЕЧНОЙ НАКАЧКОЙ

Исследовательский лазер с оптической накачкой имитатором солнечного излучения (светодиодная матрица)



Мощность – 2-3 КВт

Лазер с прямой солнечной накачкой для орбитальной электростанции и демонстрационного эксперимента



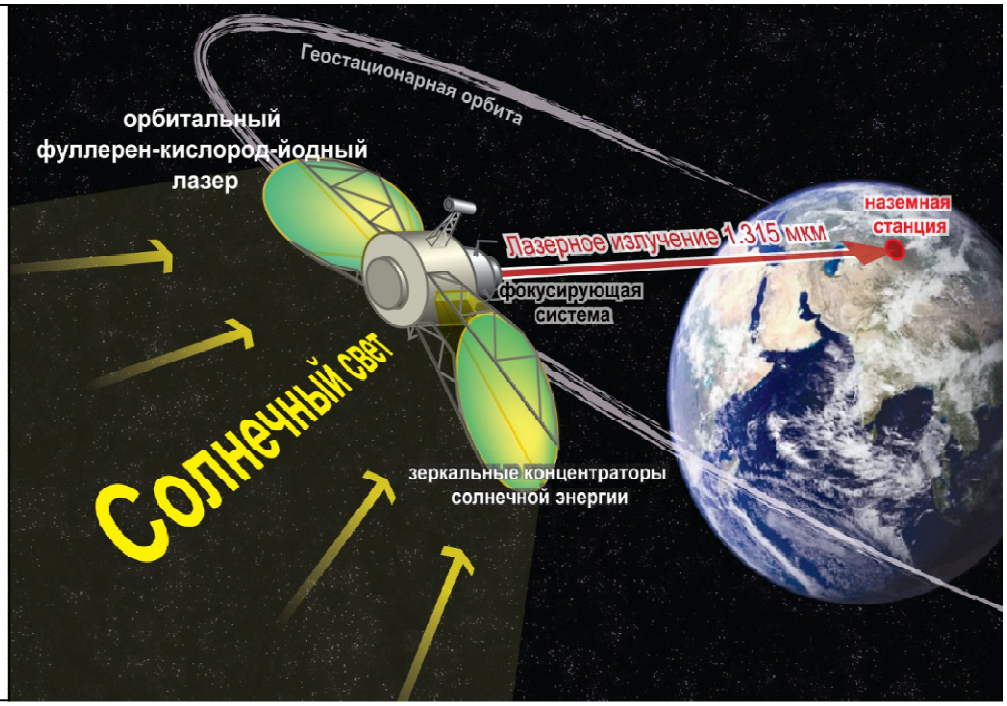
Мощность – 1 ГВт

ЭНЕРГЕТИЧЕСКАЯ ЛАЗЕРНО-ОПТИЧЕСКАЯ СИСТЕМА КОСМИЧЕСКОГО БАЗИРОВАНИЯ НА ОСНОВЕ ФУЛЛЕРЕН-КИСЛОРОД-ЙОДНОГО ЛАЗЕРА.

ПРИНЦИПИАЛЬНАЯ СХЕМА.

Состав орбитальной лазерной энергетической системы :

- ⇨ Орбитальный фуллерен-кислород-йодный лазер (ФОИЛ) мощностью 1 ГВт, размещаемый на геостационарной орбите высотой ~36 000 км
- ⇨ Зеркальный космический концентратор солнечной энергии пленочного типа суммарной площадью 2,56 кв.км
- ⇨ Лазерно-оптическая адаптивная система формирования угловой расходимости до 10^{-7} радиан и сверхточного наведения на Землю (10^{-8} радиан)
- ⇨ Энергетическая наземная станция приема и преобразования лазерного луча в электрическую энергию



КПД преобразования солнечной энергии в лазерный луч – 30%

КПД преобразования лазерного излучения в электрическую энергию ≥ 70%

Dr. Mikhail Berezkin.

Moscow State University named after M.Lomonosov, Professor.

In 1992 he graduated from the Lomonosov Moscow State University, Department of Geography. Since 1993 he has been working in the Renewable Energy Research Laboratory, Faculty of Geography, Lomonosov Moscow State University. In 2003 he received PhD (geography). Since 2004, the senior researcher. In 2008 he was appointed deputy head of the Laboratory for Research.

GLOBAL INNOVATION GEOGRAPHY OF TRADITIONAL AND RENEWABLE ENERGY

senior researcher Lomonosov Moscow State University, Russia

PhD Berezkin Mikhail

Geography of innovation

can be represented as a change of technological structures and their innovation distribution from «countries-centers» to «countries-peripheral».

Due to the diffusion of innovations «countries-periphery» are eventually adapted and were used new technologies from «countries-centers».

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OBJECTIVES:

- analysis of structural and innovative processes in traditional and renewable energy of the world;
- study of spatial patterns of distribution and development of innovative processes;
- identification of territorial heterogeneity of innovation processes in renewable energy.

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At present perspective the use of renewable energy sources should not be separated from the traditional ones. After decades of development traditional energy sources practically reached technological limits of growth. At the same time they are dependent on the unstable energy prices.

It is necessary to evaluate the advantages of renewable energy in the innovation sphere, such as: growth rates of installed capacity, adoption of new technologies, attractiveness for investments, research intensity, etc.

The renewable energy is particularly advantageous on the global and regional scale.

The research in the global innovation geography of traditional and renewable energy sources is undoubtedly challenging.

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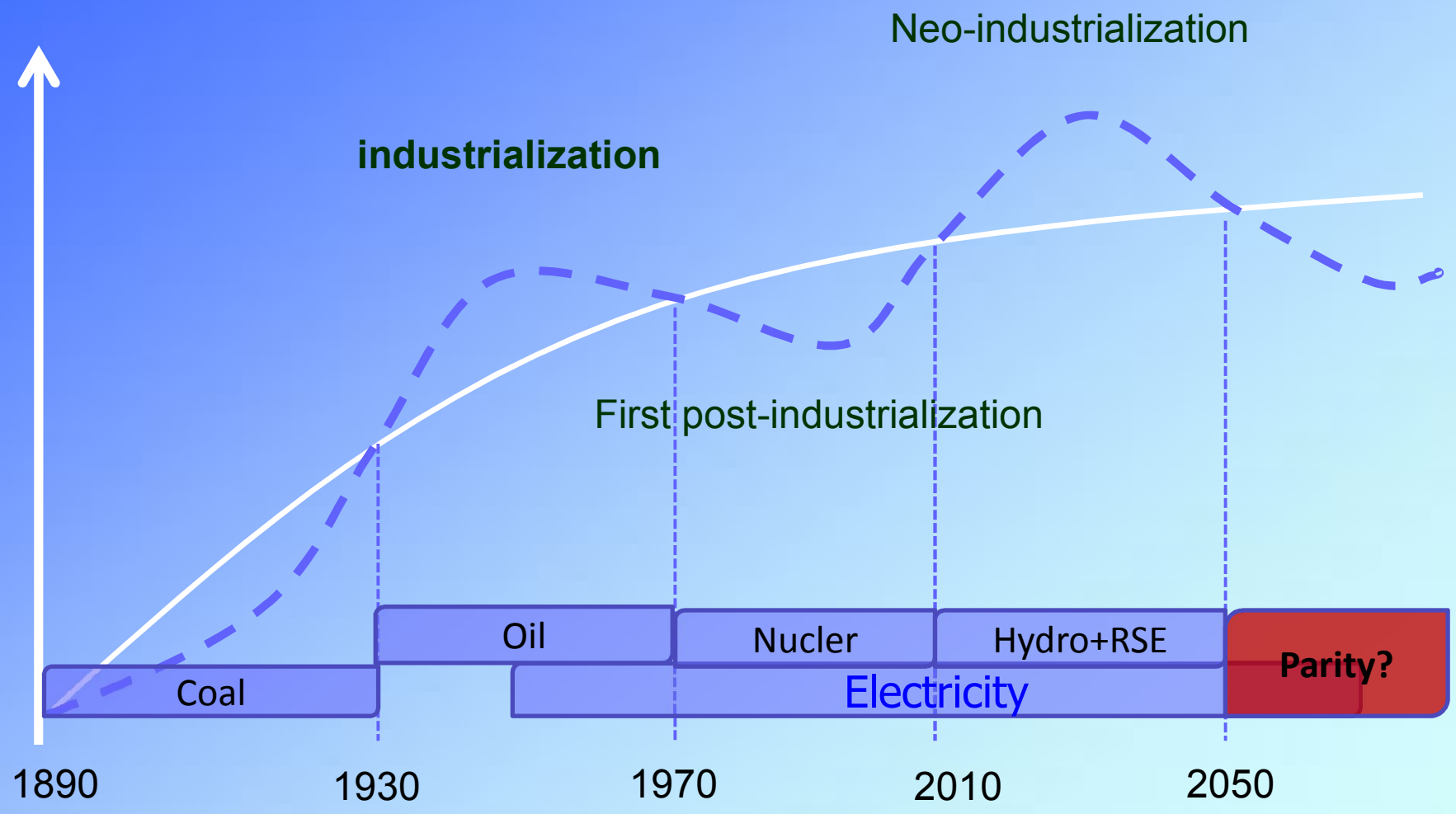

Source: Bushuyev V.V. World Energy: Philosophy, Fixer, Forsyth, 2011

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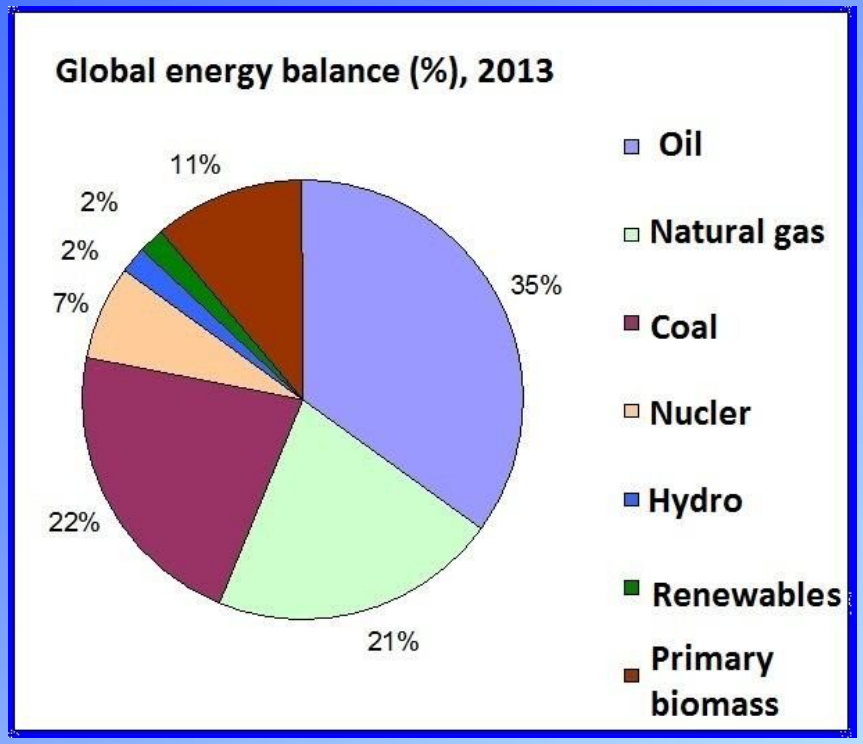

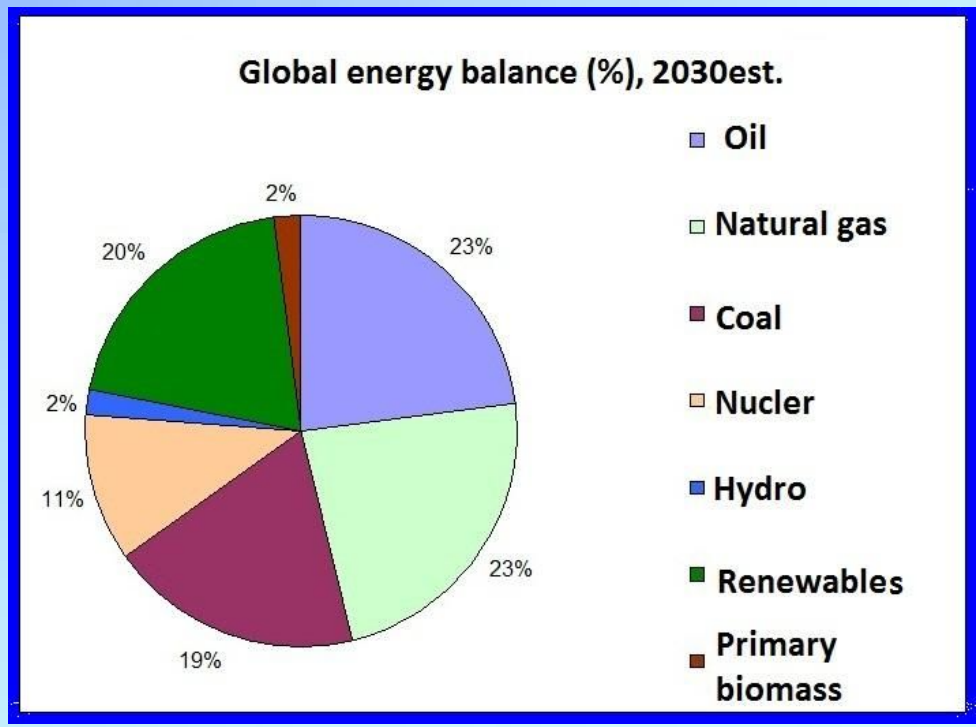

The innovations of renewable energy are concentrated in the countries of the "Triad" - Western Europe, North America and developed in countries of East Asia, which produces half of the world's GDP.

In terms of absolute level of funding USA, Japan and Germany account for 68% of total expenditure on the development of renewable energy in the world. In the process of innovation, diffusion manufacturing base moves to the periphery countries.

The member countries of the Organization for Economic Cooperation and Development (OECD), together with Brazil, India and China stand for 80% of commercial electricity and 77% of heat in global total use of renewable energy sources, as well as 99% renewable transport fuel.

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Global innovation geography of renewable energy

	innovative "Center" ("Triad") - North America (1) Western Europe (2) and Japan (3), which accounted for 4/5 of total expenditure on renewable energy in the world.
	"Semi-Periphery" - China, India, Brazil, which together with the "Triad" of global accounts for three quarters of installed capacity of renewable energy.
	"Semi-Periphery" with a share of renewable energy in the energy balance of more than 2% of biomass burned and less than 10%.
	"Semi-Periphery" with a share of biomass burned in the energy balance 10-30%.
* * * * * *	"Periphery" with the share of primary biomass in the energy balance 10-30% share of renewable energy or less than 1% or fraction of primary biomass in the energy balance 30-70%.
/ / / / / /	"Deep-Periphery" with the share of primary biomass in the energy more than 70%.

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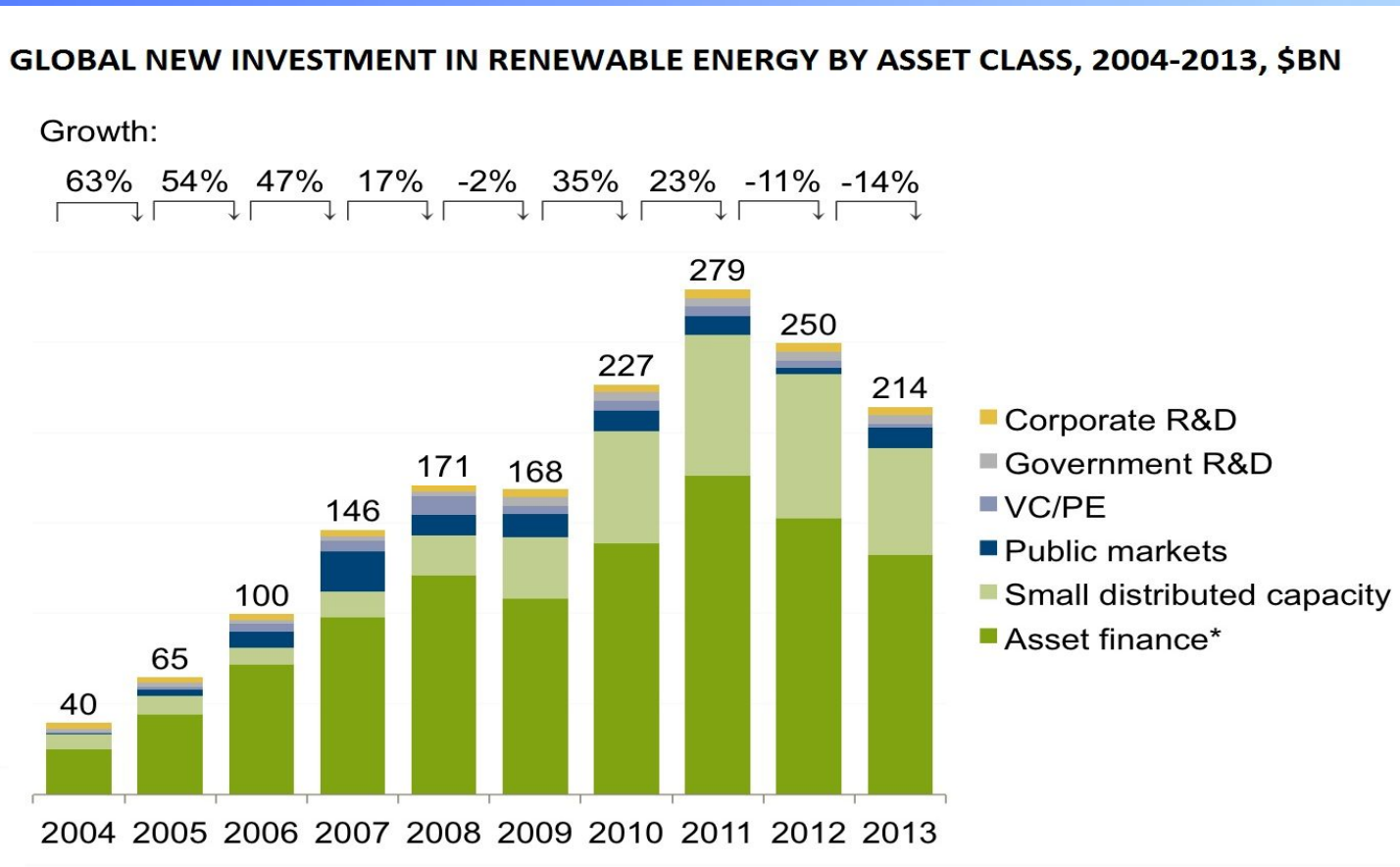
Investment potential of renewable energy



Source: GLOBAL TRENDS IN RENEWABLE ENERGY INVESTMENT 2014.Bloomberg New Energy Finance.

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Investment potential of renewable energy

A fourth was that, renewable energy excluding large hydro made up 41.3% of the new power capacity added in all technologies in 2013

In 2013 investment in renewable energy totaled more than traditional energy.

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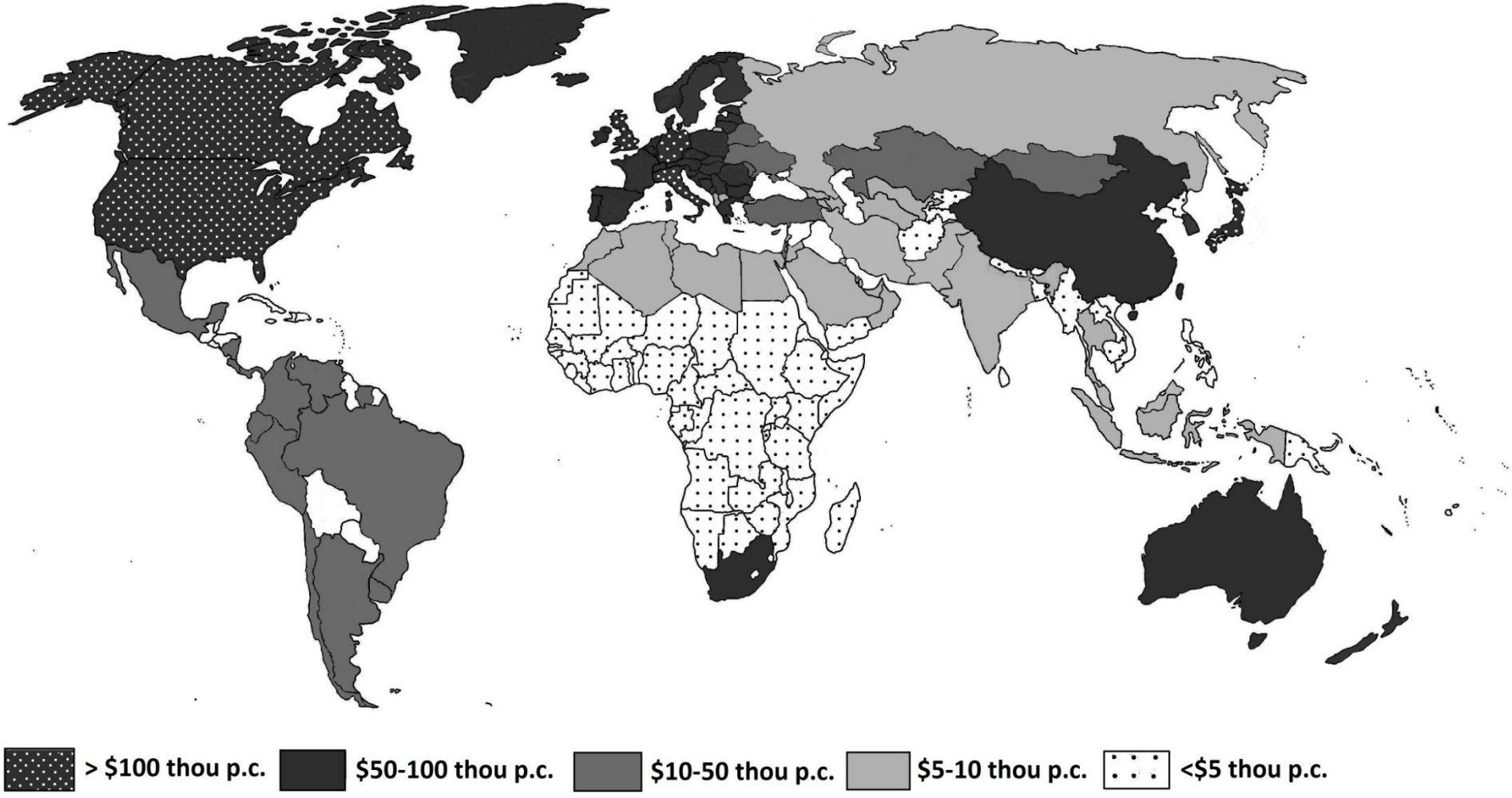
The volume of investments in renewable energy per capita, 2013



Promising niches for utilizing renewable energy in Russia

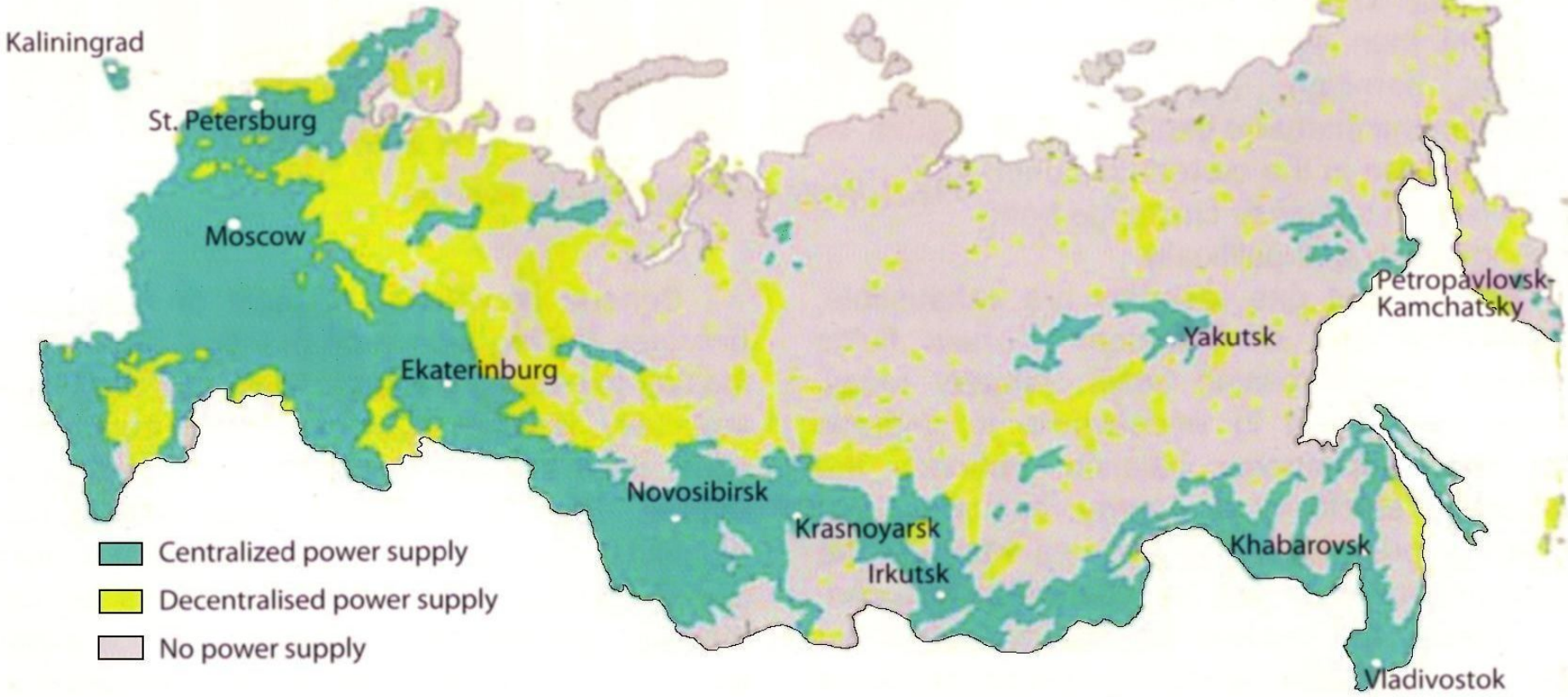
In Russia centralised energy supply systems only cover around 1/3 of its area.

Largely decentralised power plants supply energy to 70% of the country's area, populated by around 20 million people.

More than half of the administrative districts are energy-deficent.

Natural gas is piped only in 50% of rural commuites.

Centralised and decentralised energy supply areas in Russia



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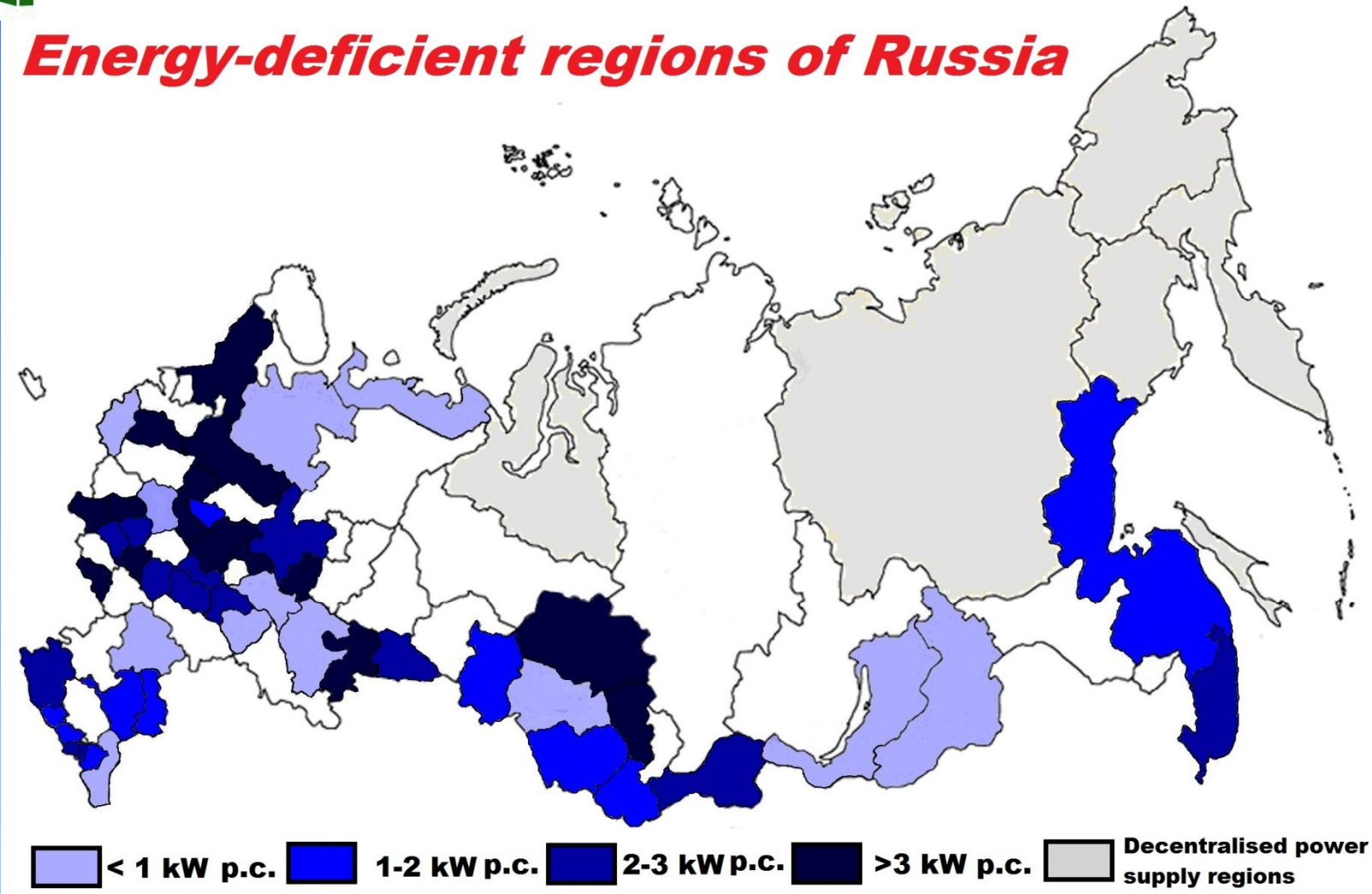
Energy-deficient regions of Russia



Study of the world energy development results in the following conclusions:

- With the increase in the share of gas and renewable energy sources and reduction in the share of coal and oil dominant energy source will not be identified. Structure of the global energy industry in the coming decade should be strongly diversified.

Study of the world energy development results in the following conclusions:

- Given the high rate of investment growth, renewable energy can be considered as a high-tech innovation sector. As a dynamically growing industry, located on the ascending phase of technological development, renewable energy has got significant potential to improve new technologies.

Study of the world energy development results in the following conclusions:

- In terms of cost of renewable energy, the share of the global installed renewable capacity, as well as the share of renewable energy in the national energy balance we can distinguish Center, Semi-Periphery and Periphery countries.

Thanks for Your Attention

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Laboratory

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Dr. Samarsky Dmitry.

Kuban State University, Krasnodar

Dmitry Samarsky is of 1985 year of birth. Graduated University of Physical Culture, Sports and Tourism in Krasnodar.

Doctor degree in Physiology (2011). Founder and a head of the Business Incubator at the Kuban State University since 2011.

The scope of activity is a commercialization of scientific developments in the field of physical culture, sports and sport medicine.

Commercial director at the Photochem Electronics Co. Ltd, Russia.

He has authored more than 27 research articles and conference proceeding, 7 patents in the field of biomedical engineering and nanotechnology. His research interests are mainly focused on the nanotechnology in power sources and biomedical applications.

ФОНД СОДЕЙСТВИЯ РАЗВИТИЮ
малых форм предприятий в научно - технической сфере

innovateRussia.ru
зворыкинский проект

Russia POWER
A POWER-GEN EVENT

Reduce the cost of solar cells based on perovskites at fully printed production

Photochem Electronics LLC

By ***Lopatin Dmitry***, PhD, CEO

Global Energy
The International Energy Prize

सत्यमेव जयते

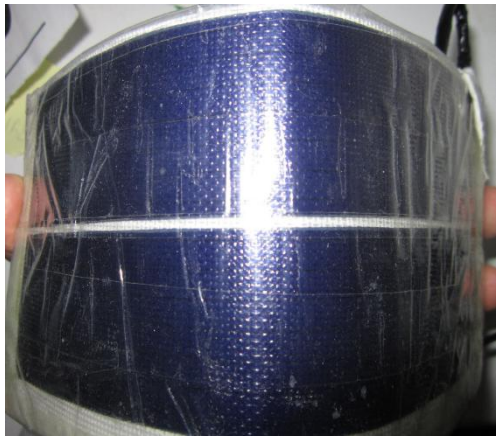
MAJULAH SINGAPURA

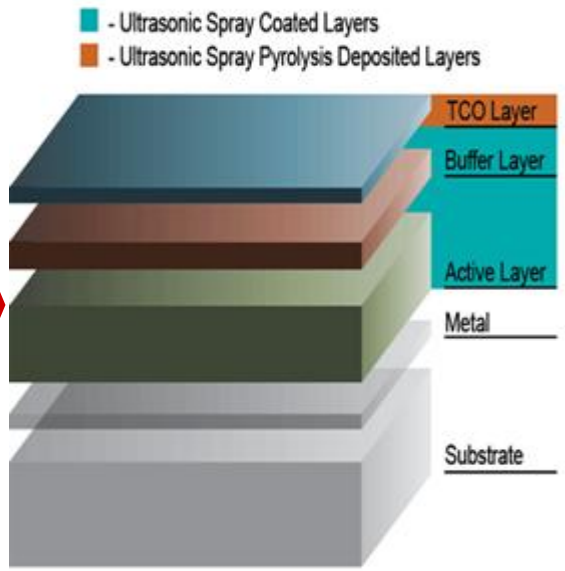
КУБАНСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

Reduction in price: roll-to roll coating

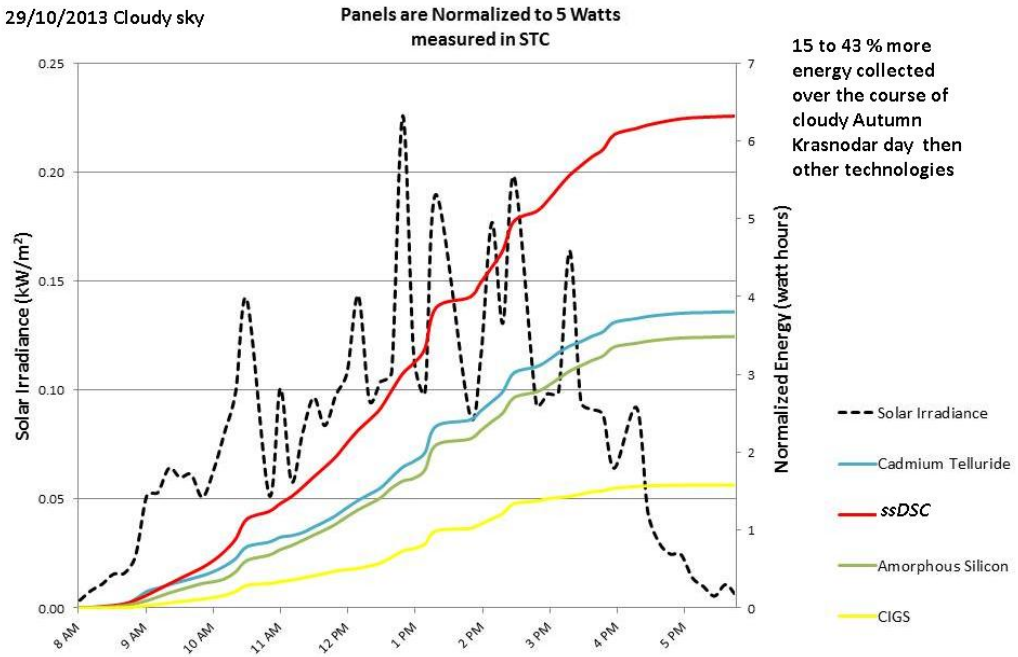
Prepare solvent of nanoparticles

Dispersion on drops size smallest 100 nm in ultrasonic and electric field



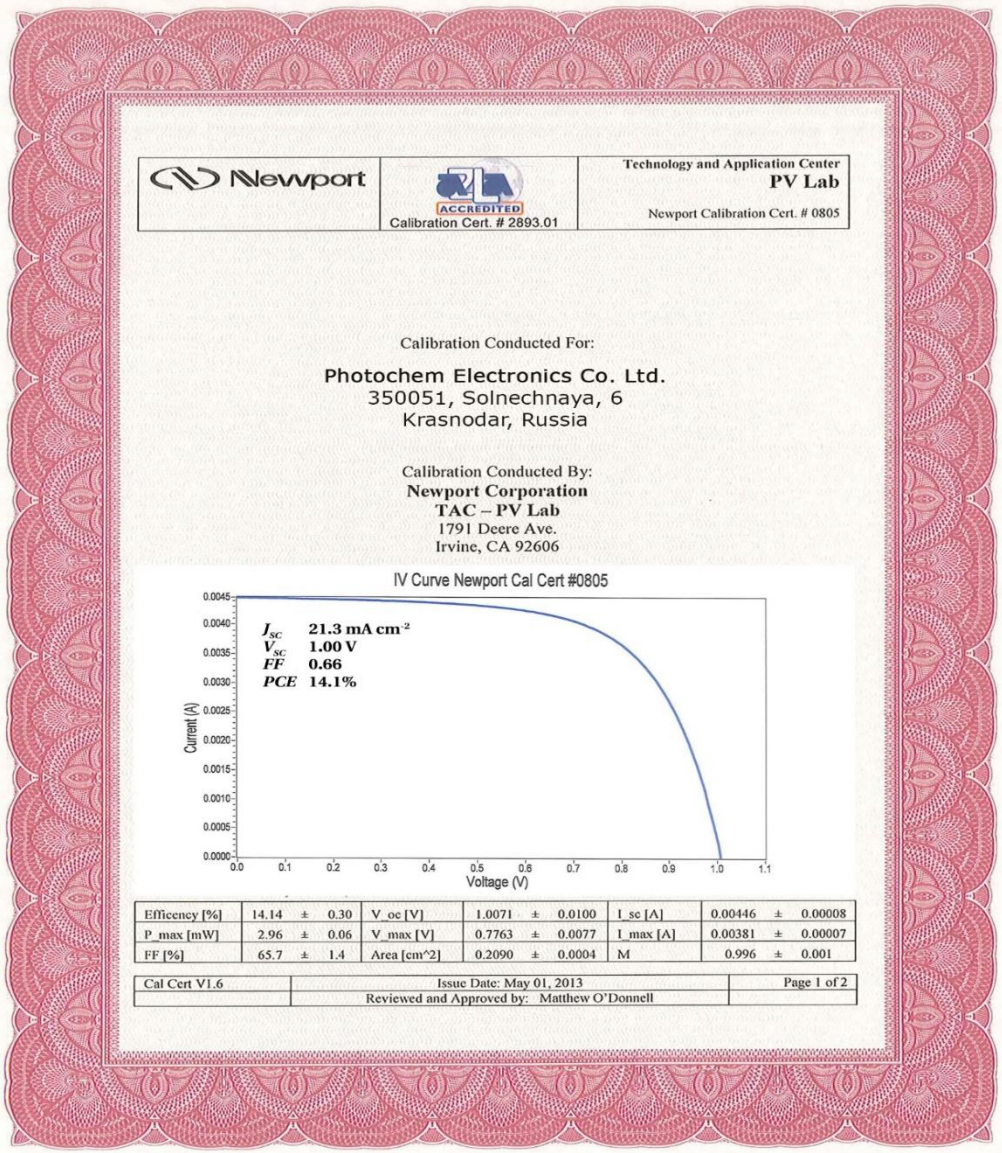


Solar panels for use in construction and charging of mobile devices



Advantages:

- Price 0.35 $ /W
- Ability to change shape , lightness, thinness, strength
- High efficiency at diffuse , oblique light
- Max efficiency 14%



Newport

ACCREDITED
Calibration Cert. # 2893.01

Technology and Application Center
PV Lab
Newport Calibration Cert. # 0805

Calibration Conducted For:

Photochem Electronics Co. Ltd.
350051, Solnechnaya, 6
Krasnodar, Russia

Calibration Conducted By:
Newport Corporation
TAC – PV Lab
1791 Deere Ave.
Irvine, CA 92606

IV Curve Newport Cal Cert #0805

Efficency [%]	14.14	±	0.30	V_oc [V]	1.0071	± 0.0100	I_sc [A]	0.00446 ± 0.00008
P_max [mW]	2.96	±	0.06	V_max [V]	0.7763	± 0.0077	I_max [A]	0.00381 ± 0.00007
FF [%]	65.7	±	1.4	Area [cm^2]	0.2090	± 0.0004	M	0.996 ± 0.001

Cal Cert V1.6	Issue Date: May 01, 2013	Page 1 of 2
	Reviewed and Approved by: Matthew O'Donnell	

Volt-amper curves

Sertified by Newport Corp. (USA, CA)

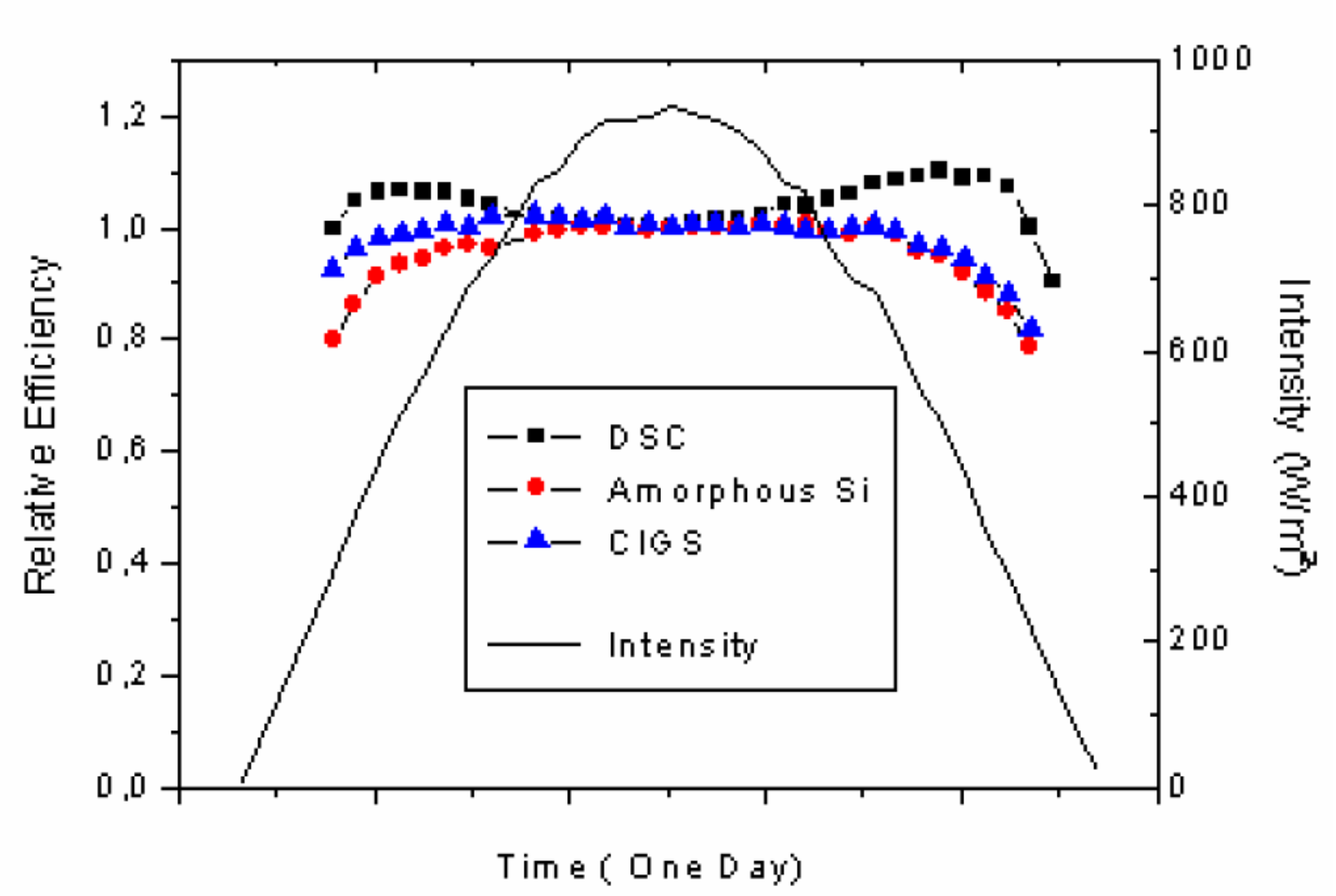
Power efficiency

~14.1 %

21 mA/sqr. cm

1.008 V

Comparison efficiency on one day

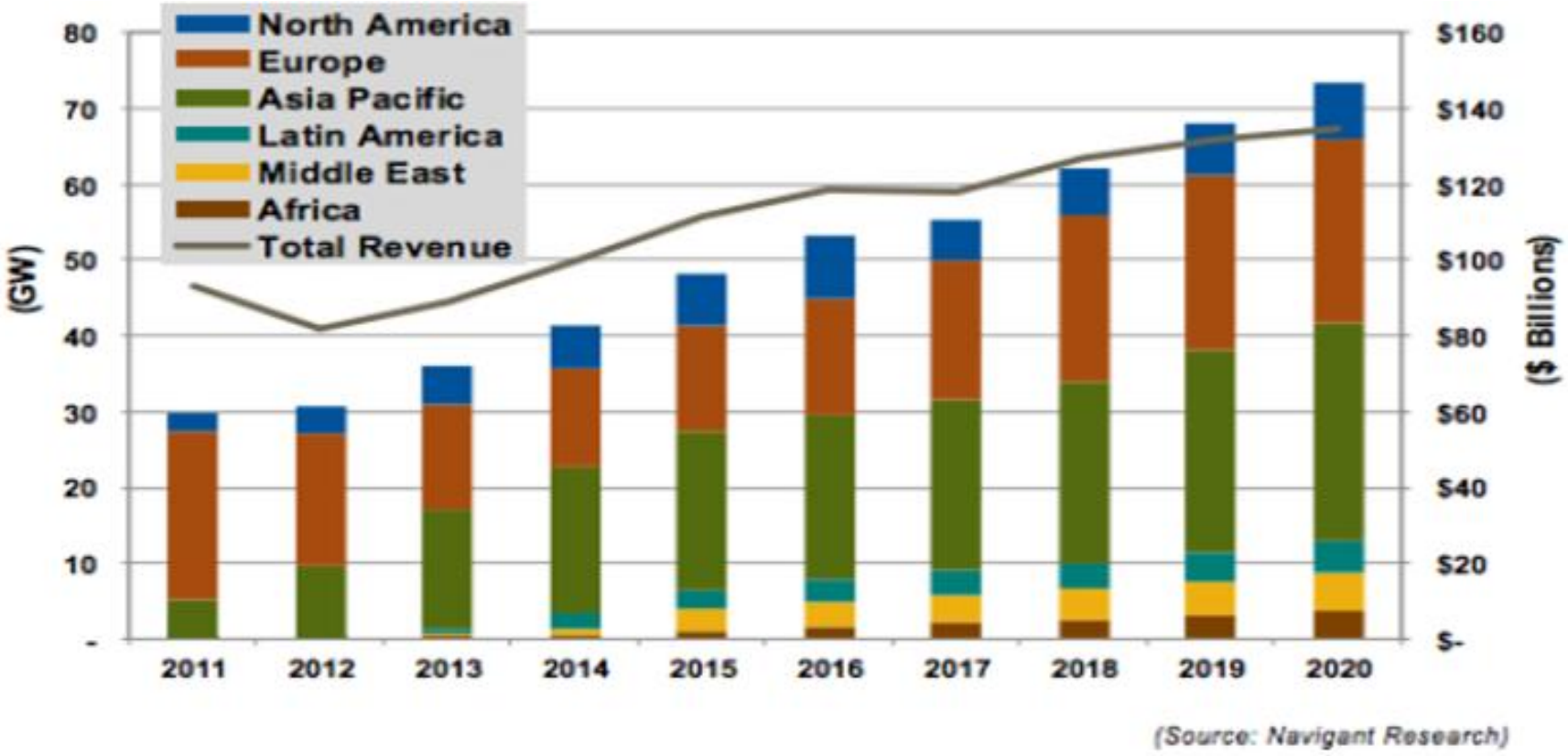


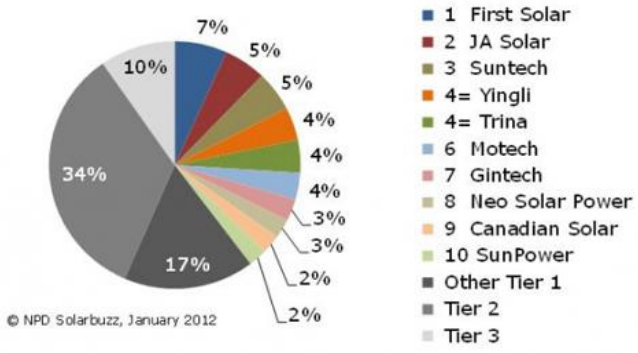
Bill of materials

what to need for 1 sqr meter of solar cell

Weight., mg	wholesale price USD	retail price USD	material/source
20000	3	5	Metal surface, encapsulate
0.15	2	5	Perovskite (sintered)
0.1	2	5	Fluorine tin oxide + titanium dioxide
0.05	4	10	Graphene (option) AkkoLab (Russia)
0.05	6	20	Hole transtpot material (Borun Chemical, China) Merck, Germany)
-	3	3	Energy cost
-	2	12	Labor cost
	22 (18)	50	Summary

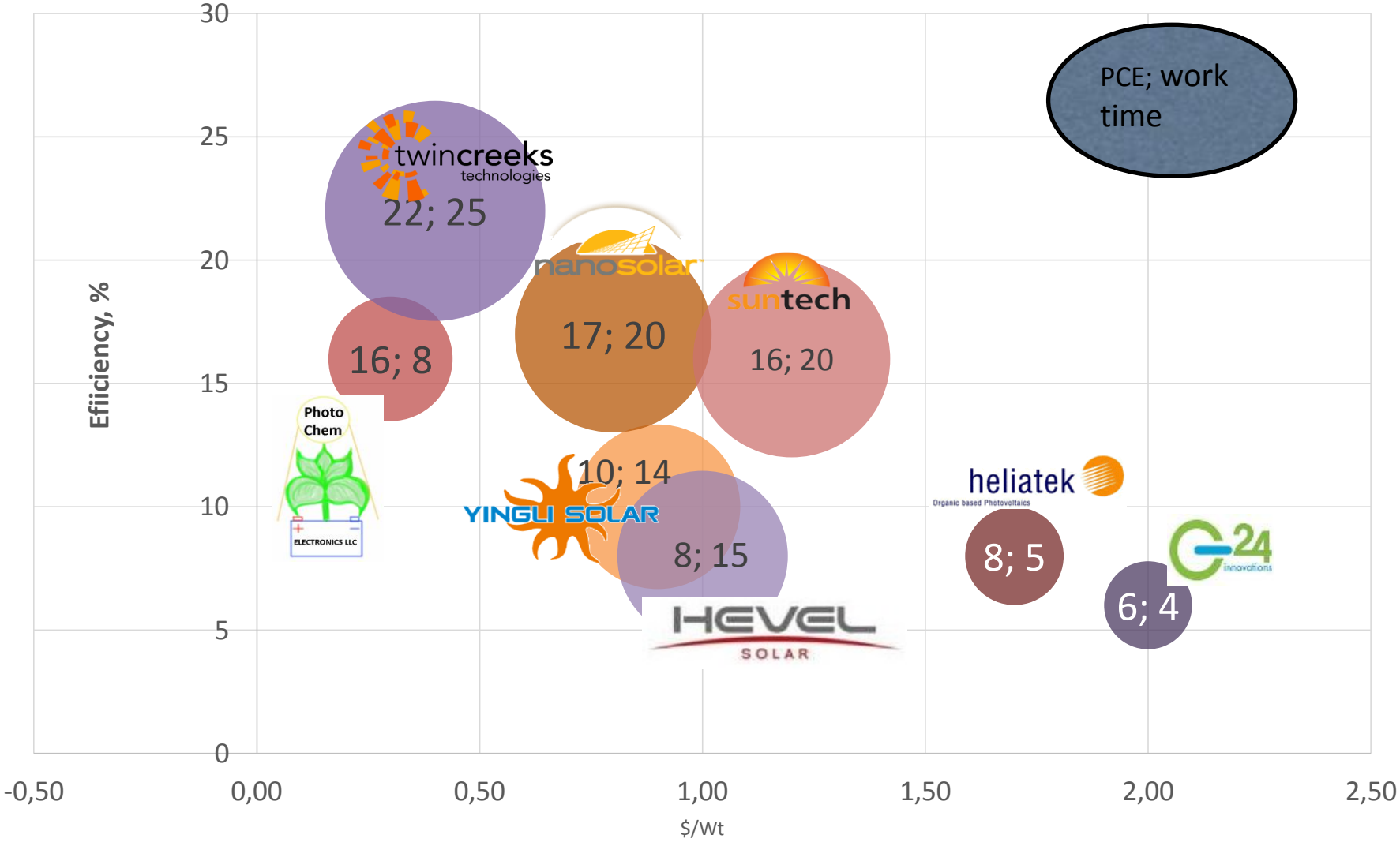
Market





- **Market Size: 1 MW ~ 0.5 -1 mln $,**
- **Size in 2014 - 40 GW, 80 bln. $**
- **India market - 10 bln.**
- **We plan to take a 10% ~ 1 bln $**

Dependence of efficiency and prices various manufacturers



Business model

Technology licensing

•Equipment for solar producers - reducing employment expenses

•**Franchise** - small factories instead of large solar plants in the greatest demand

Own manufacturing

- Tourists, gadget charge

- Houses, farms

- **Payback period for consumers.** In the U.S., the average family pays about 1500 - 3000 $ for electricity a year, so that the solar panel on the roof will pay for itself in 1-2 years

TEAM

Lopatin Dmitry
Inventor, founder

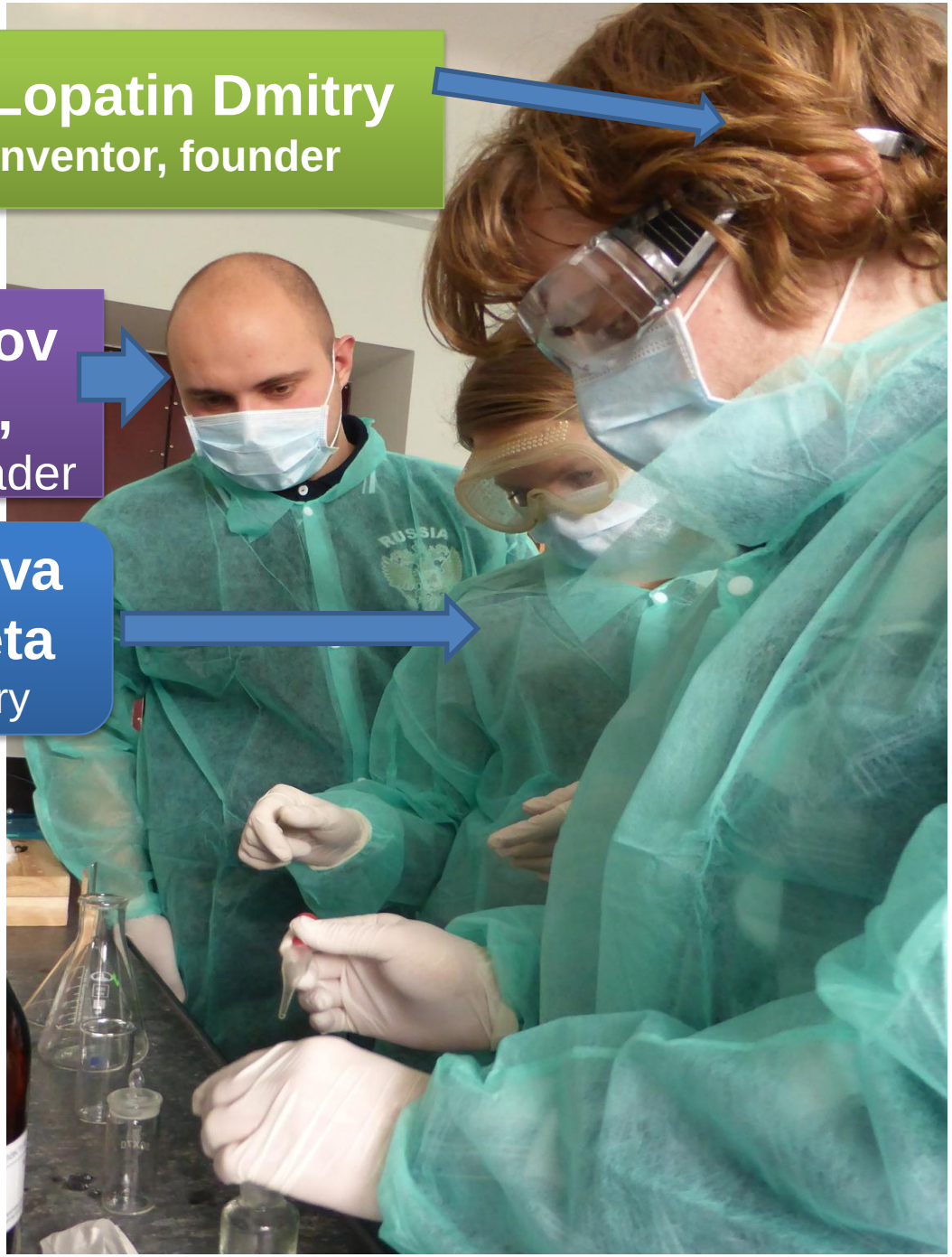
Andrey Kondaurov ,
Invest director

Baranov Oleg,
Tech header

Samarsky Dmitry,
Executive officer

Korzhova Elizaveta
Chemistry

Sergey Dychev,
Russian Embassy



Indian spin-off company

Devashis Misra,
Header, India CEO

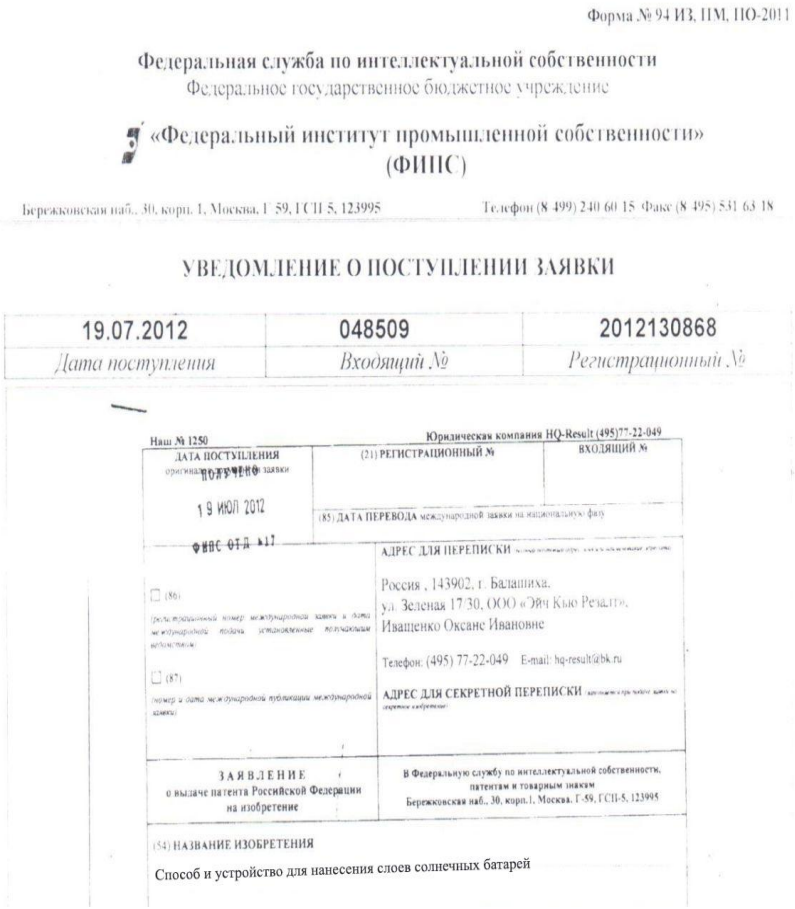
KP Eswaran,
Invest, finance director

E-mail: dimitrylsm@gmail.com,

Tel.: +7-908-678-15-48, +7(86135)-411-77

www.wiraenergy.ru

Intellectual property



Форма № 94 ИЗ, ПМ, ПО-2011

Федеральная служба по интеллектуальной собственности
Федеральное государственное бюджетное учреждение

«Федеральный институт промышленной собственности»
(ФИПС)

Бережковская наб., 30, корп. 1, Москва, Г-59, ГСП-5, 123995 Телефон (8-499) 240-60-15 Факс (8-495) 531-63-18

УВЕДОМЛЕНИЕ О ПОСТУПЛЕНИИ ЗАЯВКИ

19.07.2012	048509	2012130868
Дата поступления	*Входящий №*	*Регистрационный №*

Наш № 1250 Юридическая компания HQ-Result (495)77-22-049

ДАТА ПОСТУПЛЕНИЯ оригинала заявки	(21) РЕГИСТРАЦИОННЫЙ №	ВХОДЯЩИЙ №
ПОЛУЧЕНО 19 ИЮЛ 2012 ФИПС ОТД №17		
	(85) ДАТА ПЕРЕВОДА международной заявки на национальную фазу	

☐ (86) *регистрационный номер международной заявки и дата международной подачи, установленные получающим ведомством*

☐ (87) *номер и дата международной публикации международной заявки*

АДРЕС ДЛЯ ПЕРЕПИСКИ

Россия , 143902, г. Балашиха,
ул. Зеленая 17/30, ООО «ЭйЧ Кью Результ»,
Ивашенко Оксане Ивановне

Телефон: (495) 77-22-049 E-mail: hq-result@bk.ru

АДРЕС ДЛЯ СЕКРЕТНОЙ ПЕРЕПИСКИ

ЗАЯВЛЕНИЕ
о выдаче патента Российской Федерации
на изобретение

В Федеральную службу по интеллектуальной собственности, патентам и товарным знакам
Бережковская наб., 30, корп.1, Москва, Г-59, ГСП-5, 123995

(54) НАЗВАНИЕ ИЗОБРЕТЕНИЯ

Способ и устройство для нанесения слоев солнечных батарей

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ
НА ПОЛЕЗНУЮ МОДЕЛЬ
№ 124852

СПОСОБ И УСТРОЙСТВО ДЛЯ НАНЕСЕНИЯ СЛОЕВ СОЛНЕЧНЫХ БАТАРЕЙ

Патентообладатель(ли): *Лопатин Дмитрий Сергеевич (RU)*

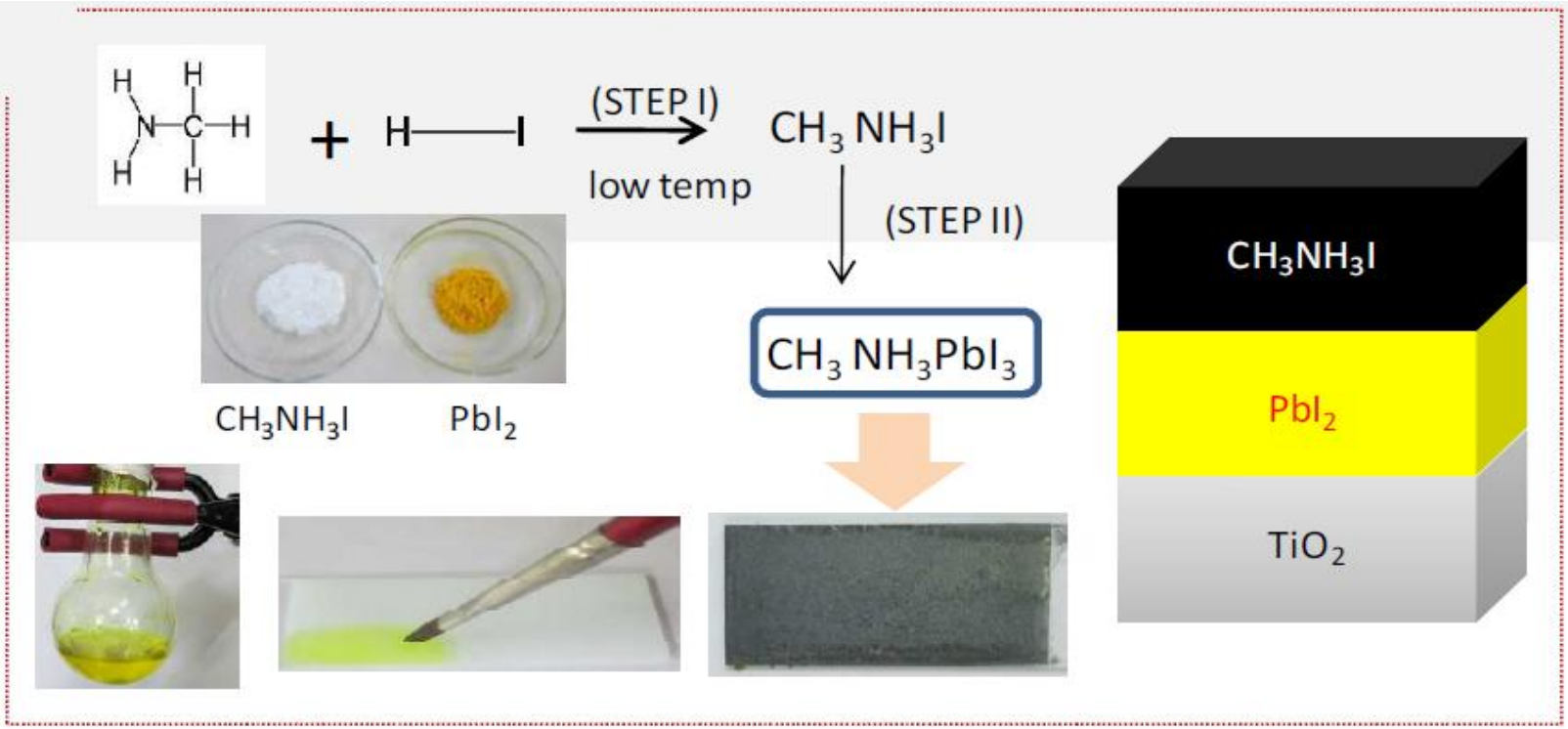
Автор(ы): *Лопатин Дмитрий Сергеевич (RU)*

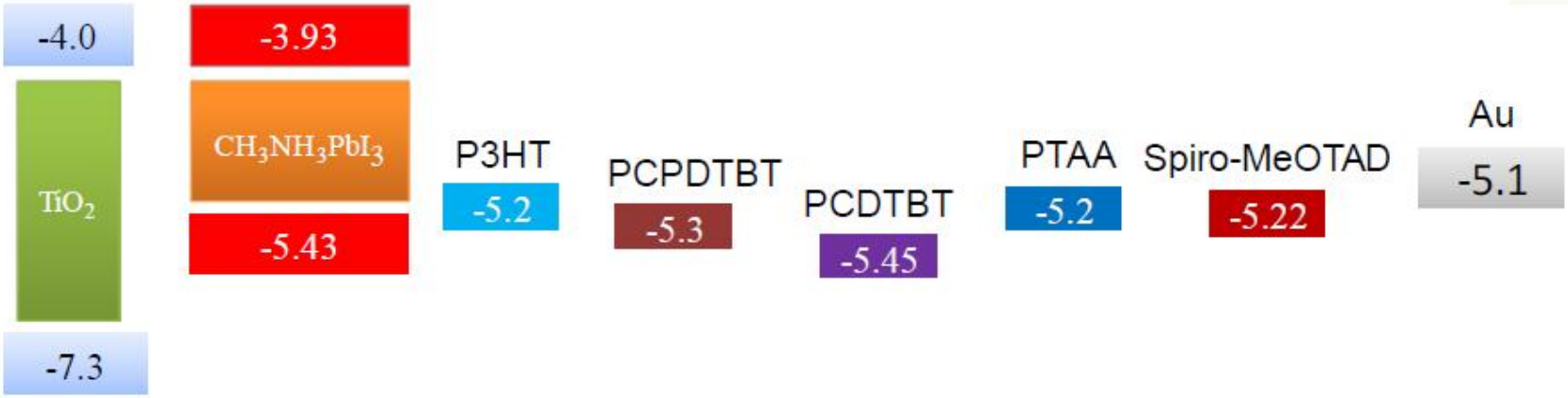
Заявка № 2012130867
Приоритет полезной модели 19 июля 2012 г.
Зарегистрировано в Государственном реестре полезных моделей Российской Федерации 10 февраля 2013 г.
Срок действия патента истекает 19 июля 2022 г.

Руководитель Федеральной службы по интеллектуальной собственности

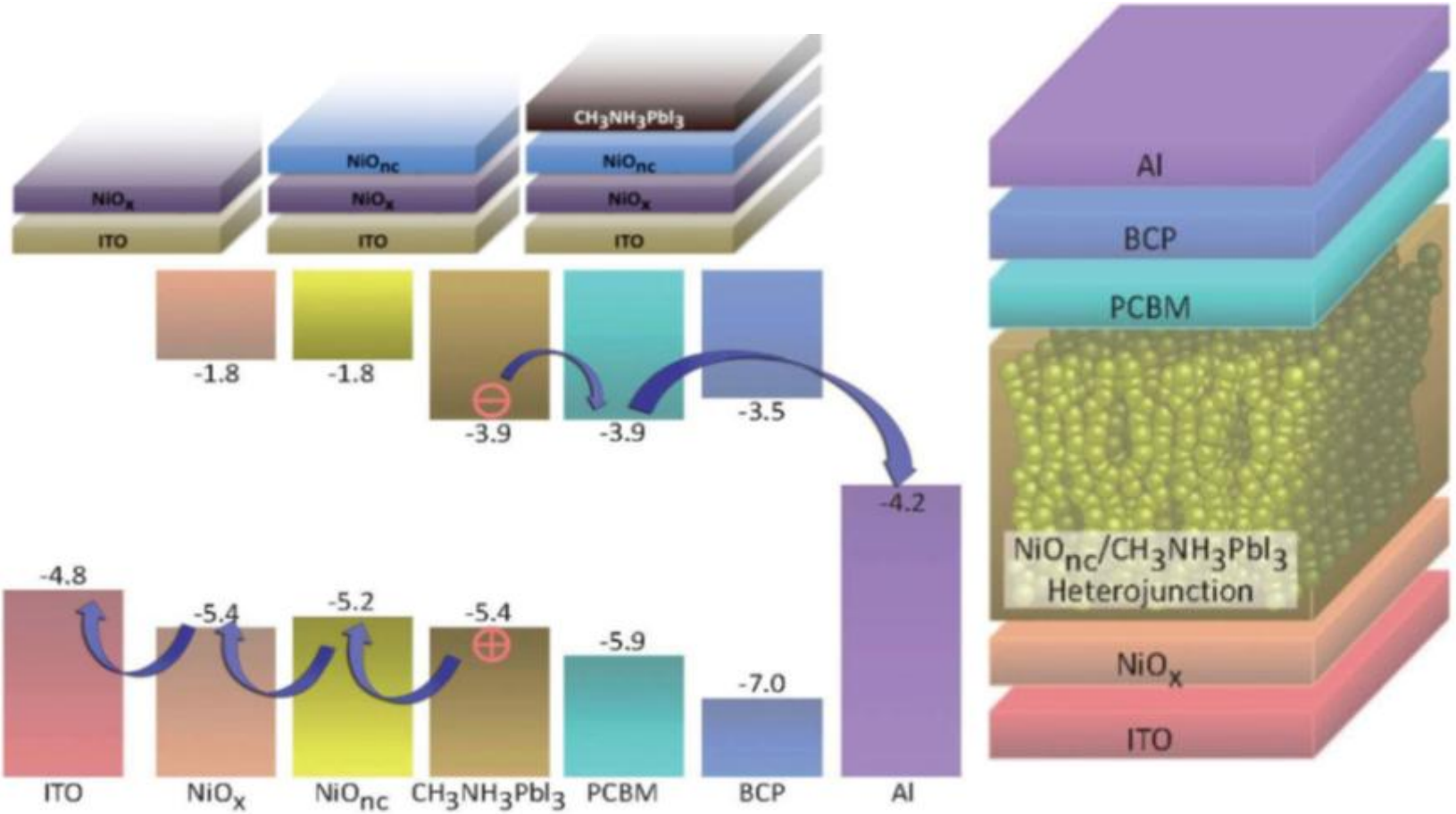
Б.П. Симонов

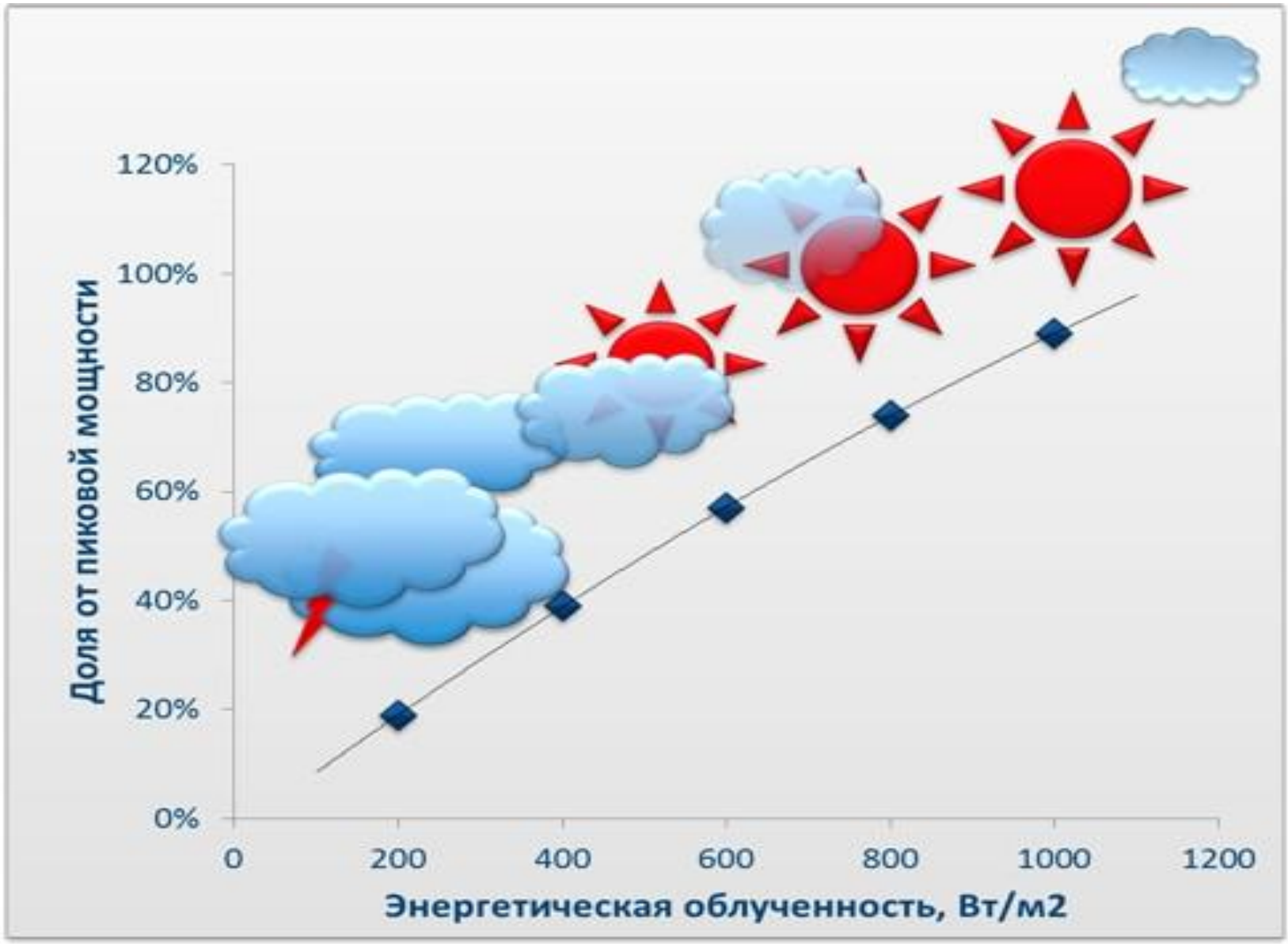
How to produce light absorber



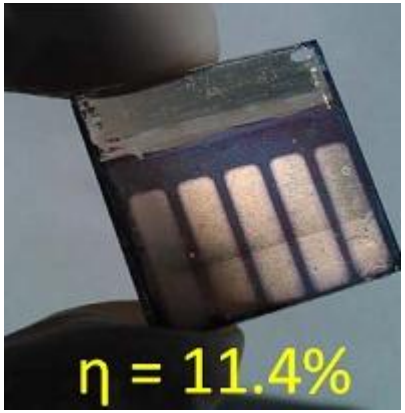


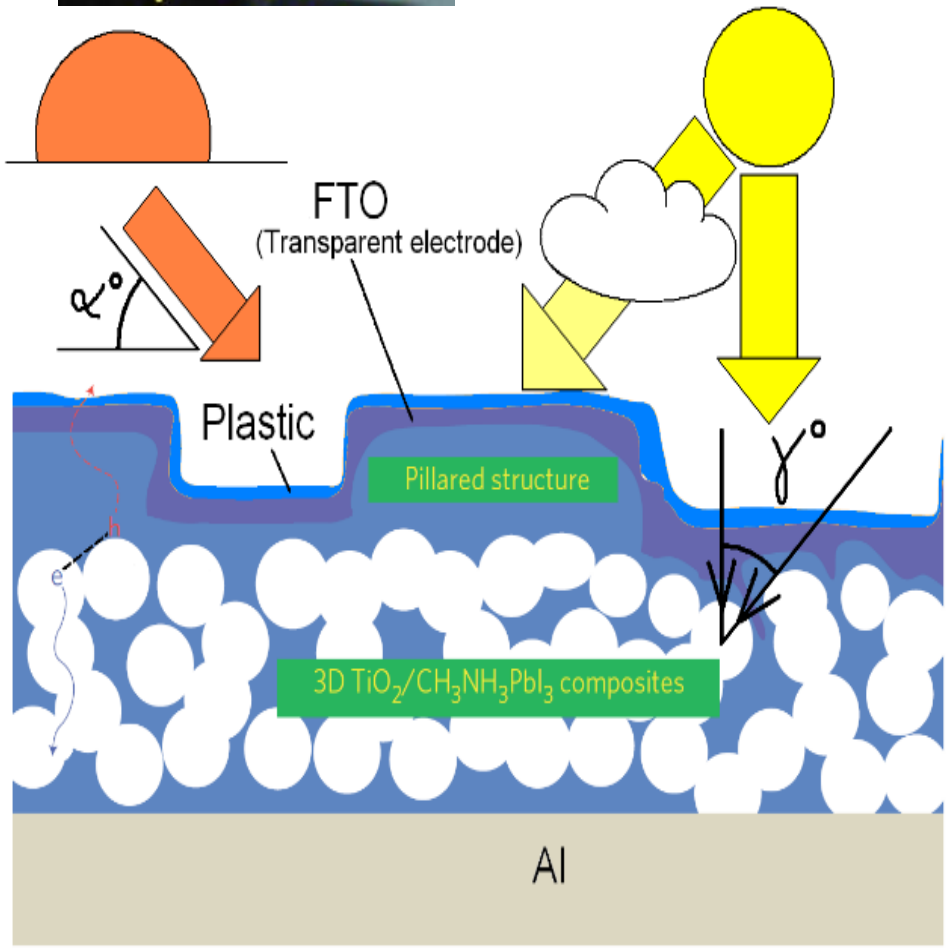
Inverse structure




120%
100%
80%
60%
40%
20%
0%
Доля от пиковой мощности
0
200
400
600
800
1000
1200
Энергетическая облученность, Вт/м2

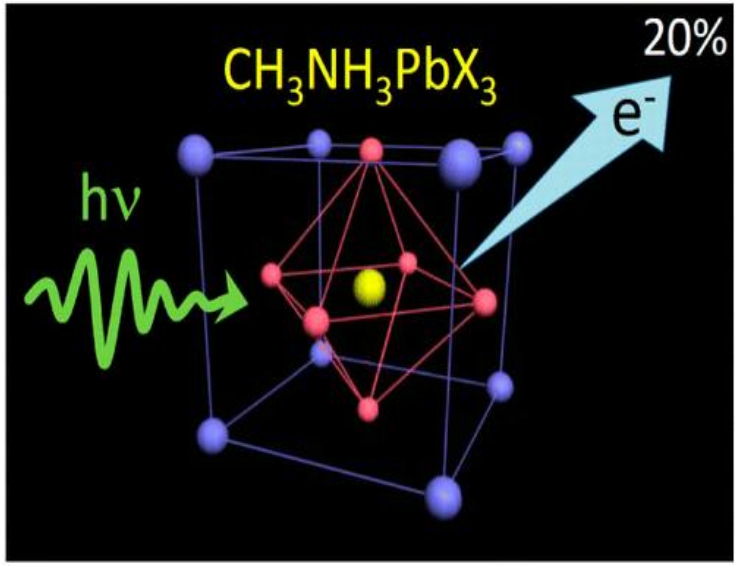
Hybrid solar cells





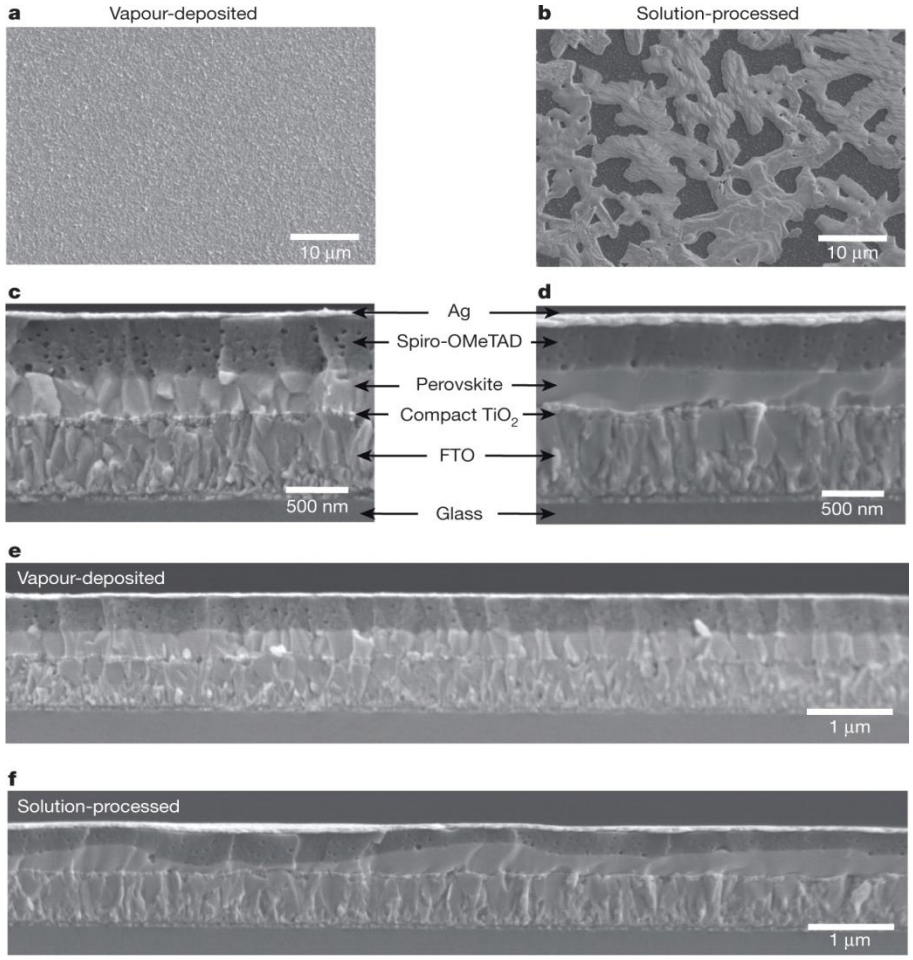
- **Perovskite $CH_3NH_3PbI_xCl_{3-x}$. структура :**
- **Ag(anode)/**
- **deped spiro-OMe-TAD(hole layer conductor)/**
- **CH3NH3PbICl2 (330 nm)(absorber)/**
- **TiO2(n-semiconductor)/**
- **FTO(catode)/.**
- Max efficiency 15%

The structure of the cell

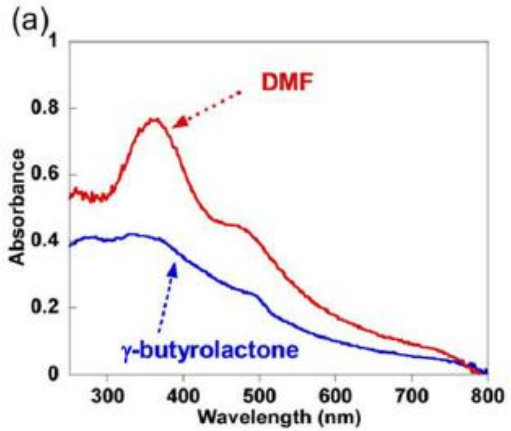


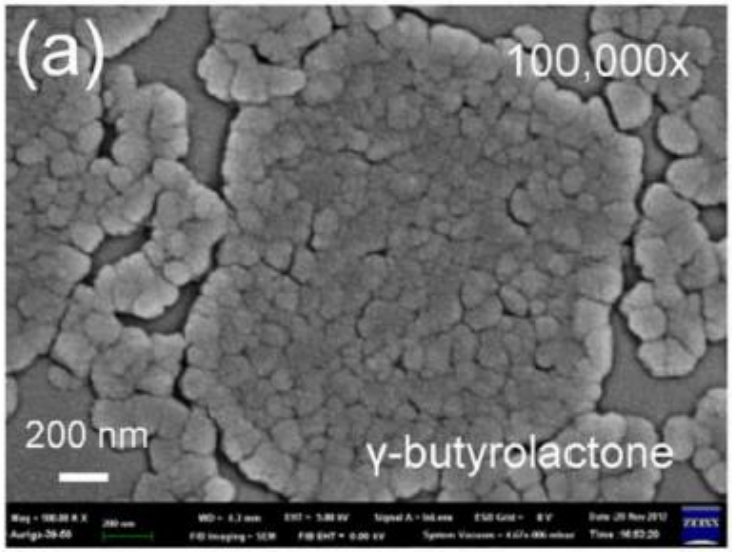
- Heterojunction TiO2/perovskit, efficiency up to 15%

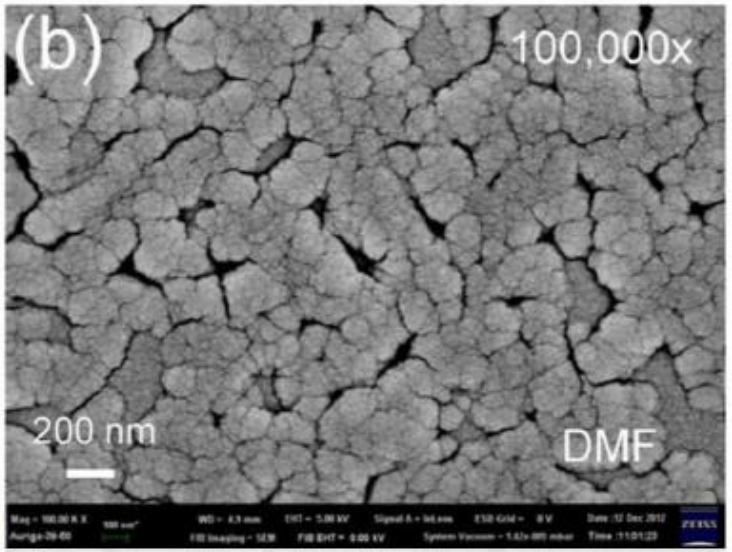
Comparison with standard techniques



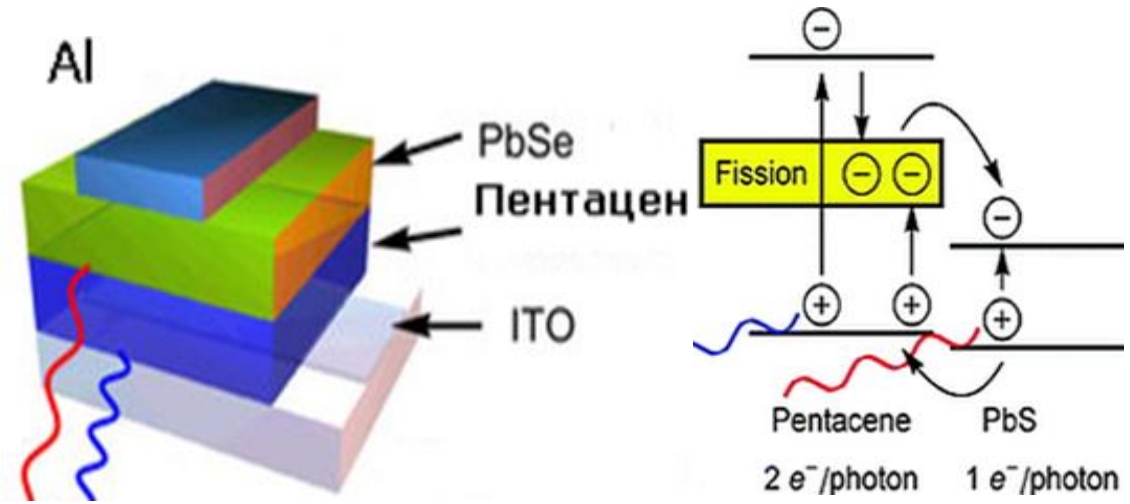
Process of causing perovskites of different solvents



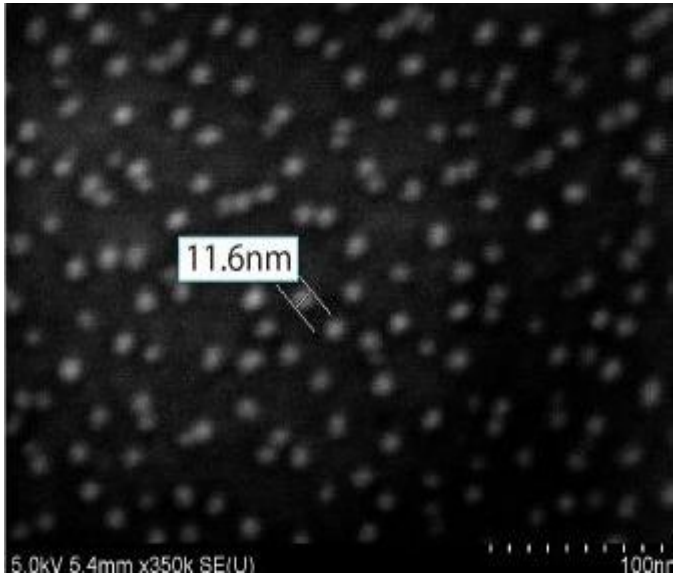


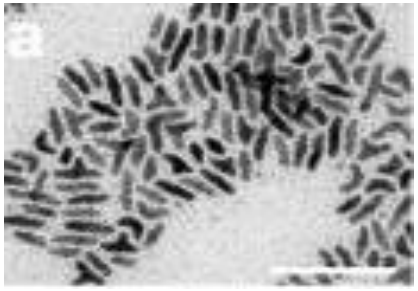


Photocell: quantum dots and nano-antenna

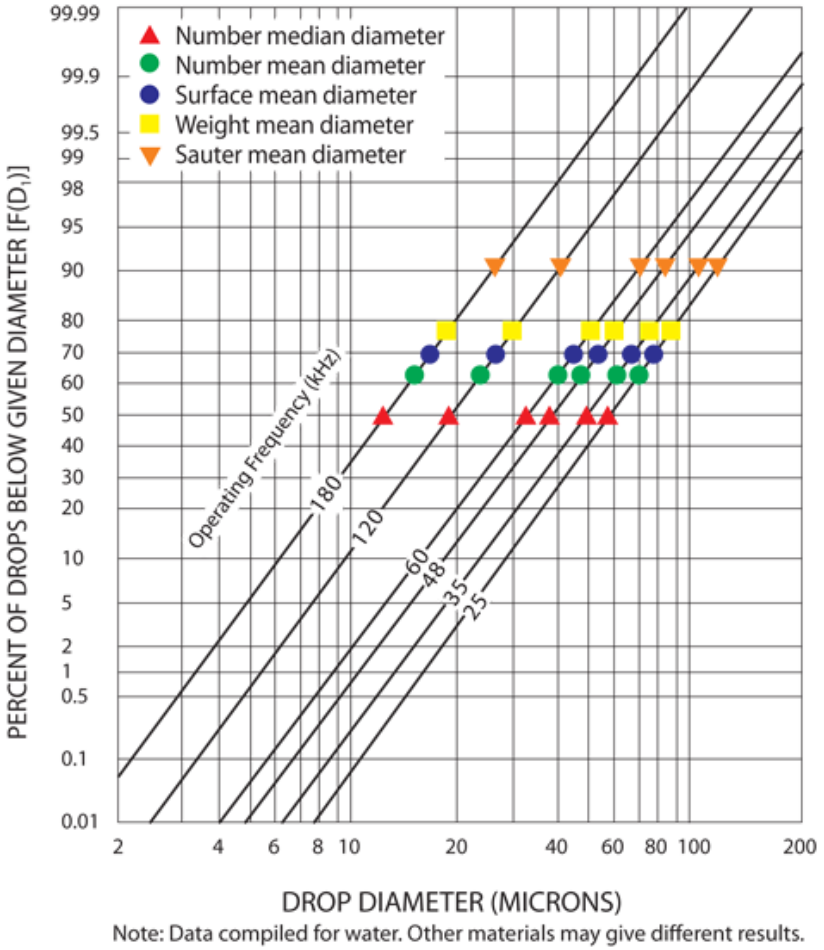


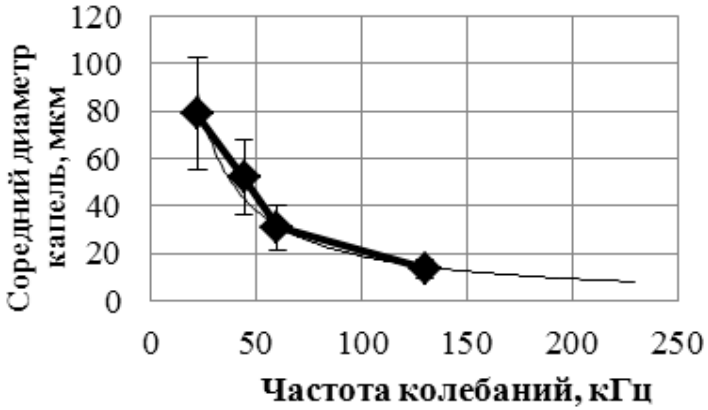
- Heterojunction organic chalcogenide semiconductor.
- Chalcogenide as quantum dots (nanoparticles of 5-20 nm, are united in the agglomerates of 500-700 nm) - give the effect of multi-exciton generation
- Nano-antenna - a promising direction

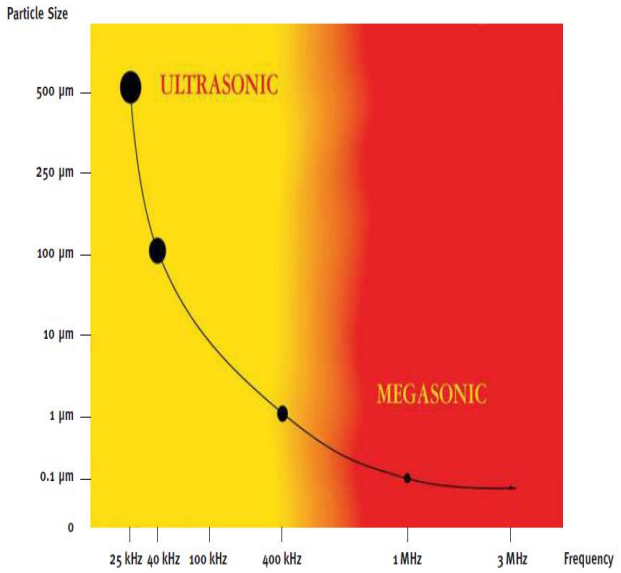




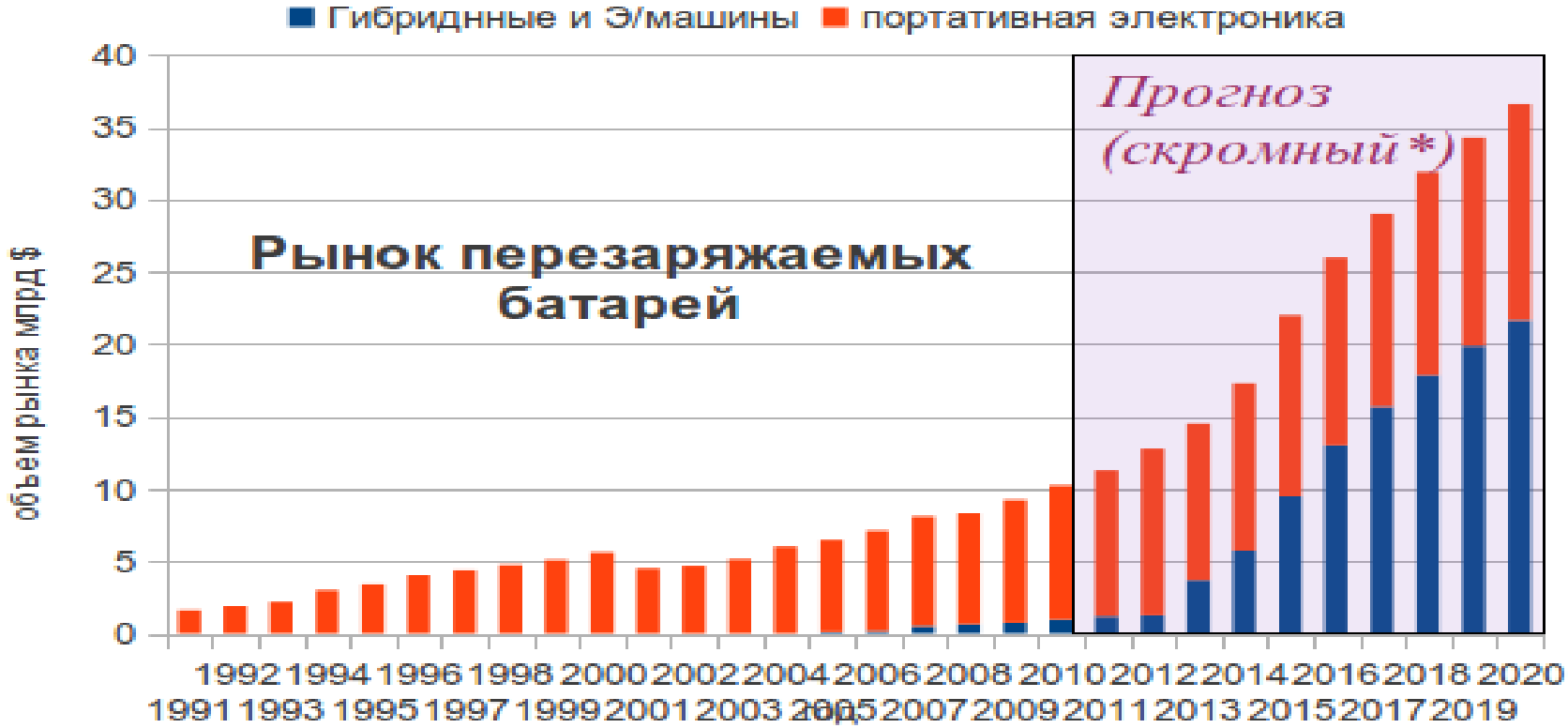
Dependence of droplet size on the sound frequency

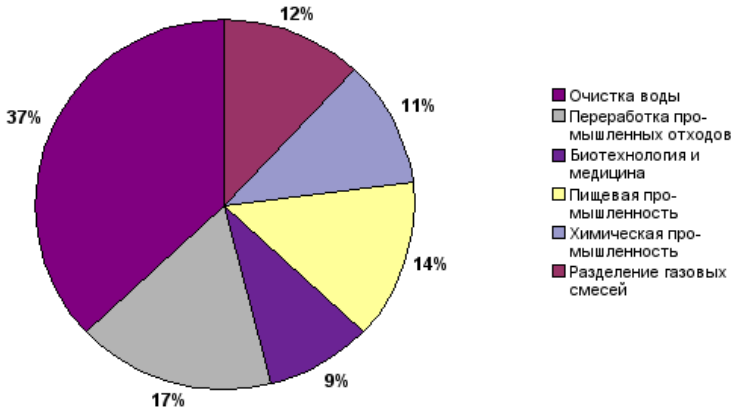






Membranes & electrodes market





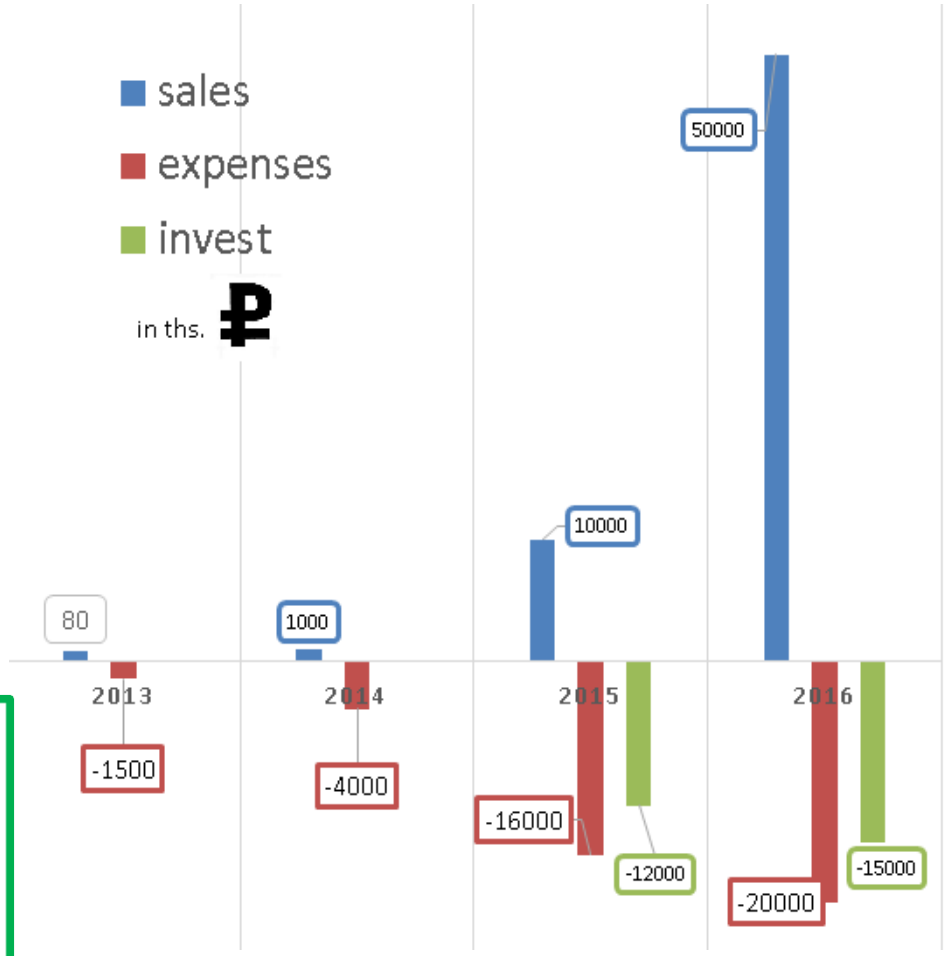
Market of membranes
In 2009 in Russia exceeded 920 thousand square meters. m in kind, or $ 23 million
in 2012 its global volume amounted to about 16 million m

Finans model

- Received grants from RFBR Bortnik Fund, Global Energy.
- Agreement with RUSNANO

the use of infrastructure

- Experimental batch given to the Ministry of Defense of the Russian Federation



- 30 m. meters per day capacity
- 10 rubles. per watt, 150 W m. meter
- Profit of 15 million after production and sales of 4000 m. meters for 14 months

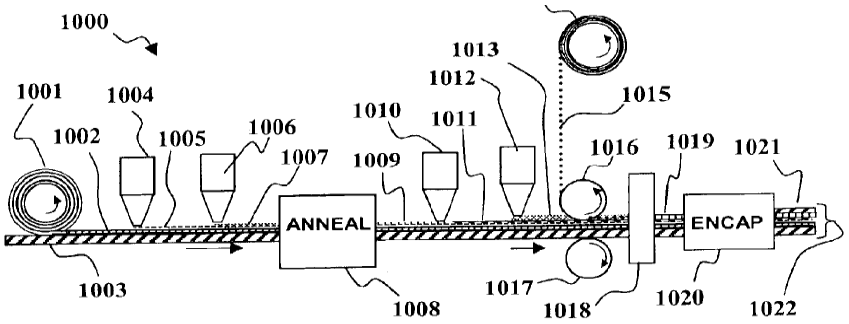
Competitors: technology leaders

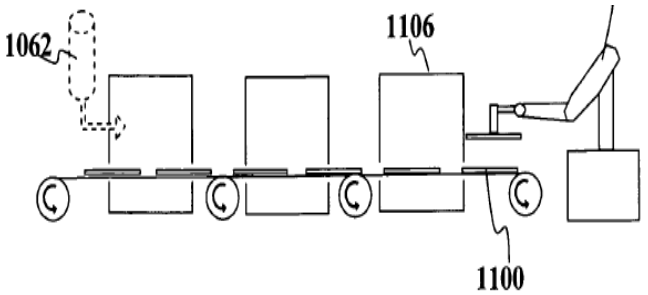
- (USA, CA) – CIGS, 1.5 $/W, 16 %
- Twin Creeks (US) – low cost fabrication 0.4 $, silicon
- G24 Inno (UK) – organic Gratcel cell, 7-11%, flexible
- Konarka Technologies, Inc., MA, US - polymer 3-7%, 2$/W **(bankruptcy)**

Printed electronics:

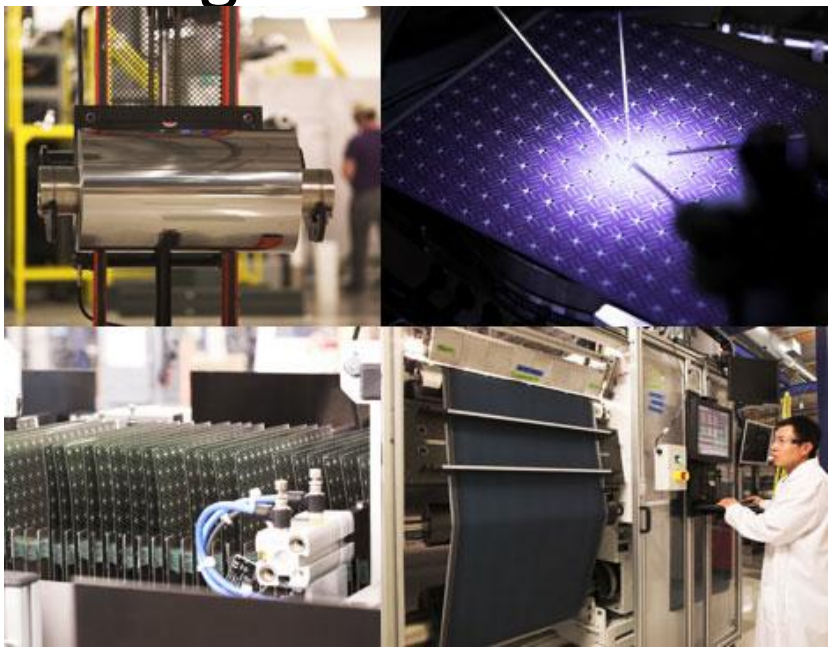
- Plextronics (USA, ME) – high precision printing
- Genes'Ink (FR) – good uniformity of the conductivity of ink

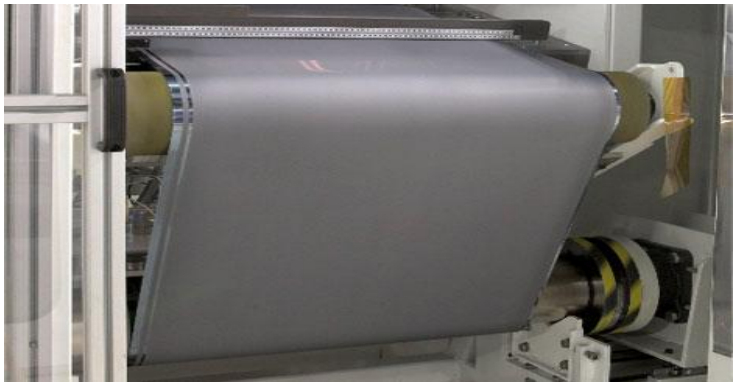
Inkjet technology ink with nanoparticles Nanosolar Inc. (US6936761)





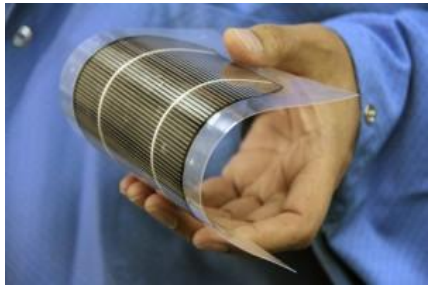
- Roll-to-roll printing





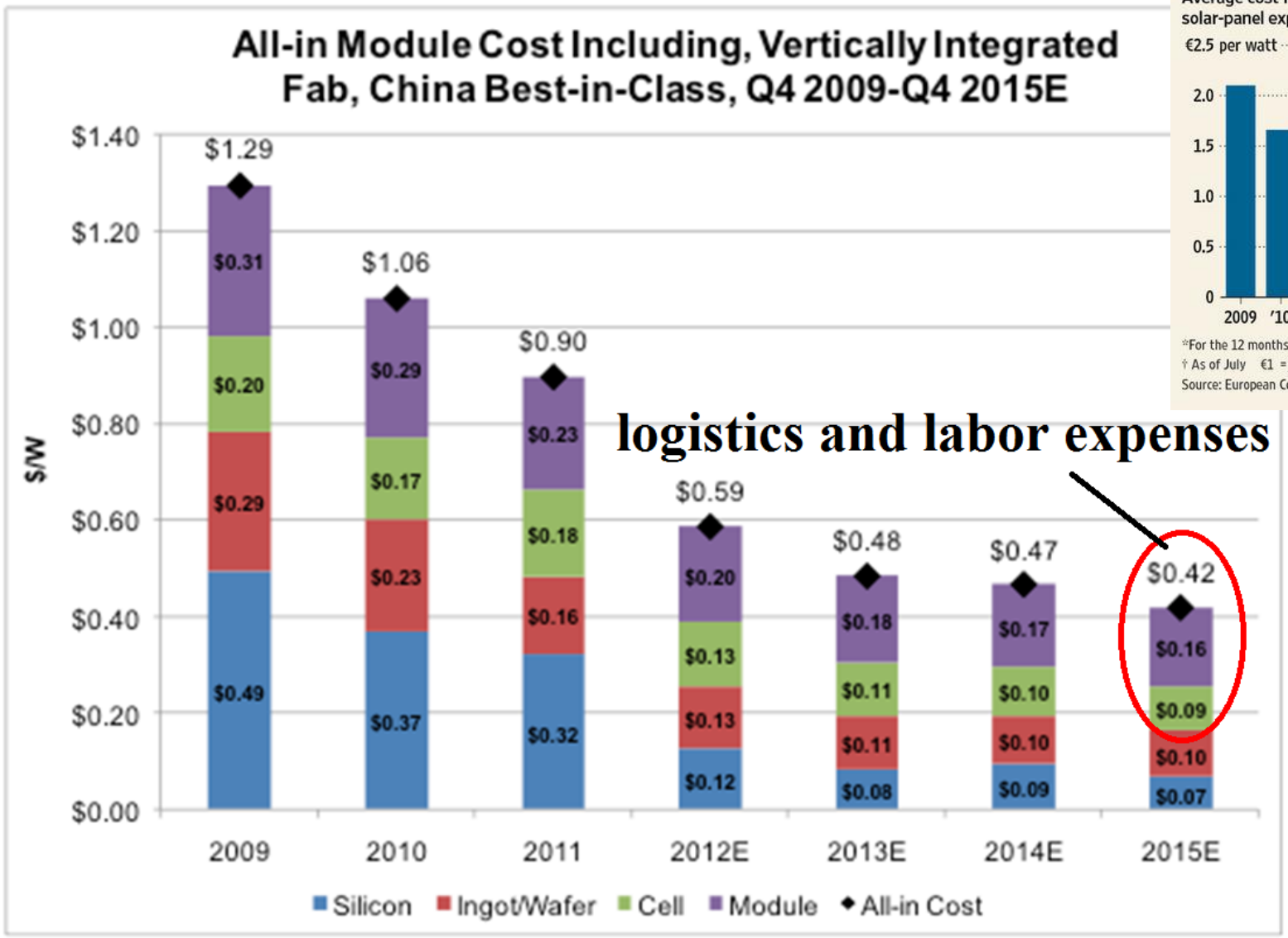
Twin creeks Tech (US, CA)

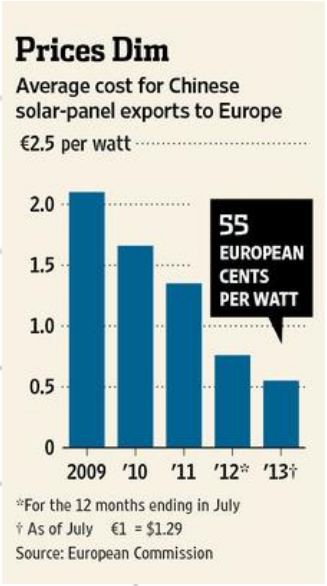
very thin film silicon by ion implantation



- Non printing, but very low cost technology: 0.4 $/Wt

Cost evolution of Chinese silicon solar cells

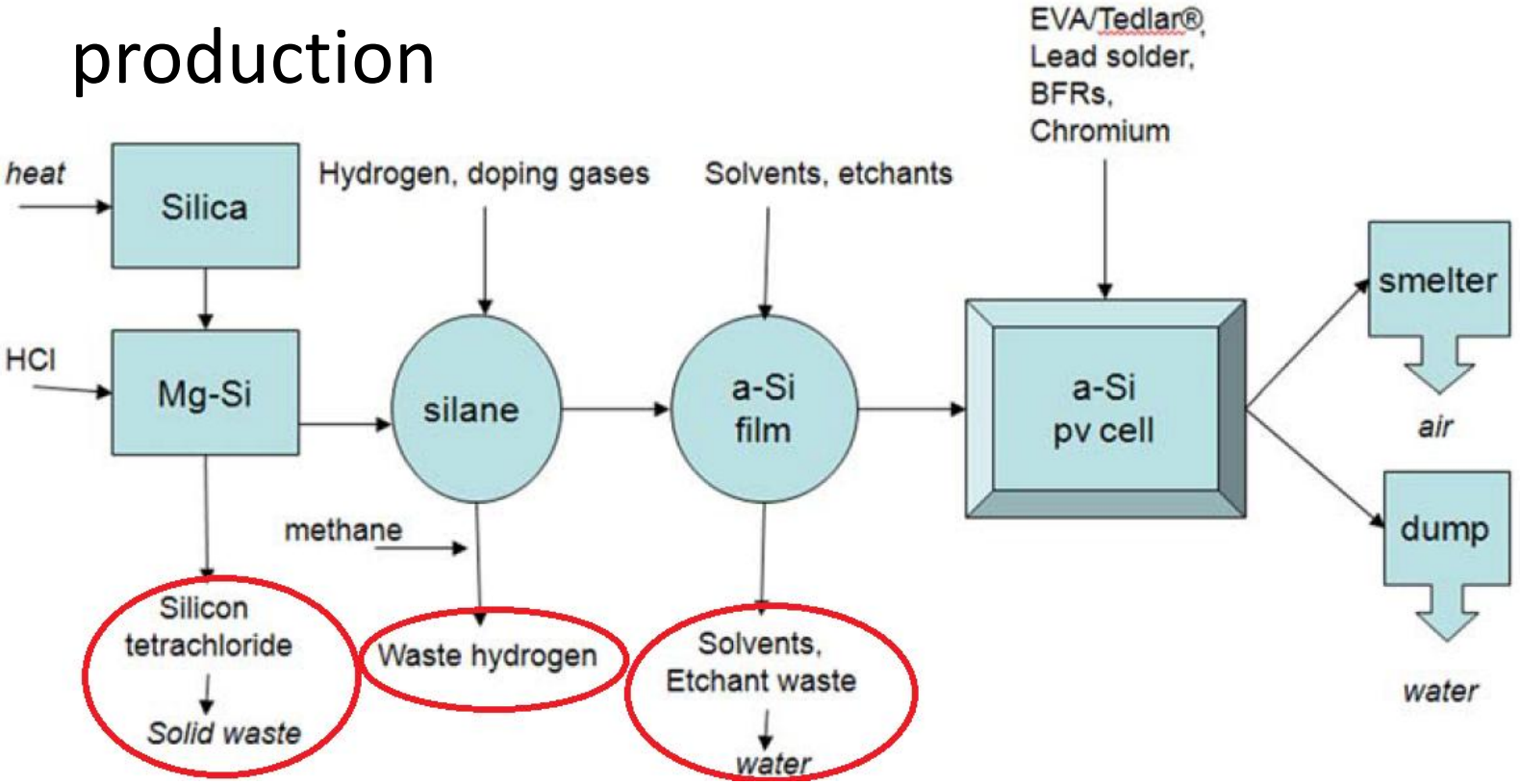




Printable technologies can compete with cheap labor

Non-pollution

Ordinary amorphous silicon solar cells production



We can be use earth-abundant non-toxic reagent with recycling solvents

Awards


РусГидро
СЕРТИФИКАТ
Призеру Молодежной программы
Russia Power 2012
«Инвестируя в будущее»
Лопатину Дмитрию Сергеевичу
За проявленную инициативу, комплексный творческий подход к созданию проекта и активное участие в развитии Российских инноваций в области возобновляемых источников энергии
Директор
Аксенова Е.А.


ДИПЛОМ
НАГРАЖДАЕТСЯ
ЛОПАТИН ДМИТРИЙ СЕРГЕЕВИЧ


ДИПЛОМ
УЧАСТНИКУ
«Зворыкинская премия»


СВИДЕТЕЛЬСТВО
Лопатин
Дмитрий Сергеевич
участник
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«Энергетика будущего»
Председатель Экспертной группы
Генеральный директор
ОАО "Кубаньэнерго"
Г.А.Султанов
21 февраля 2012 года
г. Краснодар


Фортум
РусГидро
Schneider Electric
ДИПЛОМ ПРИЗЕРА
Молодежной программы «Инвестируя в будущее» в рамках
Десятой евразийской выставки и конференции Russia Power 2012
Награждается
за проявленную инициативу, комплексный творческий подход к созданию проекта и активное участие в развитии российской энергетики
Исполнительный директор МАКО
Ольга Михайловна
Директор конференции Russia Power


Russia POWER
ДИПЛОМ ЗА АКТИВНОЕ УЧАСТИЕ
Призеру Молодежной программы Russia Power 2012
«Инвестируя в будущее»
за проявленную инициативу,
комплексный творческий подход к созданию проекта
и активное участие в развитии российской энергетики
РегионИнвест
МАКО


Министерство образования и науки Российской Федерации
Фонд содействия развитию малых форм предприятий
в научно-технической сфере
ПОЧЕТНАЯ ГРАМОТА
НАГРАЖДАЕТСЯ
Баранов
Олег Алексеевич
Победитель(ница) программы «Участник Молодежного
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Председатель
Наблюдательного совета
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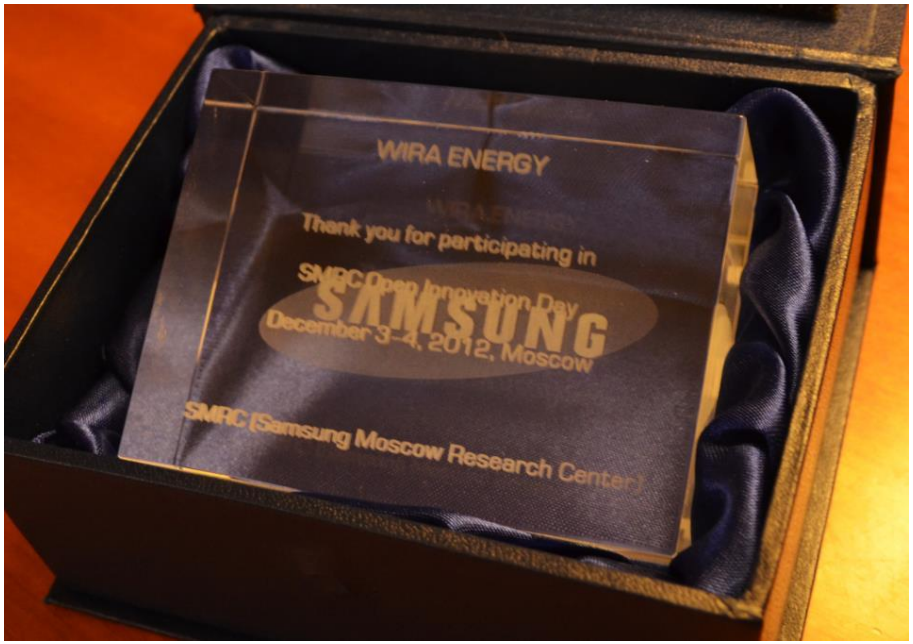
О.Г. Поляков


ПОЧЕТНАЯ ГРАМОТА
НАГРАЖДАЕТСЯ
Лопатин
Дмитрий Сергеевич



ДИПЛОМ

NANNOΣ VI

Лопатин
Дмитрий Сергеевич

победитель заочного тура
"Конкурс НИР студентов, аспирантов, молодых ученых - 2012"
VI Всероссийского интеллектуального форума - олимпиады
"Нанотехнологии - прорыв в будущее!"

Заместитель председателя Оргкомитета,
декан ФНМ МГУ имени М.В. Ломоносова — академик РАН Ю.Д. Третьяков

N 6O252632-NIR2

Москва, МГУ имени М.В. Ломоносова, 2012

Международный конкурс
научных работ
молодых ученых
в области нанотехнологий

3 ДИПЛОМ

Лауреат IV Международного конкурса
научных работ молодых ученых
в области нанотехнологий

НАГРАЖДАЕТСЯ

Лопатин Дмитрий Сергеевич

Заместитель Председателя Правительства
Российской Федерации, председатель
Организационного комитета Международного форума
по нанотехнологиям Rusnanotech

С.Б. Иванов

Rusnanotech 2011

ФЕДЕРАЛЬНАЯ СЛУЖБА ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ,
ПАТЕНТАМ И ТОВАРНЫМ ЗНАКАМ
(РОСПАТЕНТ)

Сертификат

на 12000 рублей

выдан *Коржовой Елизавете Сергеевне*

для компенсации расходов на участие в конкурсе-олимпиаде молодых исследователей **«Russian Young MemBrains»(RYM), проводимому 06-11 июня 2011 года в рамках международной конференции "Ion transport in organic and inorganic membranes»**

Председатель Оргкомитета,
Директор НИИ Мембран КубГУ,
Зав. кафедрой физической химии КубГУ,
профессор — В.И. Заболоцкий

Соруководитель российско-французской
лаборатории «Ионообменные
материалы и процессы» — В.В. Никоненко

Theme 3.

Management of Bio-resources in the Era of Climate Change

EURASTECH ㈜유라스텍
АО ЕвразТех

Dr. Inom Normatov.

Dr. of Sci. Normatov Inom Sherovich of 1958 year of birth. Corresponding Member of Academy of Sciences of the Republic of Tajikistan (2004), Doctor of Chemistry (1993), professor (1996). Winner of the Award of Lenin Komsomol (1990). For the period 2002-2009 Director of the Institute of Water problems, Hydropower and Ecology of the Academy of Sciences of the Republic of Tajikistan, Head of the Department of Meteorology and Climatology of the Tajik National University. Sub-Manager of the International EUROPEAN Commission 6thFP Project "JAYHUN" (2006-2009).

Manager of the Project Volkswagen Fund "Impact of transition processes on environmental risk assessment and risk management strategies in Central Asian Transboundary Basin" (2007-2010), USAID-University of Colorado Project "Contribution to High Asia Runoff from Ice and Snow" (2013-2016), Manager of the ISTC Project T - 2109 (2014-2017).

Estimation of Carbon Dioxide formation in heat-power complexes of the Central Asia and perspective of development of Hydrogen power engineering

Inom Normatov

Tajik National University
Republic of Tajikistan

Total stocks of mineral fuel of the Central Asian Region (Mln t):

natural gas - 3419.5

oil - 1156.4

- coal - 3873.4

Emission of pollutants in Central Asia Region

SO_2 - 31%

CO_2 - 14 %

nitric oxides - 10 %

suspended particles - 35%

Power supply systems of the Republic of Uzbekistan

UZBEKENERGO

largest manufacturer electric and thermal energy

11238 MWt

covers of requirements in

electric - 98 %

thermal energy - 35 %

at burning in coppers of stations of natural gas, black oil, coal and gas of underground gasification of brown coal

Fuel Balance on system of UZBEKENERGO

natural gas	black oil	coal
86.7 %	10.26 %	3.04 %

Basic emissions of toxic components in atmosphere

206,143 Th. t

coal ashes	– 47.94 Th. t
sulfur dioxide	– 120.12 Th. t
nitrogen oxides	– 37.166 Th. t

In 2004 emissions of a dioxide of carbon have made

29640 Th. t

and have increased in comparison of 2002 by

240 Th. t

Power supply systems of the Republic of Kazakhstan

√ Requirements of Kazakhstan on heat and energy development are satisfied on 85% by burning of coal. Average efficiency of power stations in Kazakhstan, burning coal, makes **30-32 %** whereas, according to a technical substantiation, this indicator makes **42 - 53 %.**

√ The potential of reduction of emissions CO_2 in the project on transition to other kind of fuel makes about **40 %,**without increase in efficiency of use of superfluous energy in these projects.

√ Concerning coal potential in power sector of Kazakhstan, transition to other kind of fuel can provide reduction to an indicator of **37 Mln. t CO_2** equivalents per year.

√ 12 % of the electric powers of Kazakhstan are developed from renewed energy sources, mainly from five large HPS. In the National Report is note that from 90 small HPS in Kazakhstan 21 is in operation. The general power output of all workstations makes 78 MWt. Except possible restoration of old hydroelectric power stations, Kazakhstan creates large Hydropower system by capacity of **450 MWt**.

Power supply systems of the Republic of Kirgizstan

In 2004 emissions of CO_2 gas in the Kirgizstan were considerable more **12 Mln. t.** The largest source of emissions of carbonic gas is the power sector, also cargo and passenger motor transport

According to UN Program for economic of Central Asia and diagnostic report «Rational and the effective utilization of power resources in the Kirghiz Republic» up to **2020** is predicted manufacture growth of electro- and heat energy on thermal power station and on the basis of use of coals of the Kara-keche cut is supposed to consider possibility of building of the Kara-keche thermal power station by capacity **800 MWt** that will obviously promote increase in emissions of greenhouse gases in atmosphere

Power supply systems of the Republic of Tajikistan

Stocks of coal	670 Mln. t (40 fields)
Production	20-25 Th. t
Stocks of oil	5.4 Mln. t
Stocks of natural gas	9.2 Bln. m^3

Strategy of social and economic development of Tajikistan provides increase to 2015

coal mining	600-800 Th. t
Oil production	100-300 Th. t
Production of natural gas	300-500 Mln.m^3

Taking into account growing needs for energy, at a share of coal fuel more than 50% in the general power consumption, emission of CO_2 by 2015 can increase to 30 Mln. t.

Total Hydropower Resources of the Central Asia Region

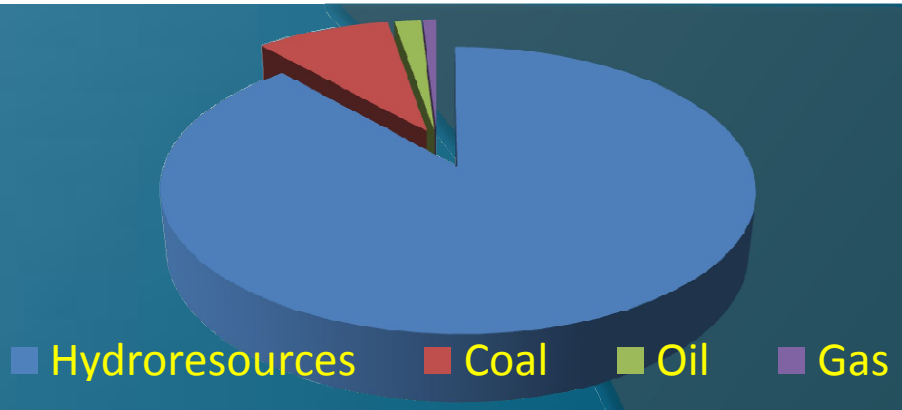
460 Bln. kWt·h/year

*At present used only **10 %***

The main volume of a regional stock of hydroenergy

Tajikistan - 69%

Kirgizstan - 22%



Summer operating mode of the
Nurek reservoir (July - September)

Single dumping - 600 m^3/sec.
Water volume - 4.5 км^3

2012

Single dumping on an equivalent
to electricity - 6 Bln. kWt·h
Losses (1кВт.ч = 3 cents) - $200 Mln.

Territorial Location of Hydropower Stations

Criterion of economical optimization of territorial arrangement of HPS :

minimization

investment for the building of HPS

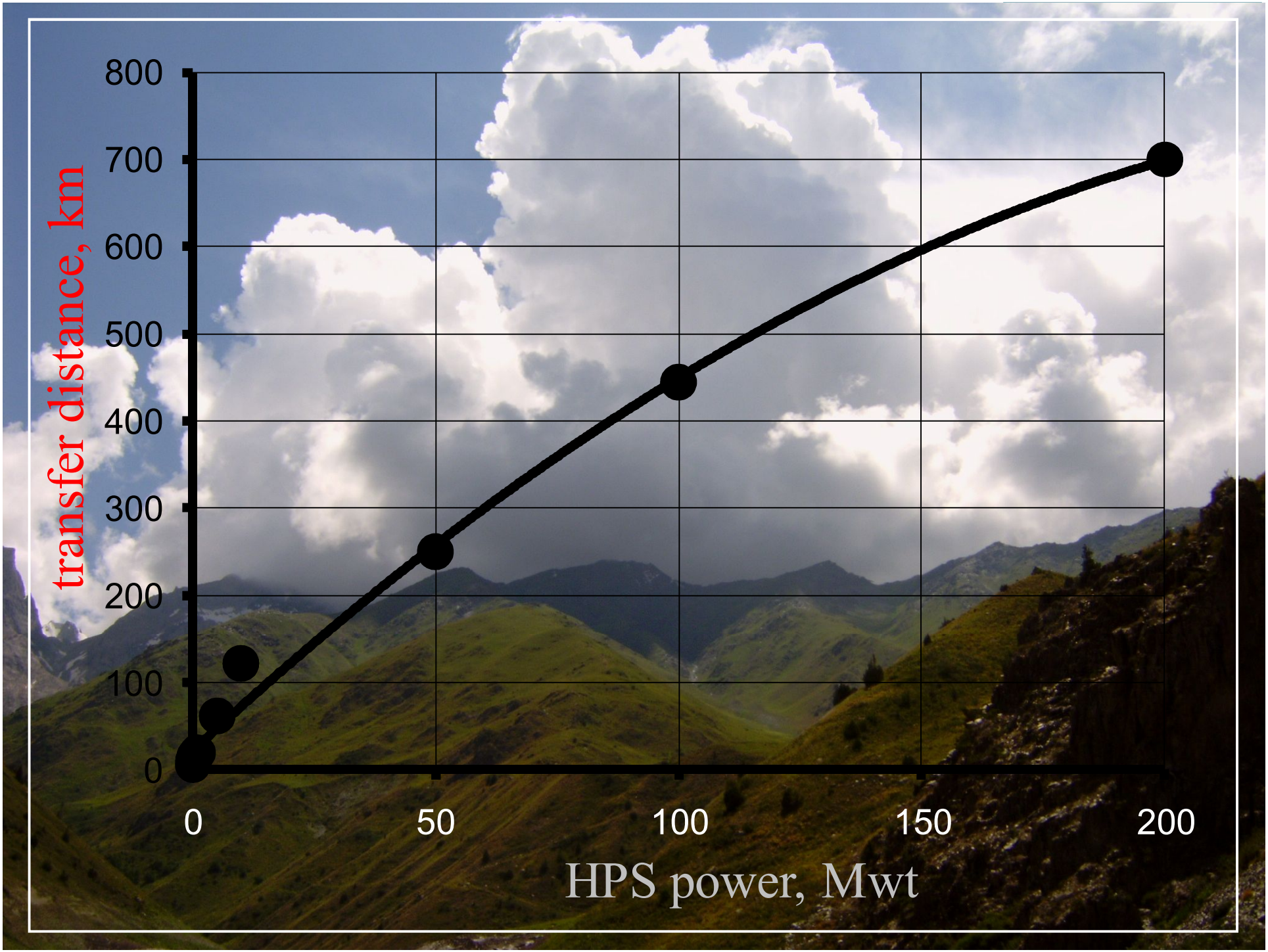
+

investment for construction of ETL (Electricity transfer lines) for the transit of power to consumers

If the zone of influence of one HPS will be limited by distance throughout which cost of power transfer by construction of the ETL will be cheaper than a construction of new HPS on the end of the ETL

Mathematically it can be written as:

$$L_{\max}^{\text{opt}} \leq \frac{S_{\text{spec}}^{\text{HPS}}}{S_{\text{spec}}^{\text{ETL}}} N$$


transfer distance, km
800
700
600
500
400
300
200
100
0
0
50
100
150
200
HPS power, Mwt

Ecology-economical Index efficiency of HPS	On capacity references to the area for building HPS **(MWt / ha)**	On power output references to the area for building HPS, **(TWt / ha)**
Annual for HPS with area of ground less 100 th. ha	**0. 123**	**0.406**

Estimation efficiency now current Nurek HPS and planed in the near future for building of Rogun HPS with reservoirs

Ecology-economical Index efficiency of HPS	On capacity references to the area for building of HPS (MWt / ha)	On power output references to the area for building of HPS, (TWt / ha)
Annual for HPS with area of ground less 100 th. ha	**0. 123**	**0.406**
Bratsk HPS	**0.008**	**0.041**
Charvak HPS	**0.130**	**0.436**
Toktogul HPS	**0.038**	**0.128**
Nurek HPS	**0.126**	**0.522**
Rogun HPS	**0.212**	**0.782**

THE ENVIRONMENTAL PROBLEMS AND ECOLOGICAL ASPECT OF HYDROGEN TECHNOLOGY

Work of any internal combustion engine depends on the engine type, kind of fuel, working condition mode and products of combustion, the following structure is formed (% vol.) :

CO : 1 – 9

CO_2: 2 – 10

H_2: 1 – 7

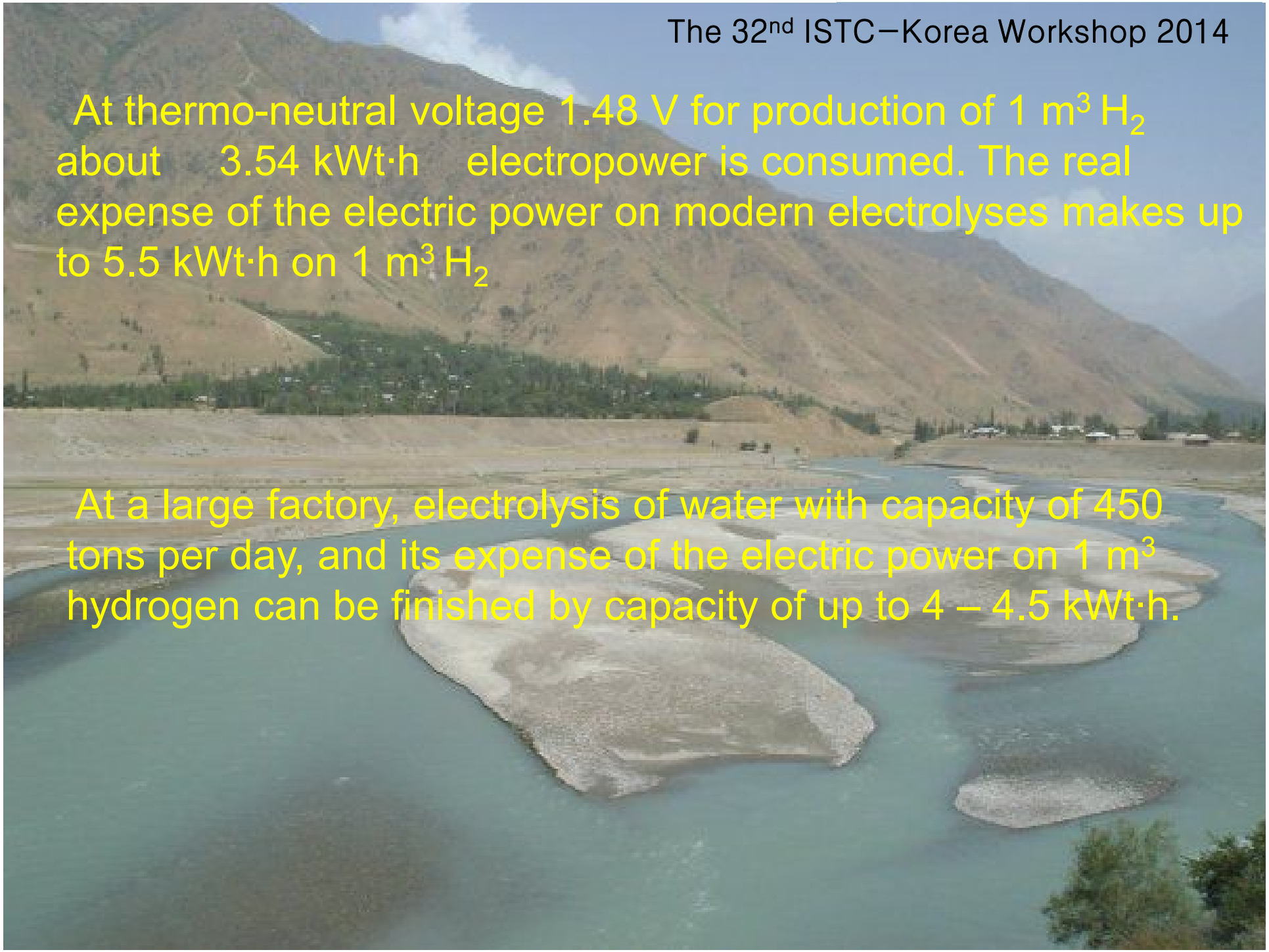
O_2: 0.5 – 5

N_2: 69 – 79

Use of hydrogen as an energy carrier allows considering and solving power problems, those related with ecological problems as well

PRODUCTION OF HYDROGEN BY ELECTROLYSIS OF WATER

Electrolysis of water is one of the most known and well investigated methods for production of pure hydrogen **(99.6 – 99.9 % H_2)** in one technological stage. Efficiency of hydrogen production process by electrolysis is mainly defined by the electric power cost which makes up **to 85%.**



At thermo-neutral voltage 1.48 V for production of 1 m^3 H_2 about 3.54 kWt·h electropower is consumed. The real expense of the electric power on modern electrolyses makes up to 5.5 kWt·h on 1 m^3 H_2

At a large factory, electrolysis of water with capacity of 450 tons per day, and its expense of the electric power on 1 m^3 hydrogen can be finished by capacity of up to 4 – 4.5 kWt·h.

I S T C

М Н Т Ц

Thank You for Yours Attention

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Normatov I.Sh. The water balance and the solution of water problems in Central Asian Region. ***IAHS Red Book Publ. №286. 2004. PP. 300-314.***

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Normatov I.Sh. Estimation of the Carbon Dioxide Formation in Heat-Power Complex of the Central Asia and Prospective of Development of Hydrogen Power Engineering. **J. Environmental Sci. & Engineering A, 2013, V.11, No 4. PP.231-239.**

Dr. Anuar Zhukeshov.

Professor, Department of Physics and Technology, Kazakh National University named after al-Farabi, Kazakhstan. Website: http://kaznu.kz

Birth in 1967 year. Doctor of Physics and mathematics (2010), associated professor (2007), PhD (2003). Graduate of the Saint- Petersburg University (1994).

From 2004 head of the pulsed plasma scientific laboratory of Experimental and theoretical physics Institute of Kazakh National University named after al-Farabi. Manager of several Projects on plasma physics and material plasma treatment technology areas (2004-2014).

Author of 2 monographs and more than 100 scientific articles. The main directions of research and applied works are plasma physics and plasma devices, thermonuclear reactors, material sciences and nanotechnology, electronics, electric power and alternative energy.

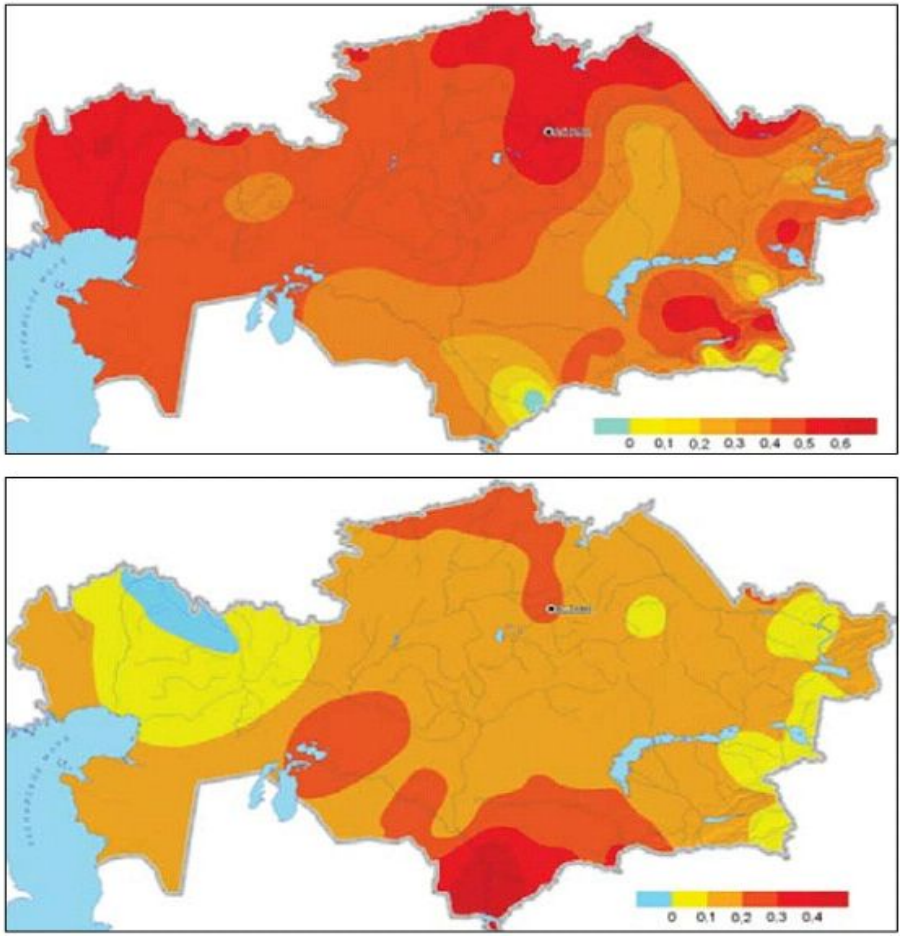
The 32nd ISTC-Korea Workshop 2014

Kazakh National University named after al-Farabi
Almaty, Kazakhstan

Climate change in the south-east of Kazakhstan and perspectives of alternative energy in the region

prof. Anuar Zhukeshov

GLOBAL WARMING IN KAZAKHSTAN



Rising temperatures in Kazakhstan in winter (upper panel) and summer (lower panel) for the period from 1936 to 2005.

In general, the growth of mean annual air temperature by the end of the 21st century in Central Asia can be from 3.7 to 5.6 degrees. Temperature rise will be due to lower rainfall, which will be expected to 4-21%

Calculations for all climate models lead to an unequivocal warming in the region. According to estimates, over the next 30 years in the mountain river basins of Kazakhstan annual runoff may increase to 22.5% as a result of melting glaciers. Annual runoff basins of lowland rivers can be reduced to 10.3%.

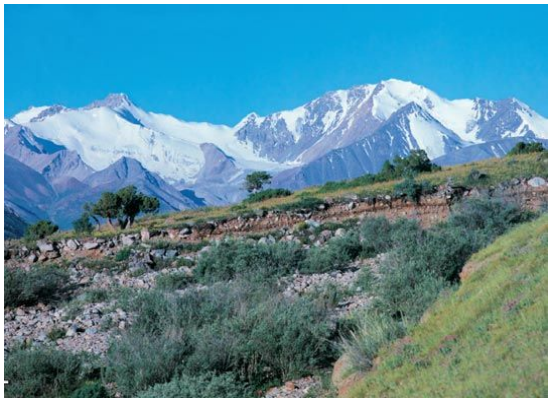
CLIMATE CHANGE SOUTH - EAST KAZAKHSTAN

South-east of Kazakhstan (Almaty region)

Almaty city

Landscape of the south-east of Kazakhstan includes all areas from glaciers to sans
The largest city in the region is Almaty population of 1.5 million people. Nature of the region is very diverse and attractive for tourists.

GLACIERS AND RIVERS



Ile Alatau

Jongar Alatau

Ile river

Almost all the major rivers southeast of Kazakhstan belong to the basin of Lake Balkhash and originate from glaciers Ile or Jongar Alatau

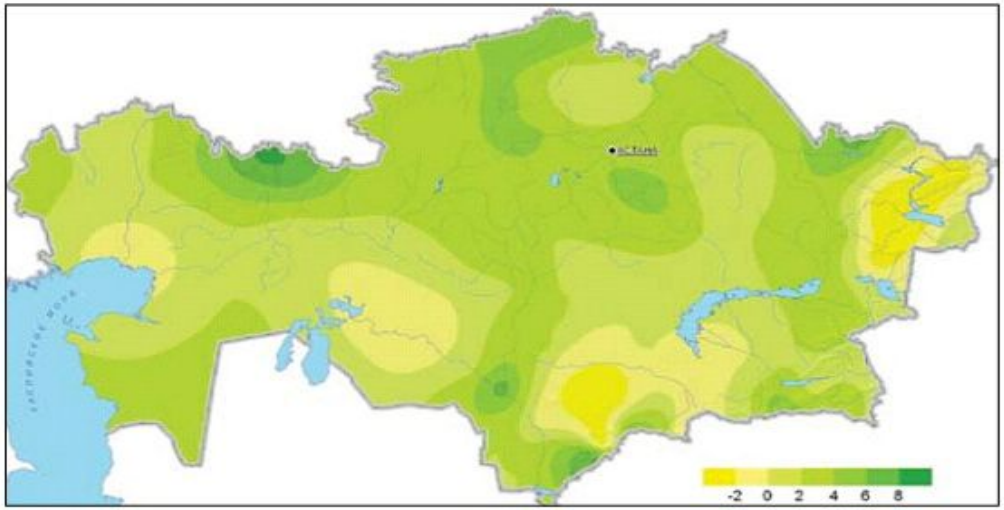
In the Ile basin glaciers dry up by 1254 km2 (36.6%) and the average for the year - 25.1 km2 (0.73%). In the whole basin of Lake Balkhash decline amounted to 1498 km2 (36.9%) or the average for the year - 30 km2 (0.74%). Calculations have shown that by reducing the long-term reserves of ice and water reserves in the glaciers in the inflow from rivers in addition more than 10% water.

FLOW ACTIVITY

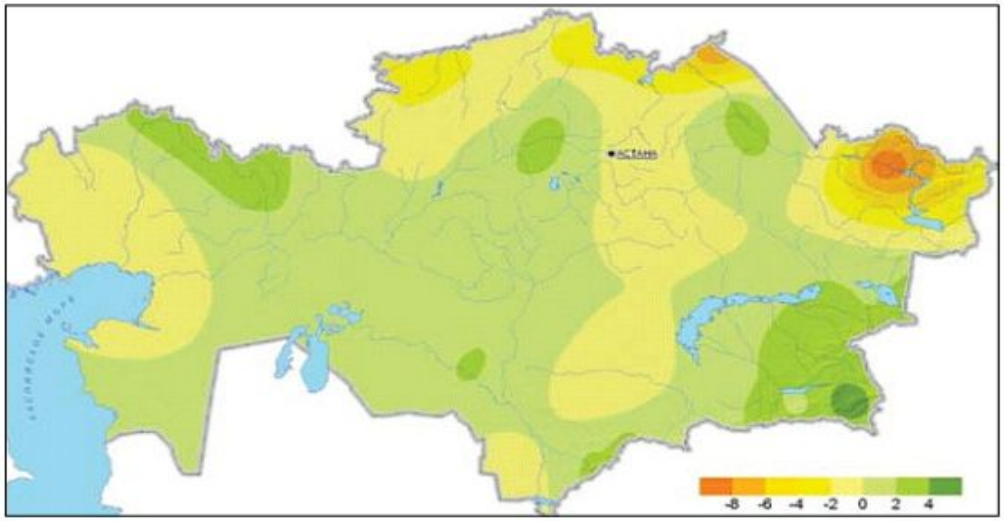
According to a review of the Eurasian Development Bank, catastrophic rain mudflows occur in the XX century, a once in a century in this region will become annual.

Mountain and foothill regions of Kazakhstan, occupying 15% of its territory, subject to the ravages of floods. By debris flow activity Ile Alatau is one of the first places in the CIS.

Precipitation in Kazakhstan



In many parts of Central Asia, fluctuations in the intensity of rainfall. Heavy rains, droughts alternating with sharp, create many problems workers agriculture sector



Change in the amount of precipitation in Kazakhstan
by decade from 1936 to 2005 mm per year.

PROSPECTS FOR THE DEVELOPMENT OF RENEWABLE ENERGY IN KAZAKHSTAN

Government plan of development of renewable energy up to 2020

Performance renewable energy sources (RES) in the Republic of Kazakhstan has been steadily increasing with the period from 2009 to 2013 with a level of 350 to 500 million. KWh. One of the prerequisites for increasing the production of renewable energy, was the adoption of measures of state support for the development of renewable energy.

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DEPLOYMENT PLAN OF RENEWABLE ENERGY SOURCES IN THE REPUBLIC

wind turbines

1 Akmola region — 45 МВт

2. Akmola region – 30-50 МВт

3. Akmola region — 300 МВт

4. Almaty region — 51 МВт

5. Almaty region — 60 МВт

6. Jongar Gate, Almaty region— 72 МВт

7 East-Kazakhstan region — 24 МВт

8 Korday, Jambyl region -21 МВт

9 Zhambyl region— 100 МВт

10. Karagandy region — 15 МВт

11. Kostanay region — 48 МВт

12 Mangystau region — 19,5 МВт

13. Noth Kazakhstan region -1,5 МВт

solar panel

1. Almaty region — 2 МВт

2. Zhambyl region -24 МВт

3. Kyzylorda region— 50 МВт

4. Astana city -1 МВт

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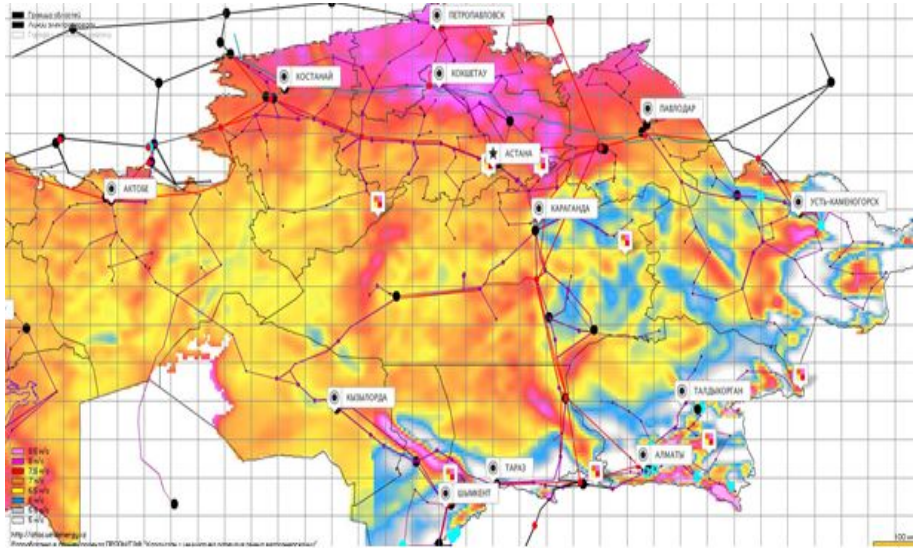
PROSPECTS FOR WIND ENERGY



Within the framework of the United Nations Development "Kazakhstan - Wind Power Market Development Initiative" work has been done, aimed at the development of wind power in the Republic of Kazakhstan. The project was developed wind atlas of Kazakhstan

Southeast Kaazahstan has the most unique in the world of construction sites of potential wind power plants (WPP). This Dzungarian Gates and Shelek corridor. So, in Djungar Gate: average wind speed at a height of 50 m - 9.7 m / s, the flux density - 1050 W / m 2, the number of hours of operation at full load WES - 4400 h / year. Accordingly, Shelek corridor: average wind speed at a height of 50 m. - 7.7 m / s, the flux density - 310 W / m 2, the amount of work wind farm at full load - 3100 h / year.

It is generally accepted that Dzungarian Gates on wind characteristics are the most promising area of construction of wind farms in the world. Vacancy on Djungar Gate will allow to develop a total capacity of over 1,000 MW wind station

Place name	Region	Wind velosity	The expected capacity of wind station
Djungar Gate	Almaty	9,7	50 MW
Shelec corridor	Almaty	7,7	100 MW
Korday	Zhambyl	6,1	10-20 MW
Zhuzimdyk-Chaian	EKR	6,7	10-20 MW
Astana	Akmola	6,8	20 MW
Ereymentau	Akmola	7,3	50 MW
Karkaralinsk	Karaganda	6,1	10-20MW
Arkalyk	Kostanai	6,2	10-20 MW
Atyrau	Atyrau	6,8	100 MW
Aktau	Mangystau	7,5	50 MW

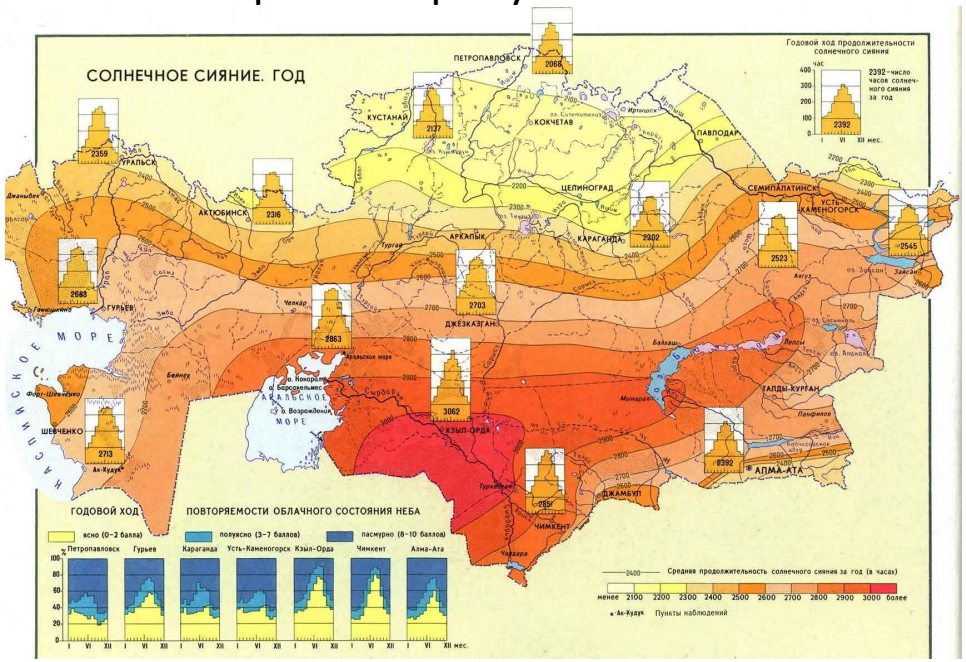
PROSPECTS FOR HYDROPOWER

The best prospects in the development of small hydropower plants exist in the southern regions of the Republic, with considerable potential, but importing from the northern areas large amounts of electricity. On the mountain rivers of the southern regions of the country accounts for about 65% of hydropower. The Almaty region is developing a network of small hydroelectric power from 5 to 60 MW

Rive	Power
Karatal	**5 MW**
Aksu	**1, -4,35 MW, 2, – 4,8 МВт**
Esik	**4,8 MW**
Almaty canal	**1,2– 12 W**
Shelec	**1,2, — 60,8 MW**
Lepsy	**4,8 MW**
Koksu	**1,2– 42 MW**

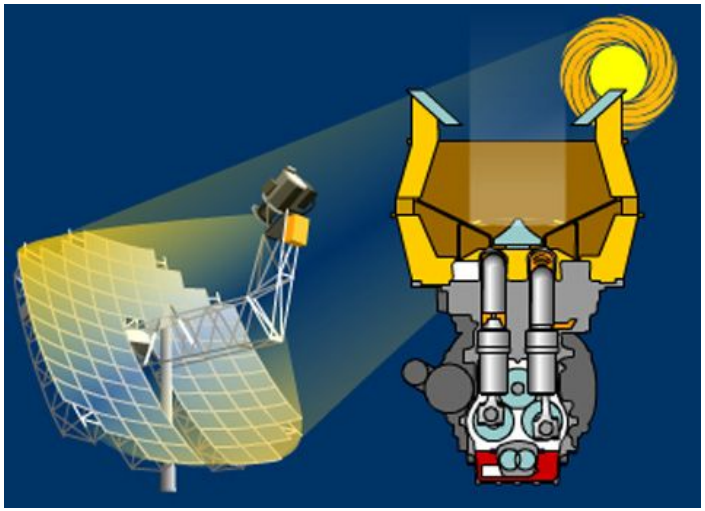
PROSPECTS OF SOLAR ENERGY

The use of solar energy in Kazakhstan is very low, despite the fact that the annual duration of sunshine is 2200-3000 hours per year, and the estimated capacity 1300-1800 kW per 1 m² per year



In 2012, the first steps were taken for the development of a new industry, and were initiated projects to build plants that will produce silicon feedstock. In 2012, in Astana started production of finished photovoltaic cells.

In 2014, on the initiative of Kazakh National University scientists developed the project Solar power Stirling engine. The project is under consideration for grant funding for the MES



SUMMARY

- In the next 50 years, the climate of the South-East of Kazakhstan will be favorable for the development of solar and wind energy;
- The presence of a network of large and small cities, the development of agricultural industry in the region will contribute to rapid return on investment in the field of renewable energy;
- Renewable energy should be a key factor in the development of tourist areas in remote, ecologically clean areas of the region;
- For renewable energy development in the region has the necessary scientific and technical sphere;
- In relation to small hydro power, despite having vast resources in the region, should be considered a high potential danger of avalanches and earthquakes;
- for the development of solar energy is necessary to develop a resource atlas of solar energy for Kazakhstan.

references

- Ministry of Environmental Protection RK

- Ministry of Industry and New Technologies RK
- Ibatullin S.R., Jasinski V.A., Mironenkov A.P. Impact of climate change on water resources in Central Asia. Eurasian Development Bank, Review, 2009, 44 p.
- www.atlas.windenergy.kz
- www.facebook.com/RadioAzattyq

Theme 4.

Advanced energy materials for Russian energy sector modernization and benefits of increasing investments through SK technologies

(Korean technology presentations)

Dr. Kang Yong Heack.

o 한국에너지기술연구원 센터장(1985이후 태양열연구실장, 신재생본부장 등 역임)

o IEA SolarPACES 집행위원회(ExCo) 한국대표 (2007-현재)

o ISES 2015 SWC(Solar World Congress) 조직위원장 (2013-현재)

o 대전광역시 에너지위원회 부위원장 (2009-현재)

o 행정복합도시건설청 설계자문위원회 자문위원 (2008-현재)

o Green Energy Expo 학술위원장 (2004 - 현재)

o 제2차 에너지기본계획 신재생 WG 위원 (2013)

o 지식경제부 신재생에너지 정책심의회 심의위원 (2006-2012)

o 지식경제부 자체 평가위원회 평가위원 (2007-2012)

o 한국태양에너지학회 회장 (2010)

o 녹색성장위원회 과학기술계협의체 위원 (2009-2010)

[연구분야 및 업무]

o 태양열 발전, 태양 연료 생산기술 개발 및 실증

o 태양열이용 신재생에너지 융복합 기술

o 녹색섬 종합계획수립

o 신재생에너지 자원지도 구축 및 활용시스템 기술

o 신재생에너지 잠재량 산정

o 신재생에너지 기본계획 수립 및 기획

KIER

GLOBAL KIER TECHNOLOGIES

Renewable Energy Resource Atlas System

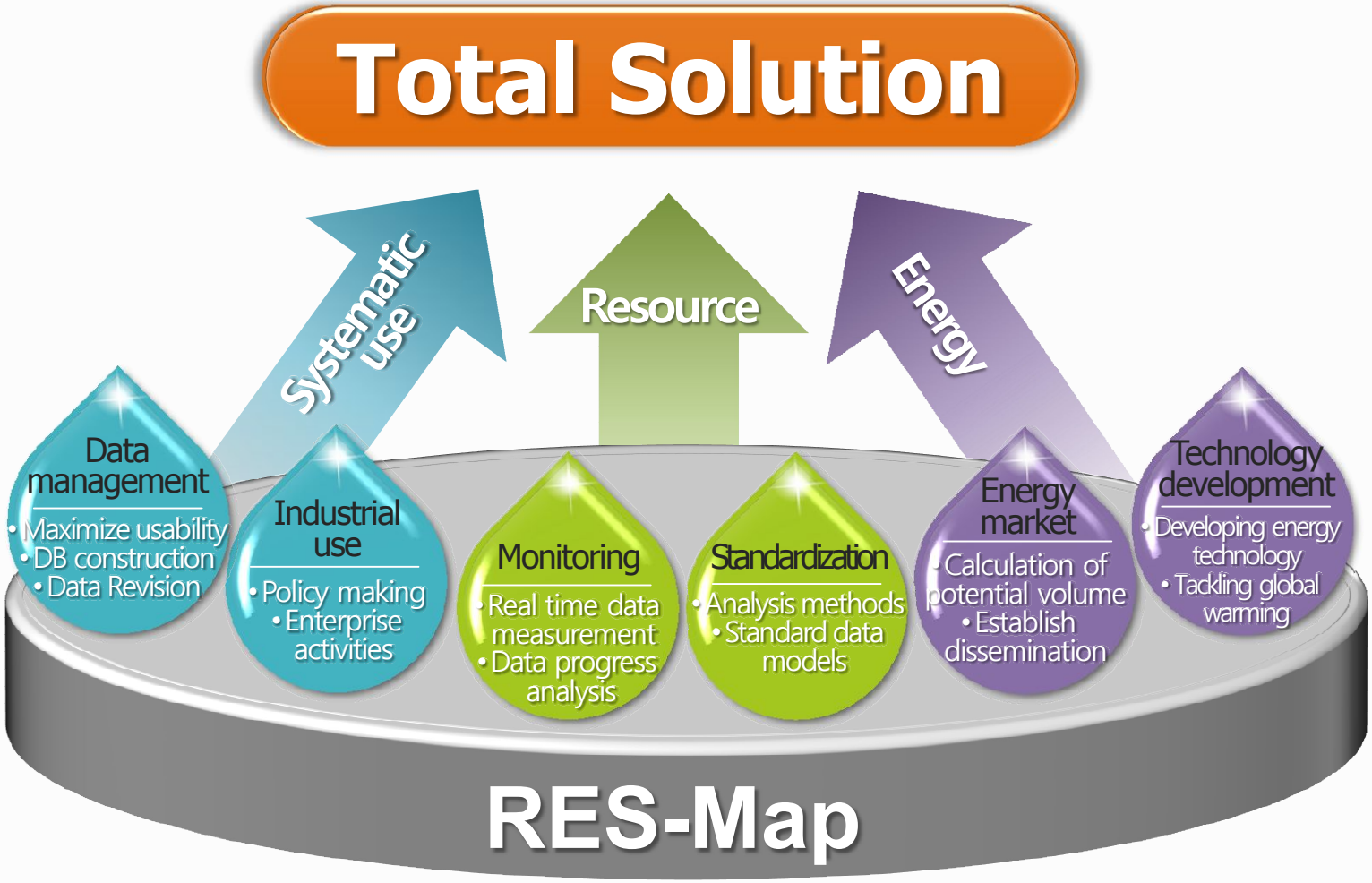
The KIER, a global energy innovator, does its best in pursuing its mission to invent world-class energy technologies based on open innovation, life-cycle research quality assurance, participatory and open communication. Therefore the KIER will become the best energy technology R&D institute in the world, contributing to the creation of wealth and improvement of quality of life for the people.

Oct. 21, 2014

Korea Institute of Energy Research
New & Renewable Energy Resource Center

Yong-Heack Kang, Chang-Yeol Yun, Hyun-Goo Kim

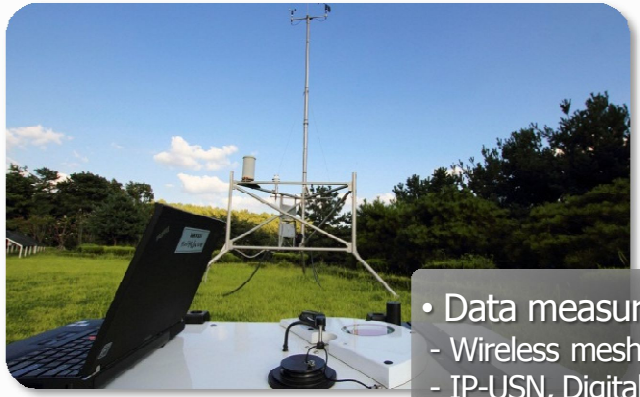
Definition



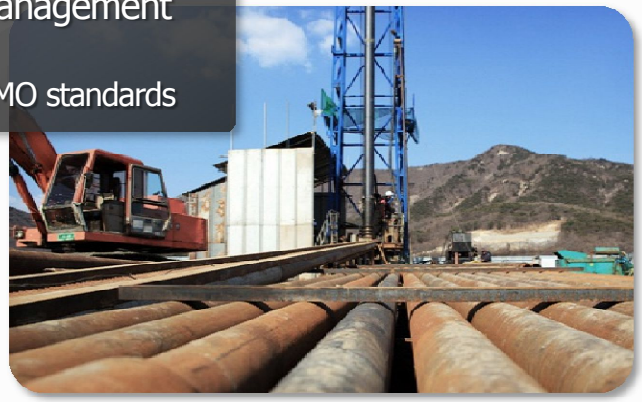
*** RES-Map : Renewable Energy ReSource Map**

Features

Provide data for studying renewable energy

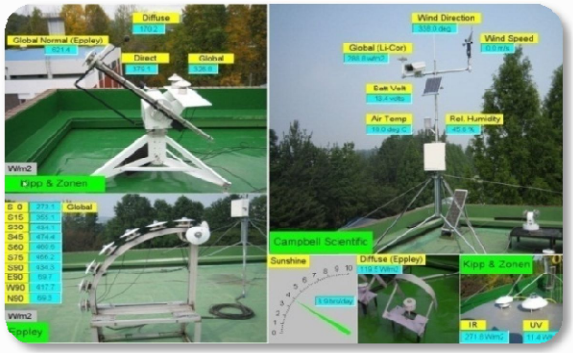


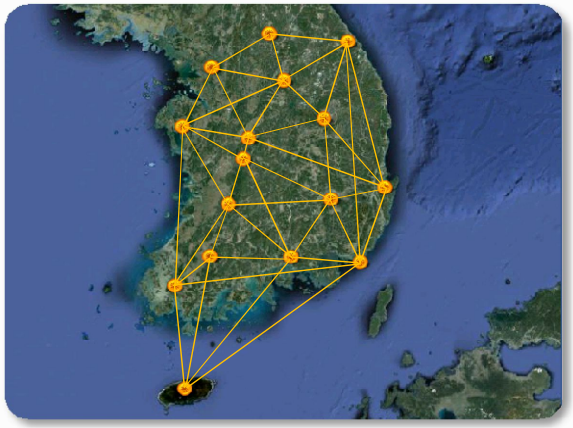
- Data measurement design
  - Wireless mesh, Ethernet
  - IP-USN, Digital meter, Data logger
- Data quality management
  - DQMS, SERI QC
  - ISO, IEC, and WMO standards



Features

Build a real-time data transmission system and support technology for renewable energy facility management



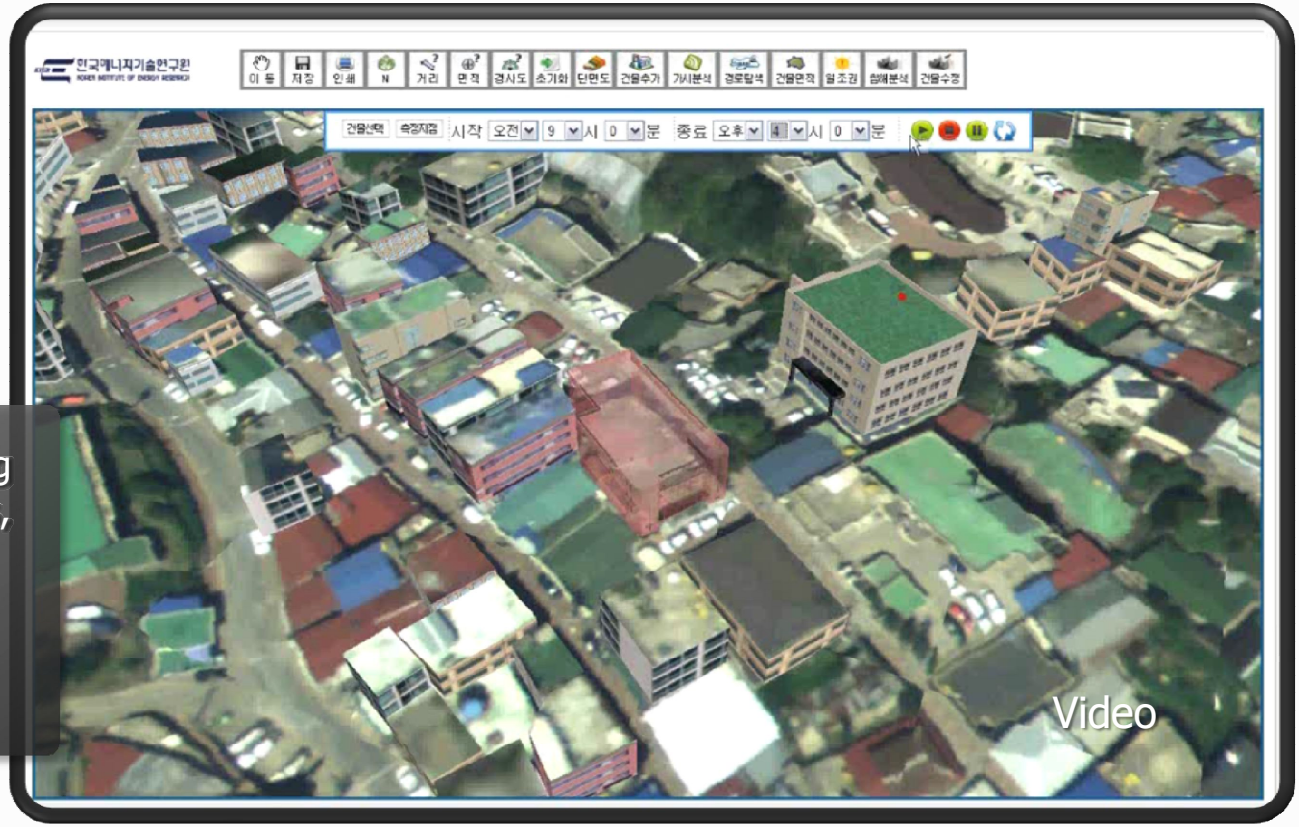


- Real-time data transmission and management technology(collection data, storage, transmission)
- Building spatiotemporal database (including GIS, RS, satellite image)

Features

Produce state-of-the-art technology result to which the latest remote sensing technique and the numerical modeling technology is applied

- Using remote sensing data(satellite images, LiDAR, SODAR, etc.)
- Numerical model analysis technology



Features

Establish renewable energy policies and dissemination plans

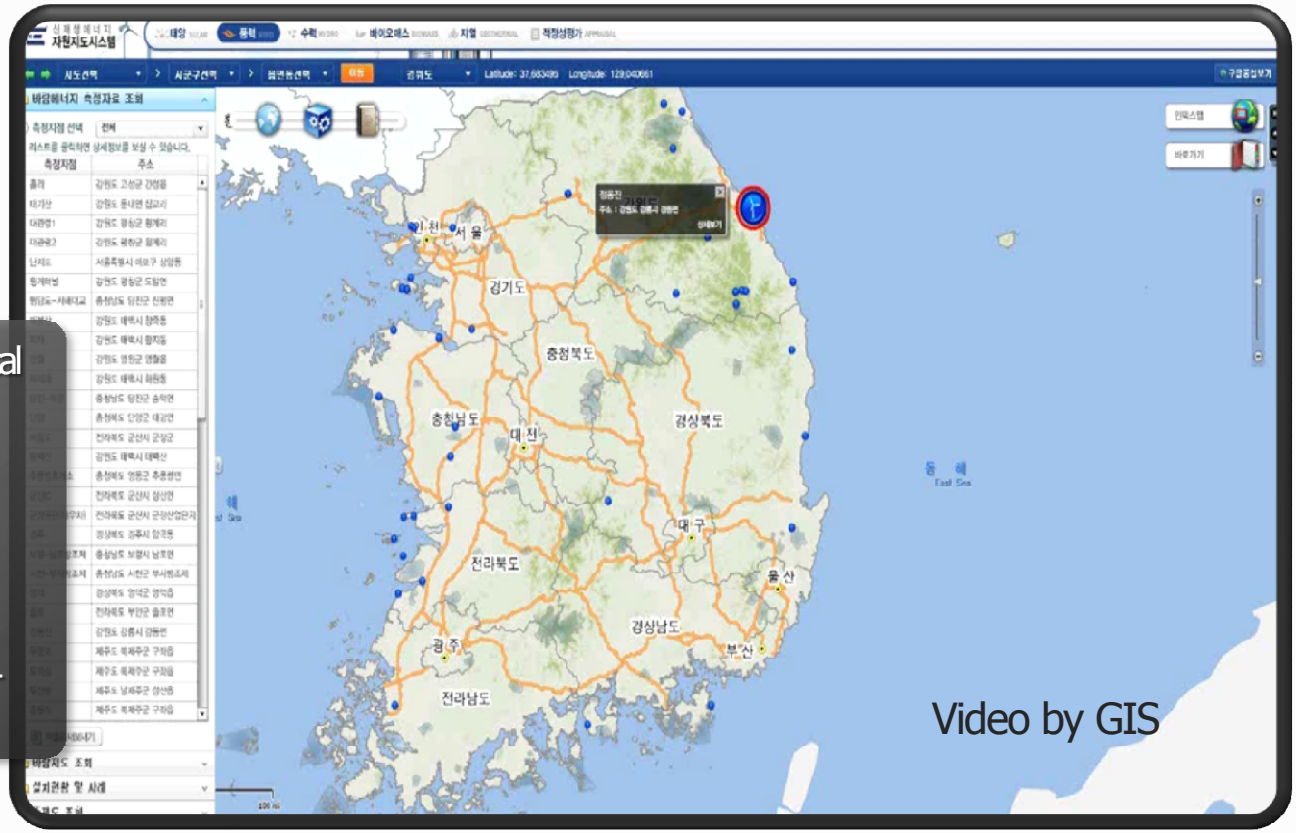
Estimate of the volume of potential resources

- Creating and using spatial information
- Analyzing renewable energy potentials
- Evaluating available energy in each target area

Features

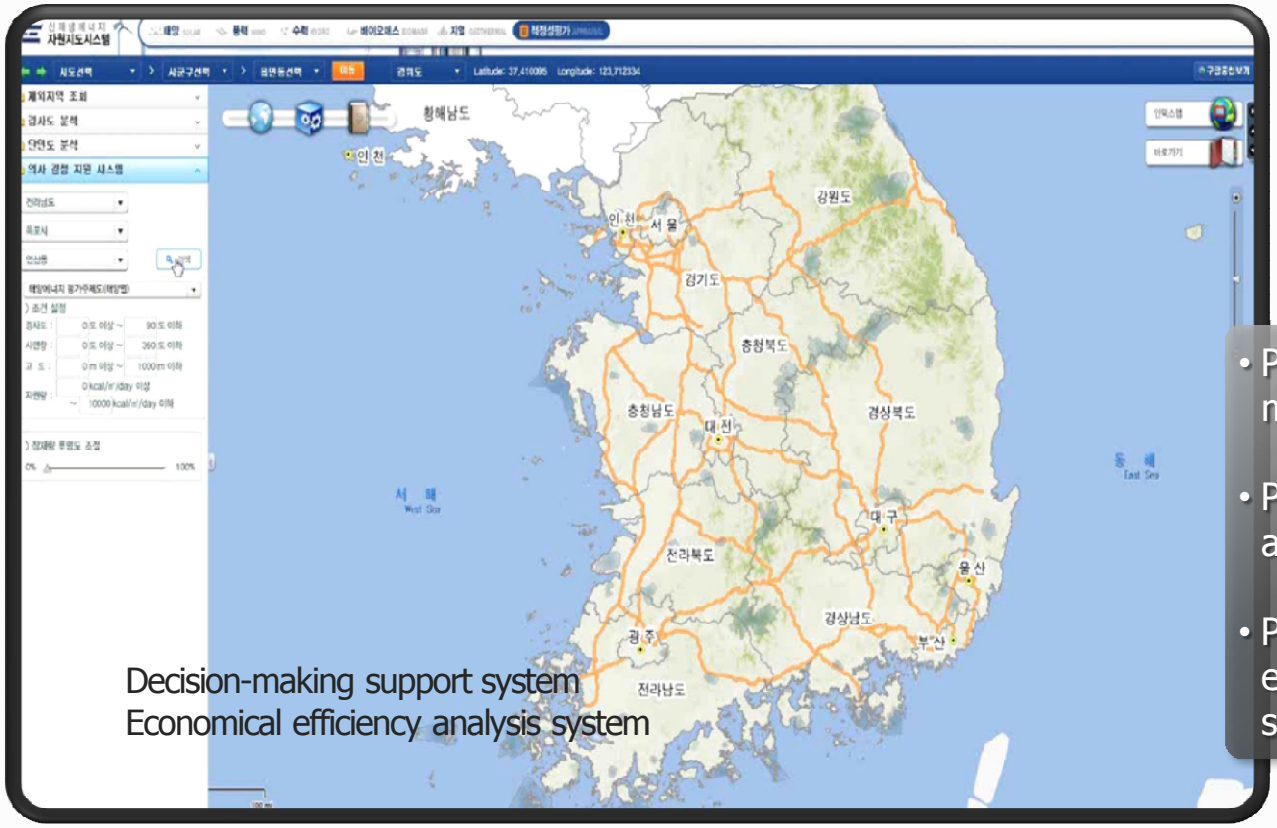
Analysis based on nationwide geographical information units

- Applying GIS (Geographical Information System)
- Location-based service technology
- Developing an analysis system to use the web-based GIS



Features

Provide tools for supporting decision making



Decision-making support system
Economical efficiency analysis system

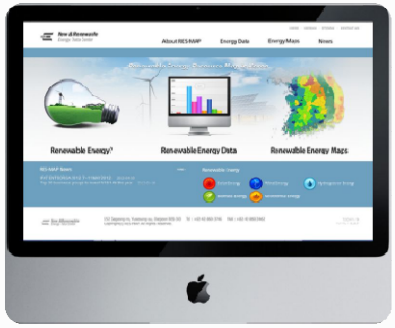
- Producing decision-making support system
- Producing optimum place analysis software
- Producing economical efficiency assessment software

Features

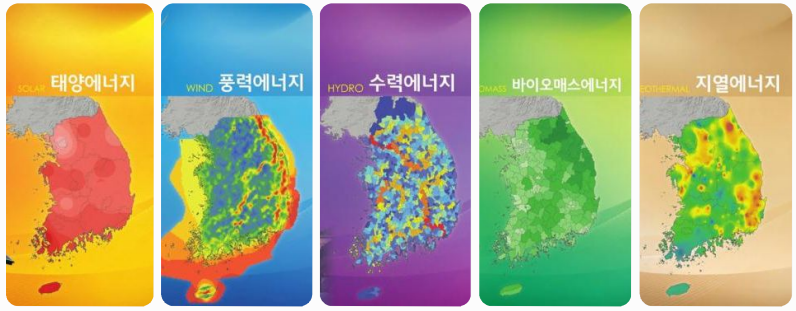
Build an information distribution system for encouraging the use of information

- Building Map-book publication system
- Producing web-based information distribution system
- Producing mobile applications

Mobile



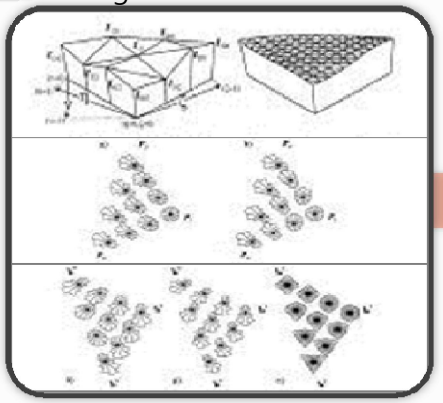
Website



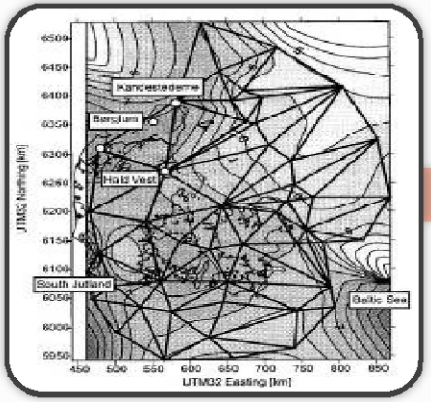
Map-Book

Building process (Solar)

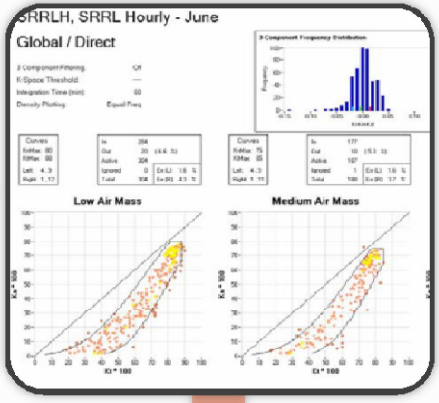
1 Determine methods of selecting and analyzing locations for building a measurement network



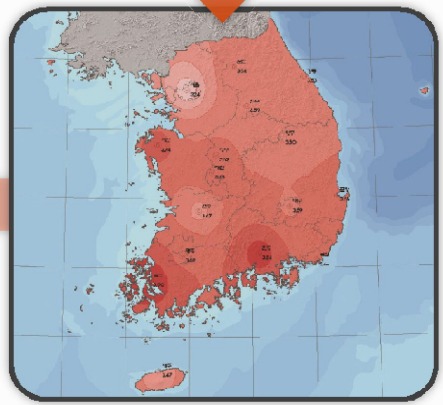
2 Build a measurement network map



3 Data collection and quality management



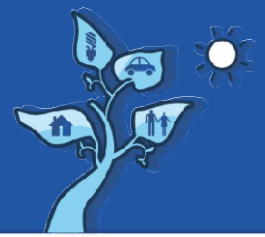
4 Prepare a resource map



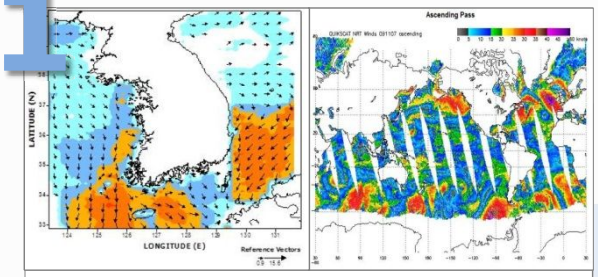
5 Analyze distribution features and evaluate the volume of resources

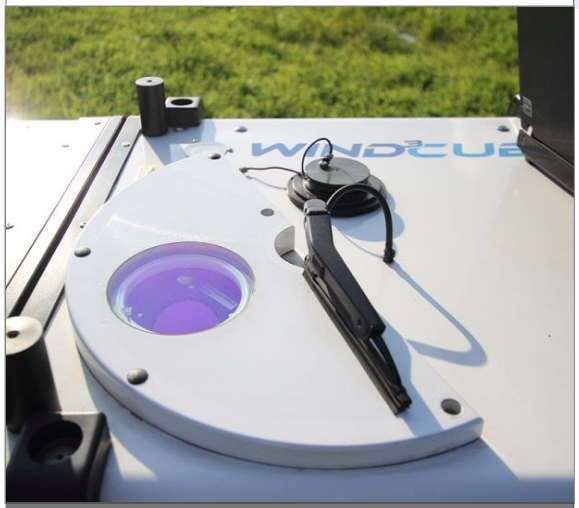
6 Apply complex design

Building process (Wind)



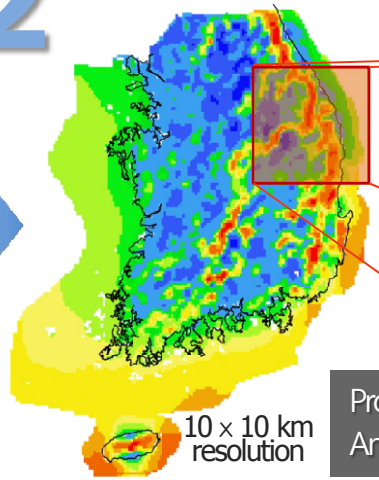
1





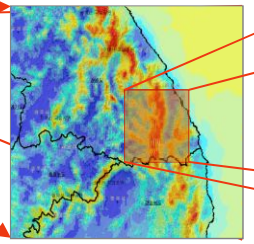
Obtain wind information by means of the numerical weather model Weather tower, Verify the wind information with LiDAR, SODAR

2

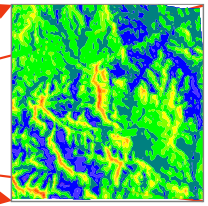


10 × 10 km resolution

< 1 km, 100 m, and 10 m for each resolution >



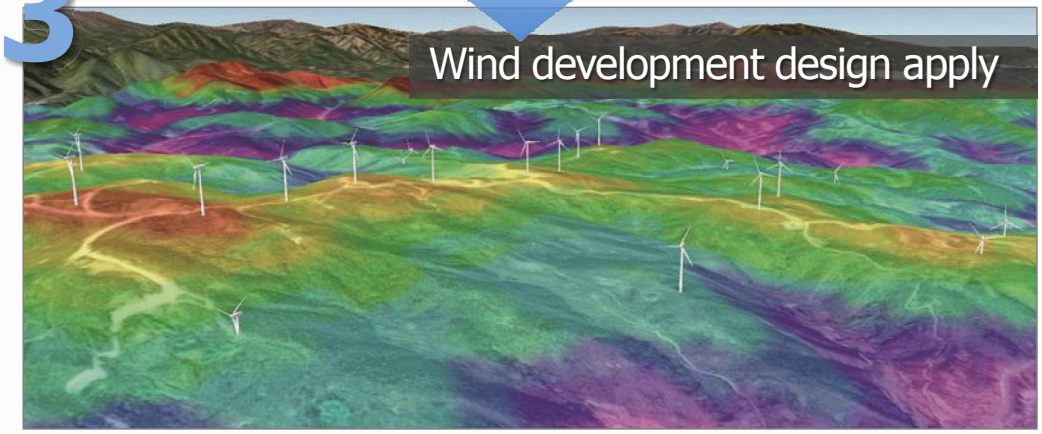
1 × 1 km resolution(now)



10 × 10 m resolution (in the future, partially)

Produce a wind power energy resource map
Analyze the volume of wind power energy resources

3

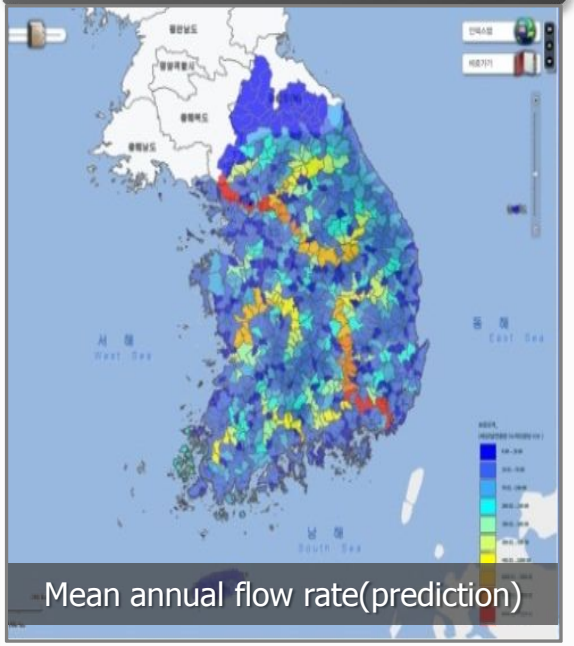


Wind development design apply

Building process (Hydro/Biomass/Geothermal)

Hydropower energy

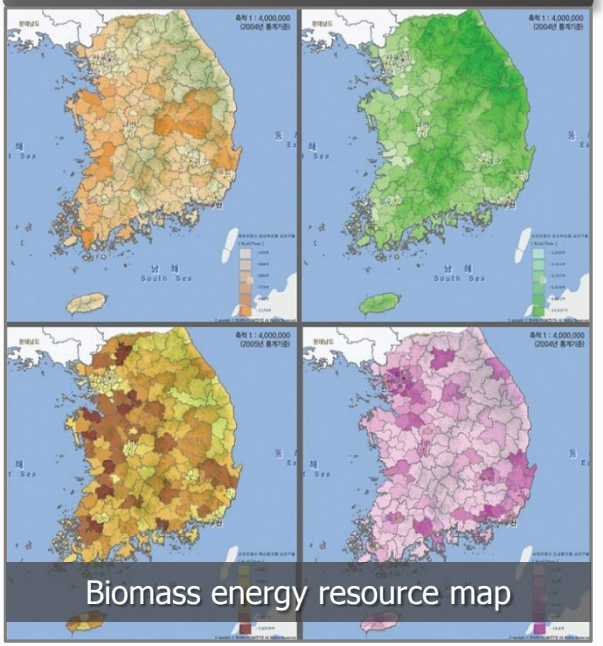
The volume of annually produced energy is estimated by calculating the flow in each standard basin



Mean annual flow rate(prediction)

Biomass energy

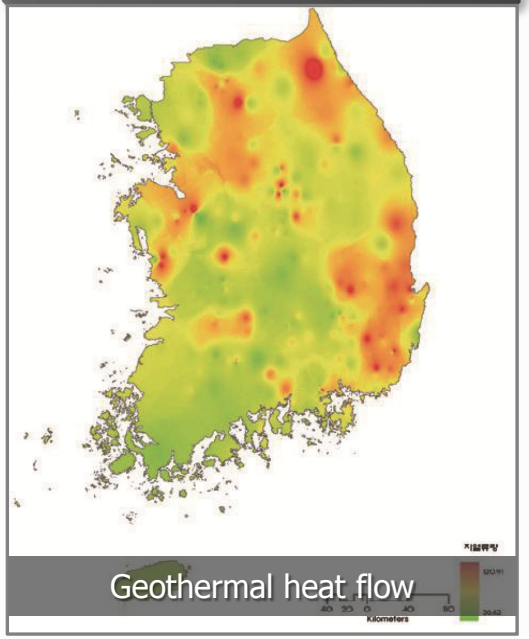
The volume of produced resource is estimated with statistics data for each administrative division



Biomass energy resource map

Geothermal energy

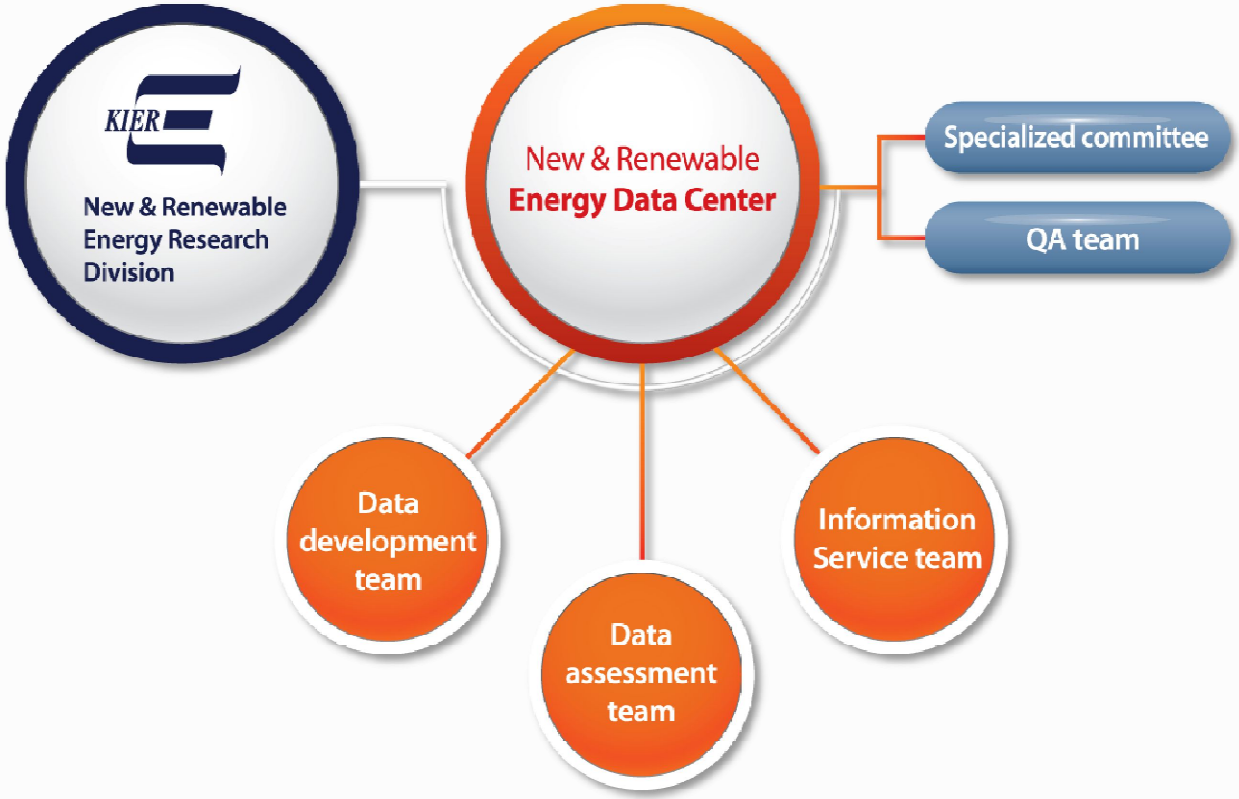
The data is produced for using geothermal energy with underground drilling data



Geothermal heat flow

Supporting

- KIER established since 1977 aims at energy research recognized
- Appointed as a national renewable energy data center
  - Researches and develops renewable energy resources, and resource maps
  - Builds a system for producing and using national standard data



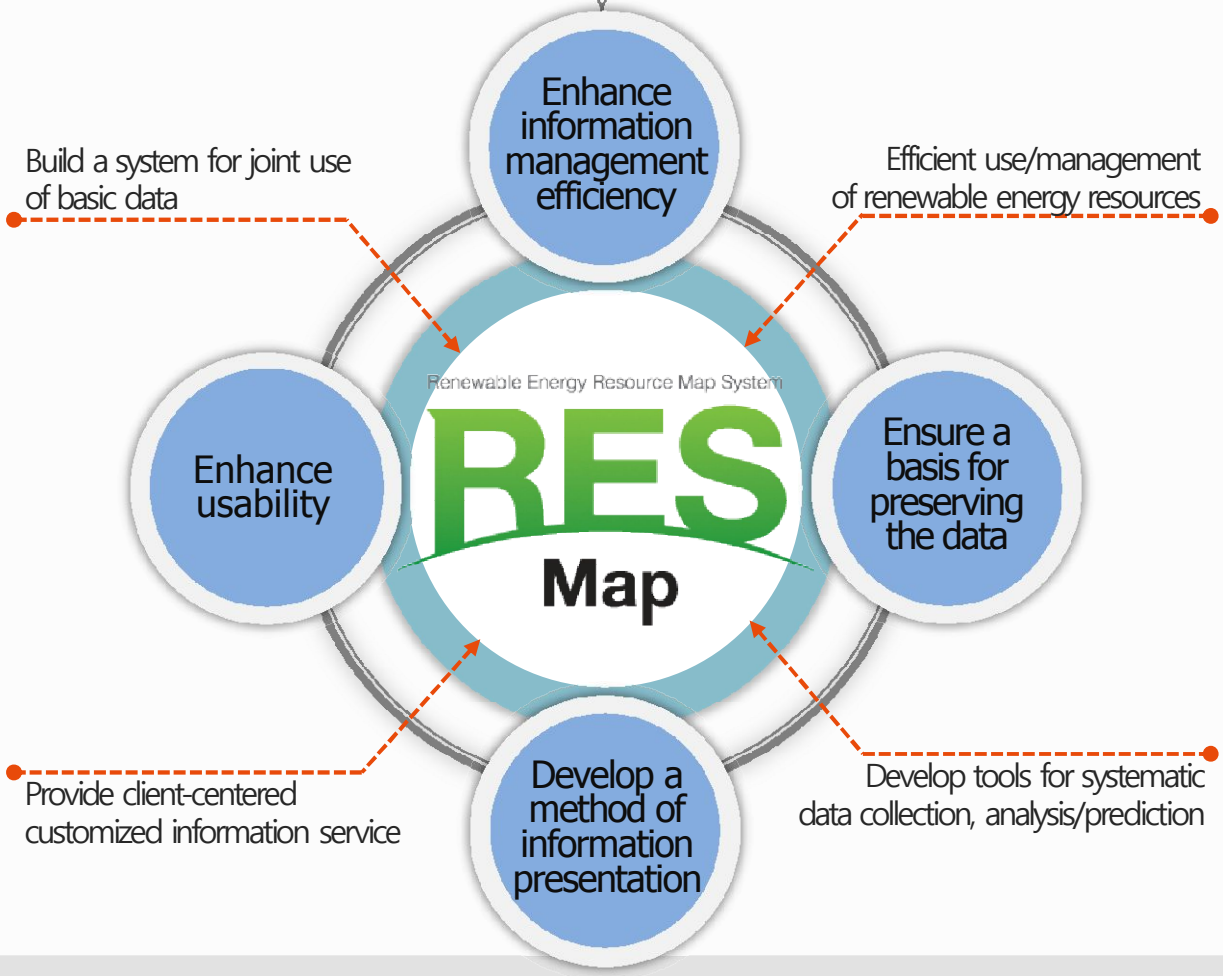
Supporting

한국에너지기술연구원
KOREA INSTITUTE OF ENERGY RESEARCH

- Main research areas
  - Renewable energy
  - Greenhouse gas emission reduction
  - Energy efficiency etc.

Expectation effectiveness

Comprehensive national renewable energy management system



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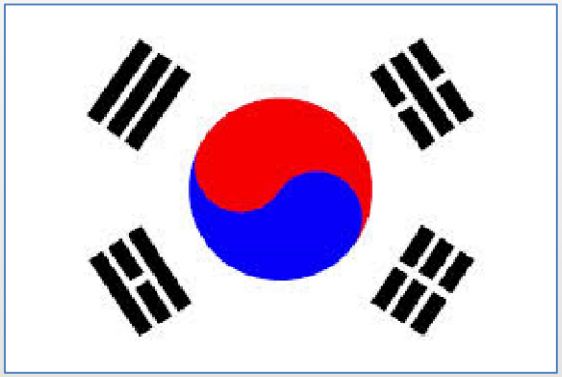
TECHNOLOGIES

Thank you
Спасибо

The KIER, a global energy innovator, does its best in pursuing its mission to invent world-class energy technologies based on open innovation, life-cycle research quality assurance, participatory and open communication. Therefore the KIER will become the best energy technology R&D institute in the world, contributing to the creation of wealth and improvement of quality of life for the people.



Dr. Ho Won Ra.

▷ Senior Researcher

▷ Clean Fuel Laboratory, Climate Change Research Division, KIER

(Korea Institute of Energy Research)

▷ **Major research fields**

Coal gasification technology

▷ **Major research**

Project on the 10BPD CTL demonstration plant from the Ministry of Science and Technology, Korea

Project on the optimization of coal gasifier and the improvement of operational reliability from the Ministry of Science and Technology, Korea

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Clean fuel technology
Based on coal gasification

2014 한-러 미래에너지 상생을 위한 협력 포럼

The KIER, a global energy innovator, does its best in pursuing its mission to invent world-class energy technologies based on open innovation, life-cycle research quality assurance, participatory and open communication. Therefore the KIER will become the best energy technology R&D institute in the world, contributing to the creation of wealth and improvement of quality of life for the people.

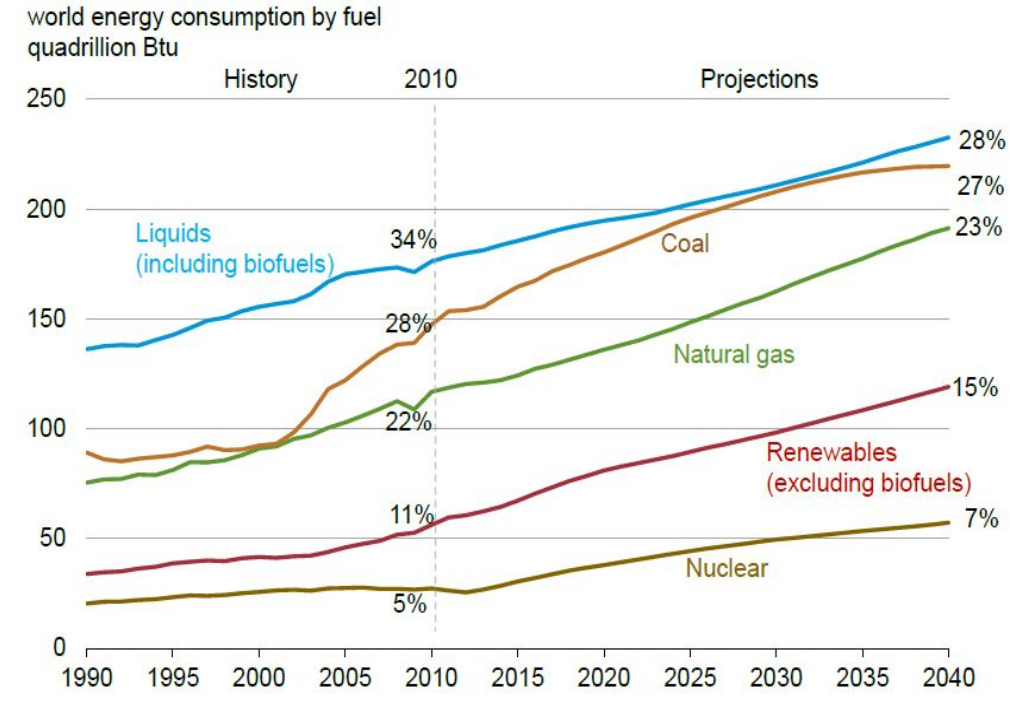
2014. 10. 21

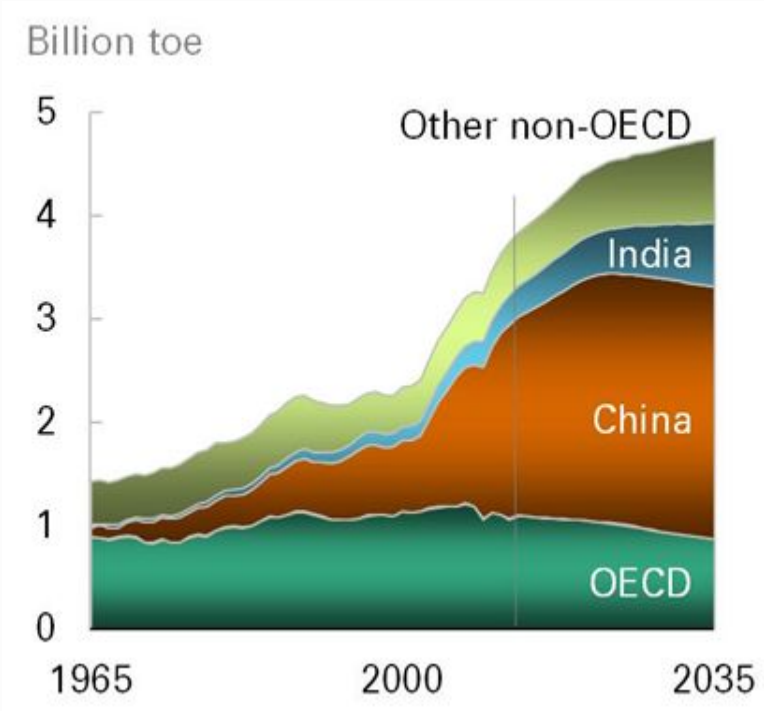
Ho won, Ra

Clean Fuel laboratory
Korea Institute of Energy Research

The 32nd ISTC-Korea Workshop 2014

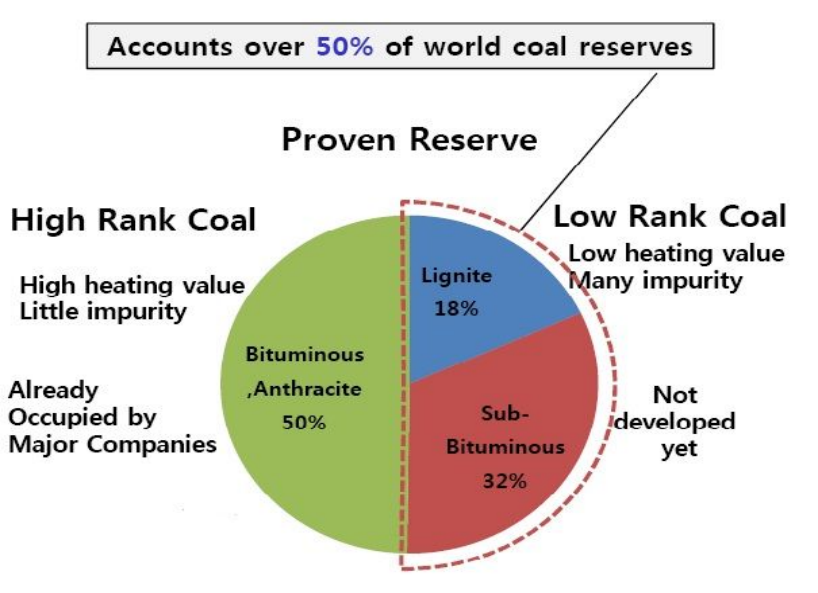
World Energy outlook-Coal Market outlook

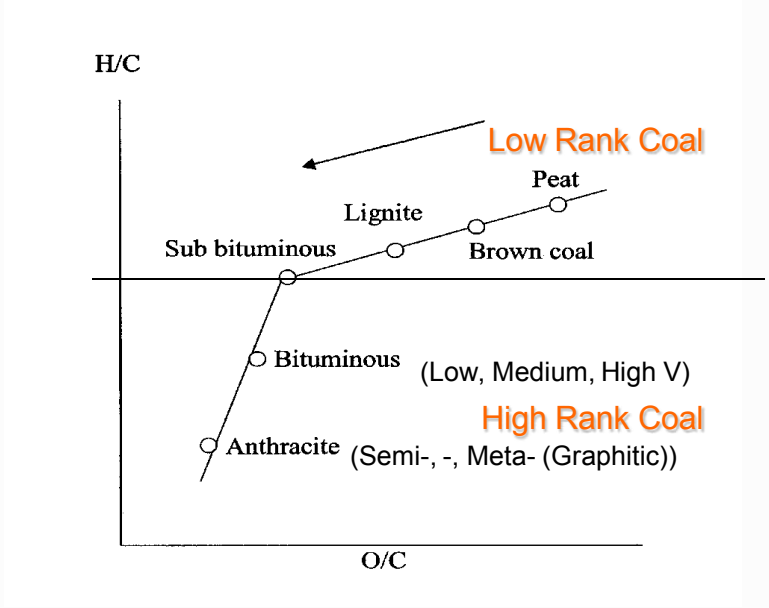




Coal is a reliable and abundant source for primary energy now and it will continue to serve as an important energy resource in the future.

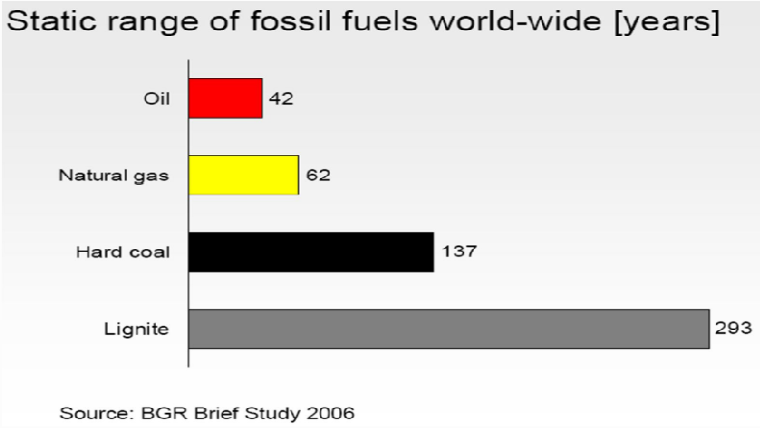
Low Rank Coal



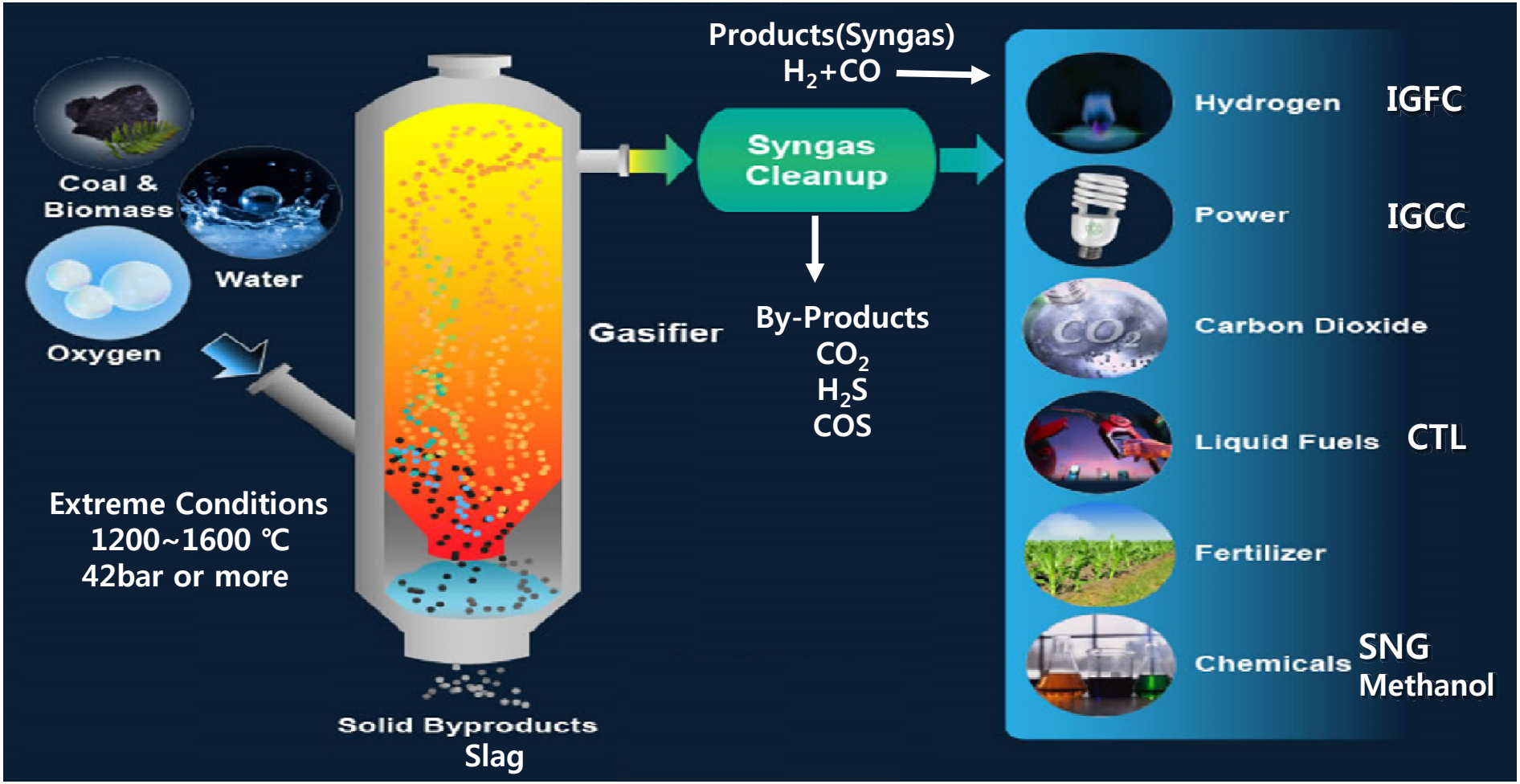


Low Rank Coal

- Vast reserves
- High moisture content entails high transportation cost, low thermal efficiency
- Safety hazards in transportation and storage due to spontaneous combustion characteristics



Coal gasification



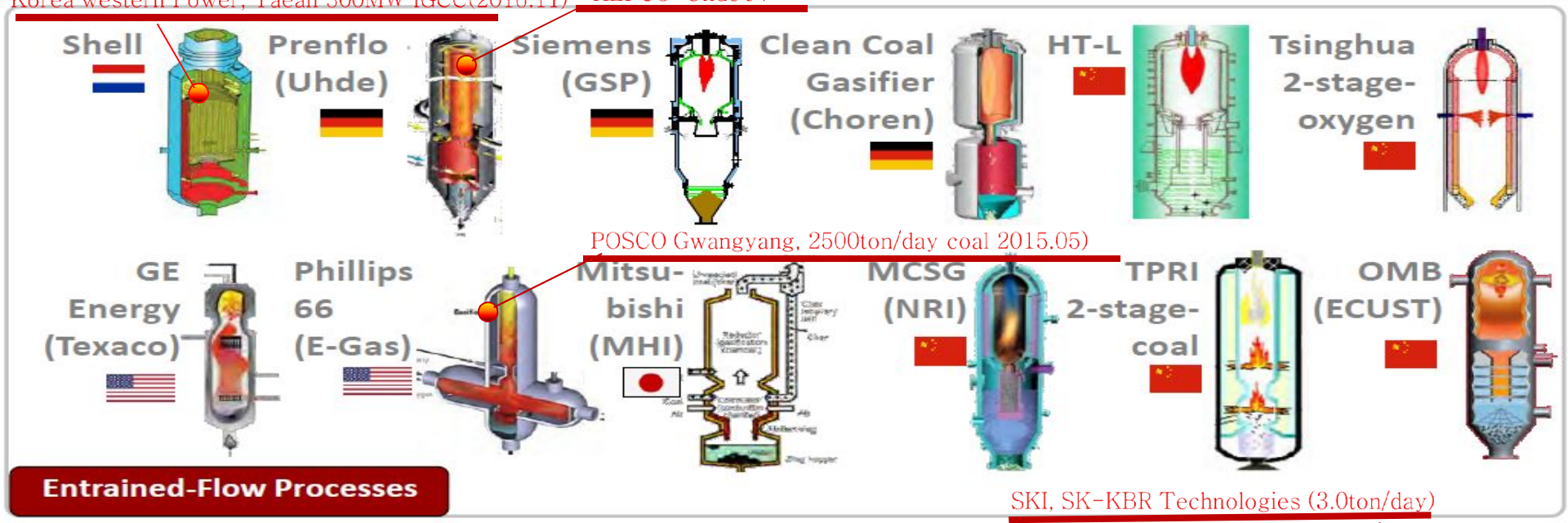
(출처 : www.netl.doe.gov)

Available Gasification Technologies

Korea western Power, Taean 300MW IGCC(2016.11)

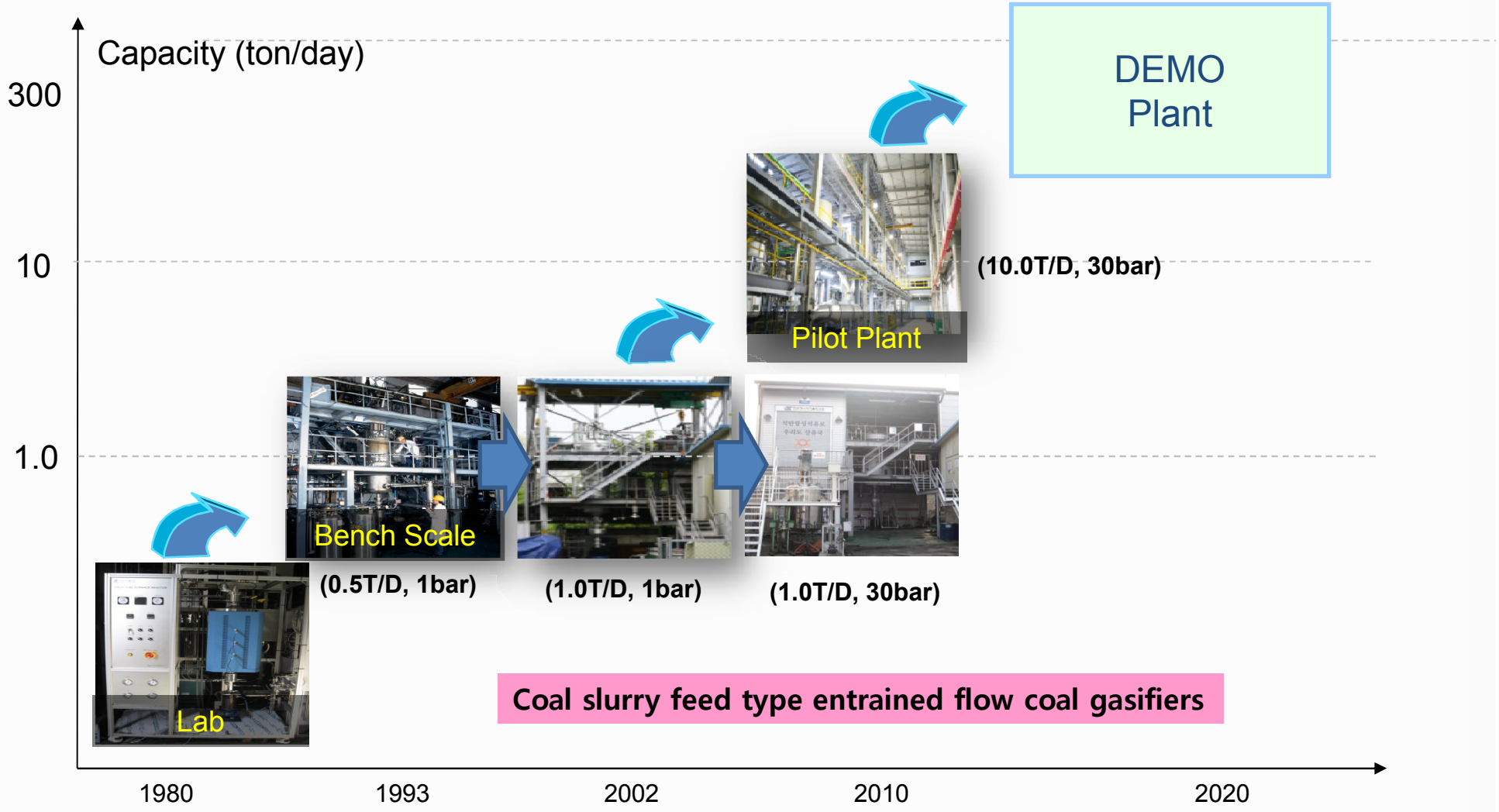
KEPCO-Uhde JV

POSCO Gwangyang, 2500ton/day coal 2015.05)

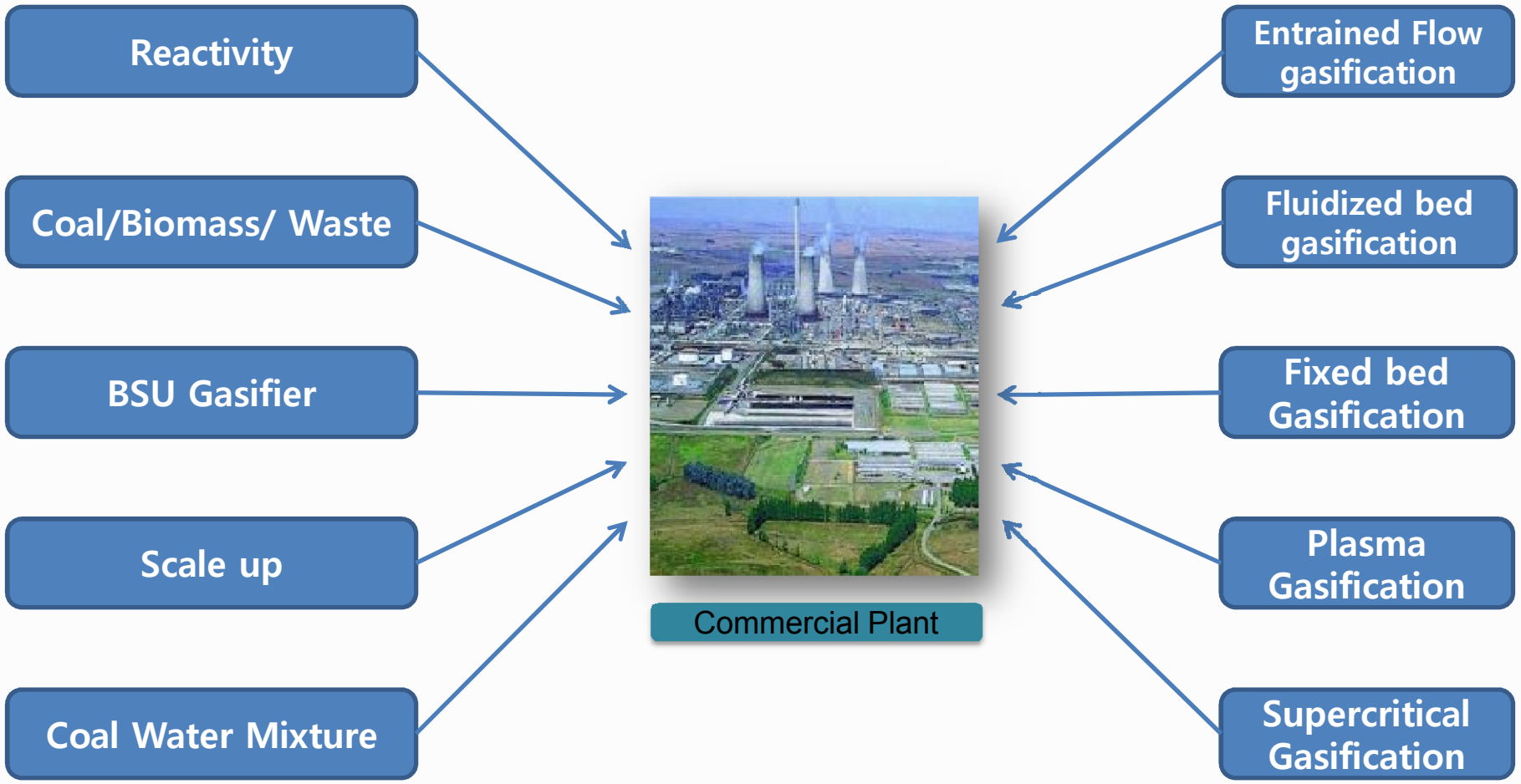


Graber & Meyer (2012)

Coal gasification R&D activities in KIER

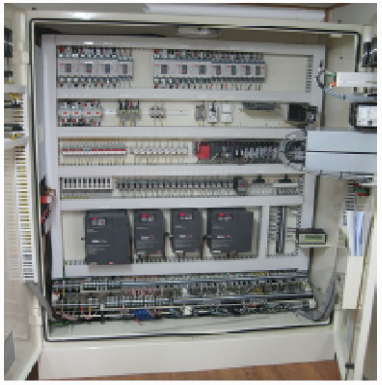


Current Status of R&D Project

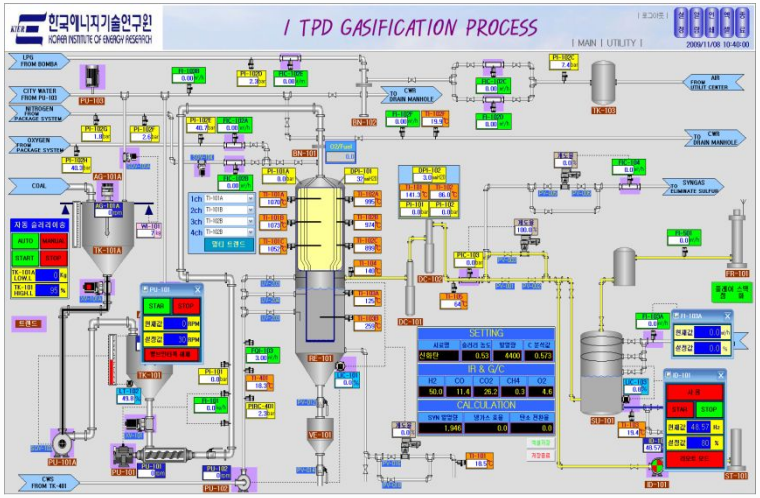


1.0T/D Entrained Flow Gasifier

[CCTV System]



[Control Panel]



[Control System]

10.0T/D Entrained Flow Gasifier

Coal/water Mixture

Oxygen

High pressure
slurry pump

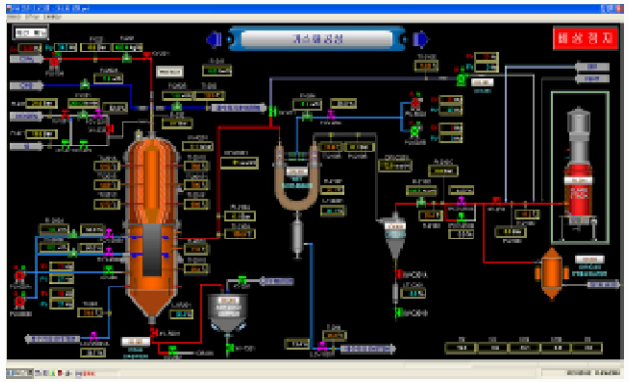
Coal Gasifier

Slag

Scrubber

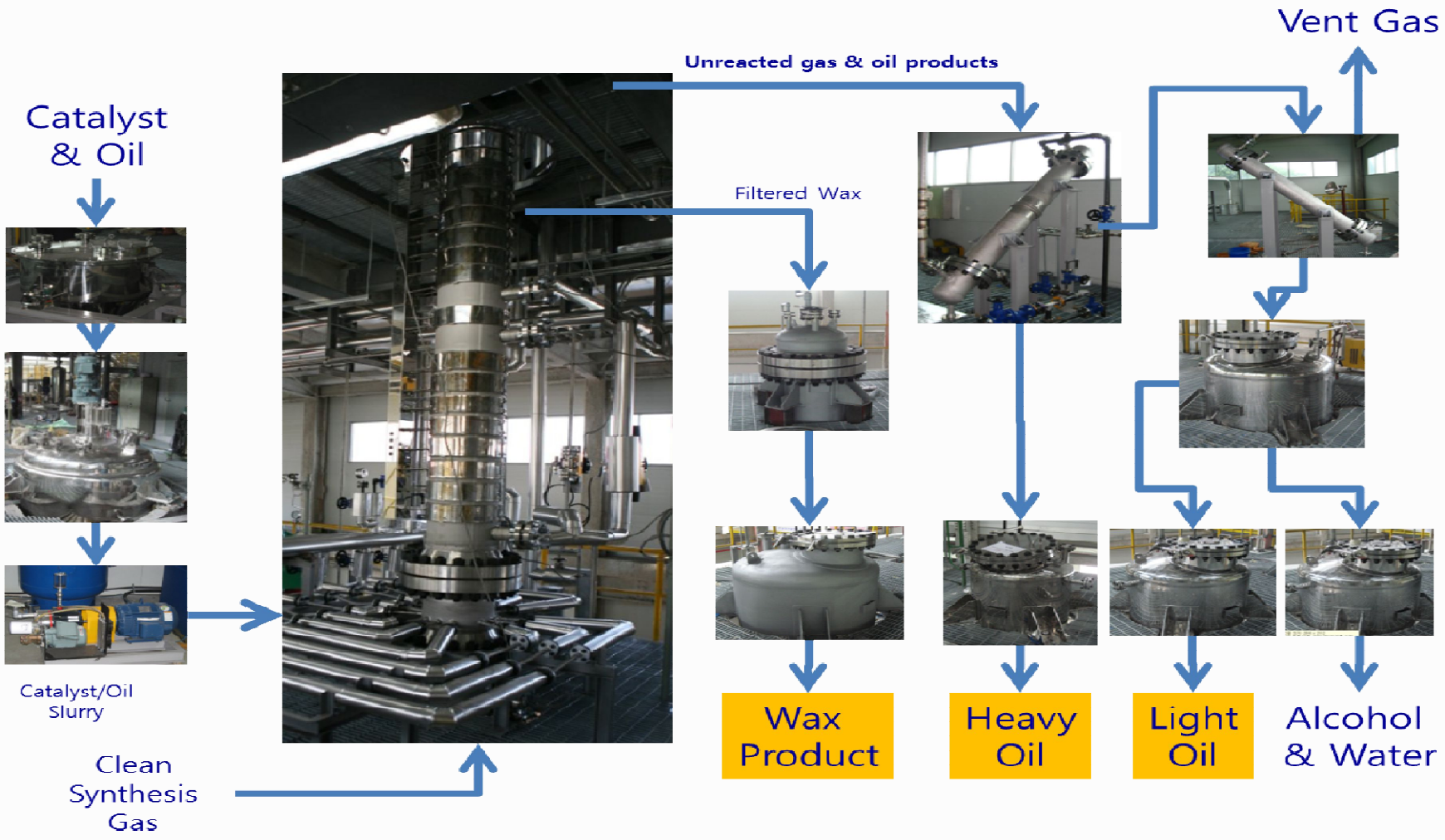
[Control Room]

Synthesis Gas

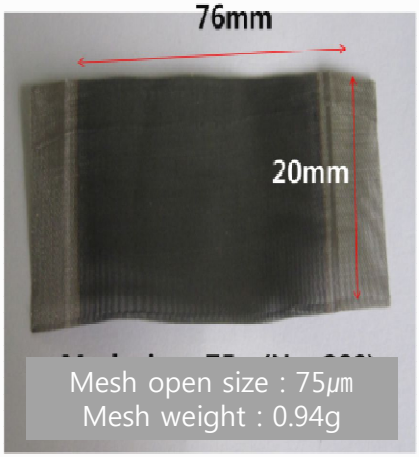


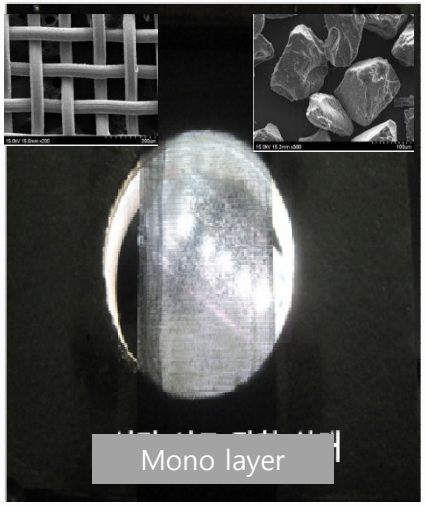
[Gasifier Control system]

Fisher Tropsche Reactors(15bbl/day)

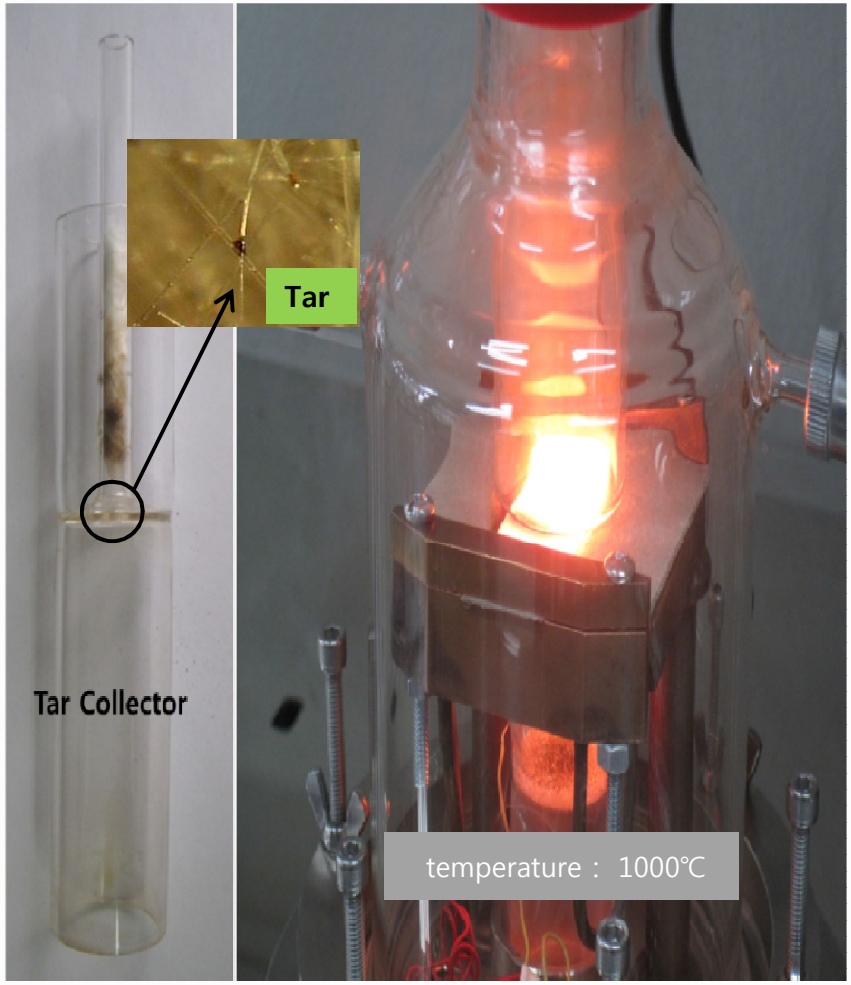


Wire Mesh Reactor



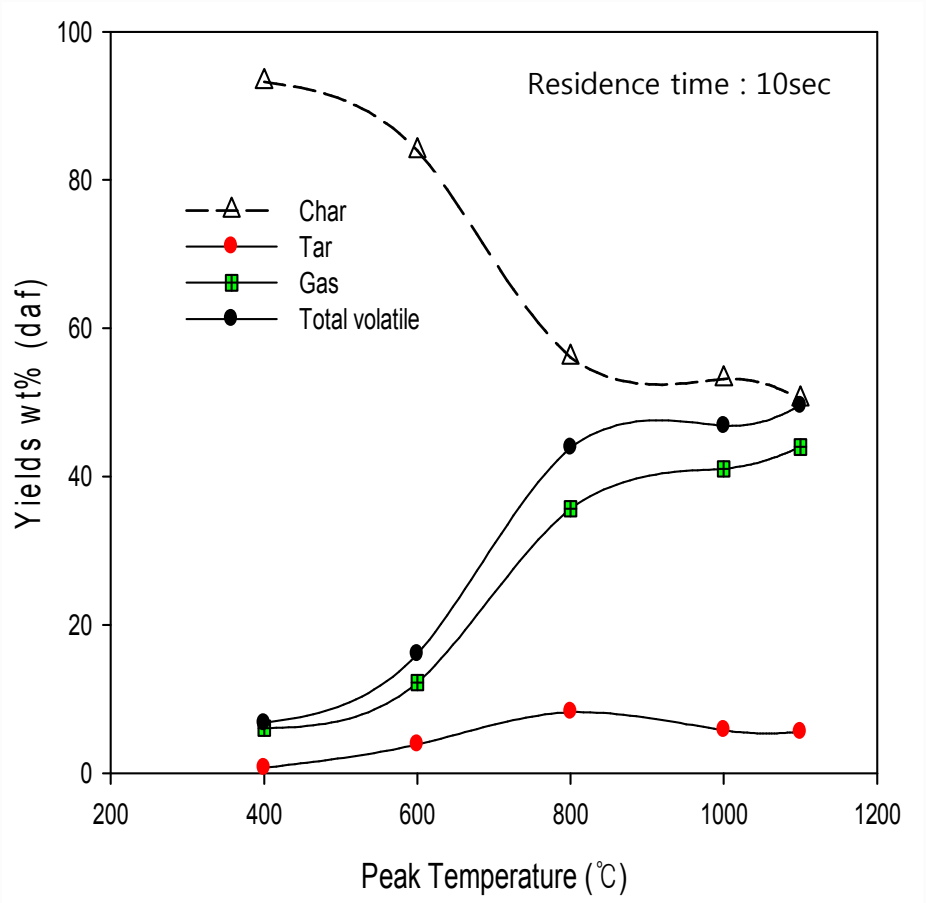


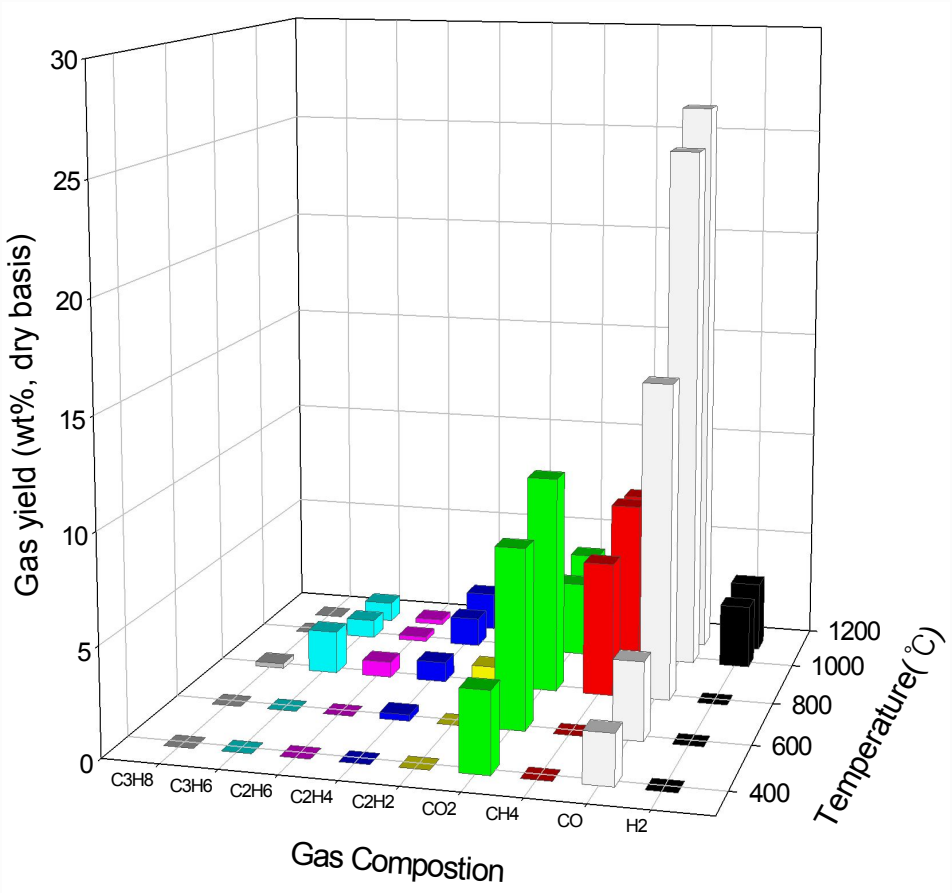
[Wire Mesh Reactor prepared for an experiment]



[wire mesh reactor in the heating stage]

Effect of peak temperature



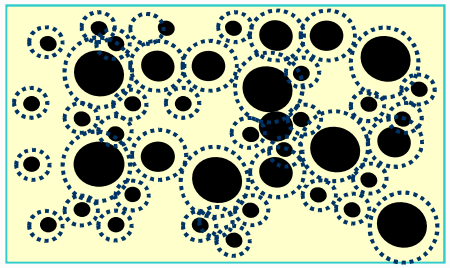


The devolatilization is almost completed at approximately above 800℃.
As the peak temperature increases, CO, CH_4 and H_2 tend to increase, while CO_2 and Hydrocarbon (CnHn) tend to decrease above 800℃.

Coal Water Mixture

- Surfactant
- Stabilizier
(under 1wt%)

Grinding & Mixing



- particle size : 74μm 75% ↑
- Coal Concentration : 60-70%

viscosity: under 2,000cp

Coal Water Mixutyre

Advantages of CWM

- CWM is a clean coal technology solution for big and small energy- By converting the coal into a liquid form, delivery and dispensing of the fuel can be simplified.
- CWM allows to utilize sewage water(from city canalization)
- CWM Ash is an ideal additive to concrete mixtures
- **Reduces cost price of Gcal and Kw*h**
- **CWM is an explosion-proof**
- **CWM is easy to storage and pumping**
- Almost any type of coal Could be used for CWM Preparation

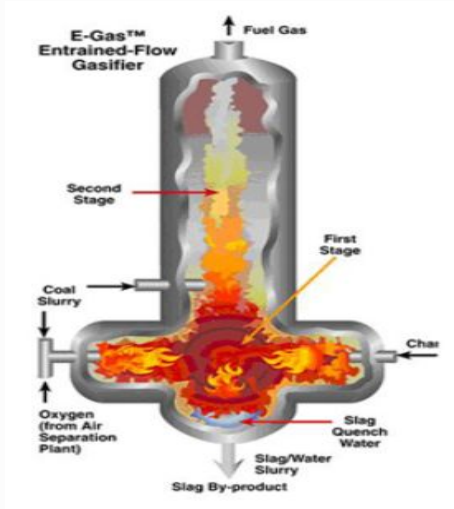
Use of Coal Water Mixture

High Concentration + Stabilization
(고농도화) (안정성)

Low Rank Coal
(Low Price)

Coal Water Mixture Plant

High Concentration



Gasifier

High Concentration + Stabilization

CWM Boiler(Heat, Steam)

Factor that affecting Concentration & stability of CWM

Configuration of the experimental apparatus

2ton/batch CWM Mixer

10kg/batch CWM Mixer

Pin Mill

Penetration Test

Ball Mill & Rod Mill

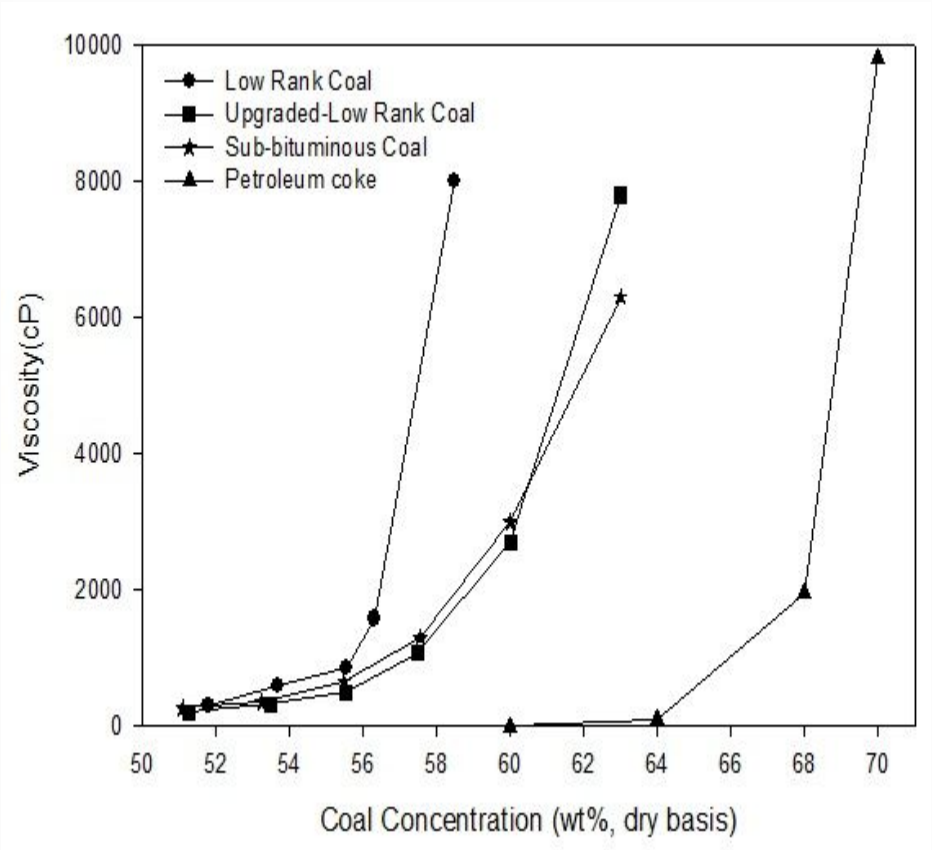
CWM Feeding Pump

Viscometer

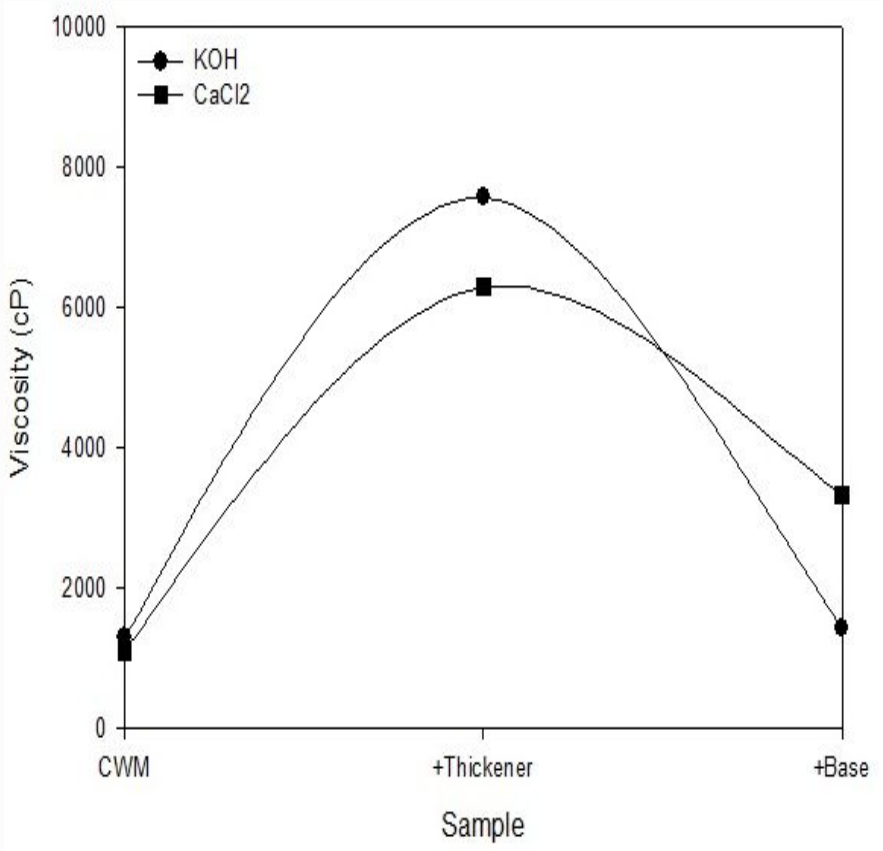
Moisture meter

High Concentration + Stabilization

CWM Manufacturing Video



[(CWM + Surfactant(0.6wt%)]



[(CWM(54wt%) + surfactant(0.6wt%)]
+[Polymer(0.2wt%) + pH additives(0.3wt%)]

THANKS FOR YOUR CONCERN

2014 한-러 미래에너지 상생을 위한 협력 포럼(베스트 웨스턴 강남)

The KIER, a global energy innovator, does its best in pursuing its mission to invent world-class energy technologies based on open innovation, life-cycle research quality assurance, participatory and open communication. Therefore the KIER will become the best energy technology R&D institute in the world, contributing to the creation of wealth and improvement of quality of life for the people.

Ho Won Ra

▷ Senior Researcher
▷ Clean Fuel Laboratory, Climate Change Research Division, KIER (Korea Institute of Energy Research)

▷ **Major research fields**

Coal gasification technology

▷ **Major research**

- Project on the 10BPD CTL demonstration plant from the Ministry of Science and Technology, Korea
- Project on the optimization of coal gasifier and the improvement of operational reliability from the Ministry of Science and Technology, Korea

한·러 기술이전 전략 및 사례

2014년 10월 21일

㈜유라스텍 이 선 영 대표

02-454-9204(5) / 010-8962-9204 /

ceoyoung@eurastech.com

EURASTECH

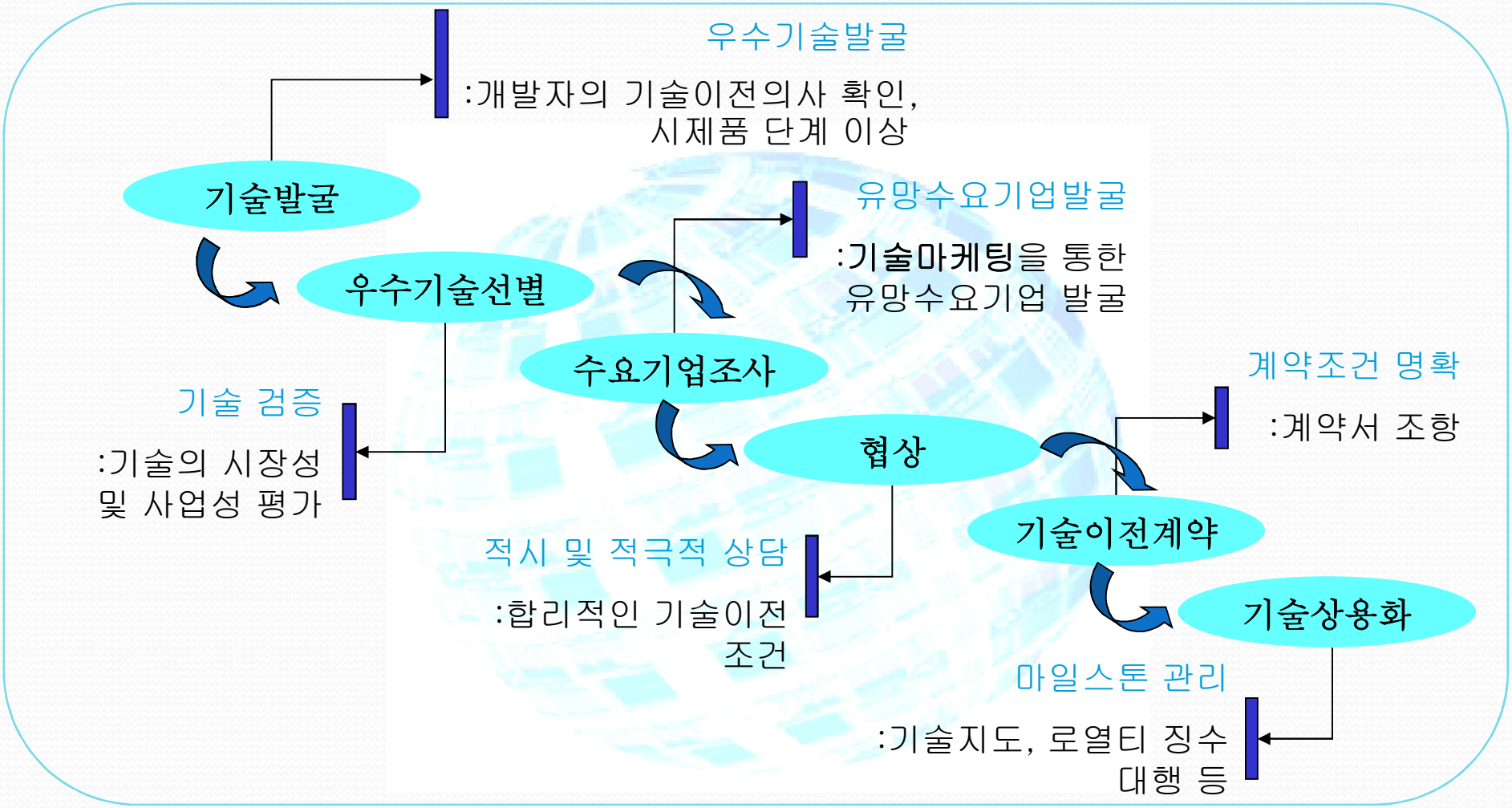
목 차

EURASTECH

❖ 기술이전의 특성에 따른 유형분류

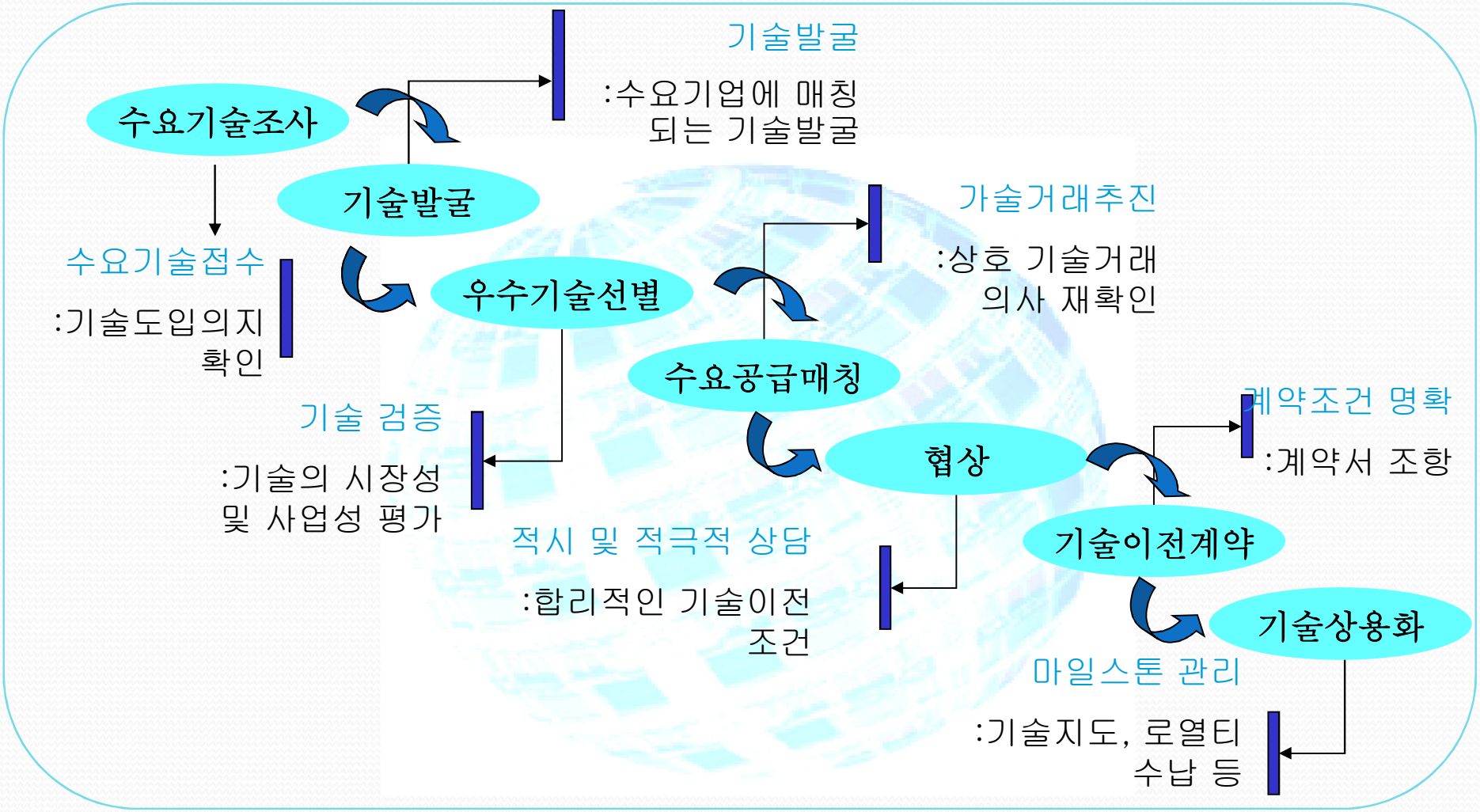
- 기술애로 극복을 위한 기술지도, 기술자문 등도 넓게는 기술이전의 한 유형임.
- 개인들 사이에서 일어나는 비공식 정보교류, 도서 및 잡지 등의 출판물, 산업전시회, 회의, 세미나, 워크숍참가 등에 따른 지식획득도 기술이전의 내용에 포함할 수 있음.

❖ Tech-push 방식의 기술거래 프로세스



EURASTECH

❖ Market-pull 방식의 기술거래 프로세스



EURASTECH

목 차

EURASTECH

❖ 네트워크 활용 기술발굴

- 기술 전문가 별로 구축해 놓은 네트워크를 활용하여 기술자료 및 정보 검색, 발굴

링웜치료제 기술도입 컨설팅

기술발굴

러시아 연방 과학 아카데미

러시아 국제과학기술센터

유한책임회사 «베트비오힘»

러시아 특허청 외 관련기관

0

기술자료 (2009년)

과학자 정보 (2009년)

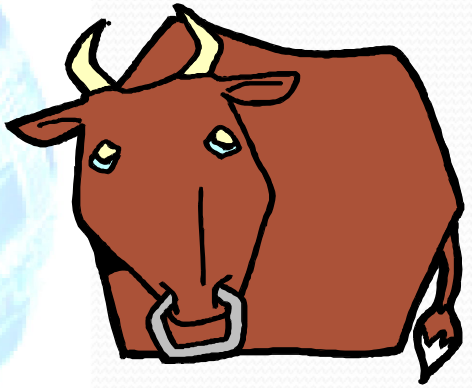
특허 정보 (2009년)

기술거래사

수요기술조사서 (2008년 하반기)

정보 (2009년)

한국 수의약품 제조기업



데르미코시드 제품개발 기술 발굴 – 데르미코사이드는 백선, 피부진균증(칸디다균, Trihophyton and Microsporum)으로 고생하는 모피를 가진 동물(주로 소, 개 및 고양이)의 치료 목적으로 사용된다.

링웜치료제 기술도입 컨설팅

기술검증 (2010년 상반기)

10개 농장 선별 – 약효 실험 –> **매우 우수 효과**

등록, 인증 조사 (2010년 하반기)

FDA 및 한국보사부 등록여건 조사

치료제 데르미코시드는 **그리세오풀빈** 8%를 항생물질 주성분을 함유하고 보조 항생물질로 노보카인, 덱사메타존, 디멕시드 (디메틸술폭시드), 트윈 80, 1.2 폴리프로필렌 글리콜을 내포하고 있다.

그리세오풀빈(분자식 $C_{17}H_{17}O_6Cl$): 물에 녹지 않으며, 에탄올 · 아세톤 · 벤젠 · 클로로폼 · 질산에틸에 조금 녹음. 진균류(眞菌類)의 발육을 강하게 저지하며 무좀과 같은 백선균증(白癬菌症)의 치료약으로 경구 투여. 호주 ADEC 분류에서는 B3로 분류, 유럽승인, 미국 FDA 미승인.

초음파 표면처리 기술도입 컨설팅

기술발굴

Institute of General Physics of the Russian Academy of Sciences

PROMETEY

North-Western Center for Ultrasonic Technologies Ltd.

모스크바전자기술대학

수요기술조사서 (2008년 하반기)

기술자료 (2009년)

과학자 정보 (2009년)

특허 정보 (2009년)

정보 (2009년)

한국 의료용품 제조업체

기술거래사

초음파표면처리기술은 초음파 진동에너지를 이용하여 큰 정적 및 동적하중이 부가된 볼로써 1초에 수만 번 이상의 타격을 금속 표면에 입히고 이로 인해 표층부의 조직을 나노결정 조직으로 개질함과 동시에 크고 깊은 압축잔류응력을 부가하는 기술임.

초음파 표면처리 기술도입 컨설팅

기술검증 (2010년 상반기)

러시아 방문하여 기술자 미팅, 개발현황 파악

샘플 테스트 (2010년 하반기)

기존 처리부품과 비교 – SEM 사진

러시아의 기술개발자의 열악한 연구 환경 확인. 대상 금속부품을 표면처리하기 위한 공작기계 준비 미흡.

러시아 기술지도, 개발자 초청 방향 논의

자동차밧데리 인디케이터 개발 과제

제품개발희망 한국기업 발굴
희망(2011년 하반기)

수요기업발굴

현지 전시회 참가

자동차밧데리 제조 기업

수요기업정보
(2011년)

기술거래사

필요제품
소개
(2011년)

한국 자동차부품 제조업체

러시아 기업의 제품개발 수요에 따라 한국 기업이 시제품을 만들어, 제품 수출계약 체결에 성공함.

자동차밧데리 인디케이터 개발 과제

수요기업검증 (2011년 8월) – 모스크바

러시아 국제자동차전시회 참가를 통해 수요기업 발굴

기술검증 (2011년 12월) – 인천

러시아기업이 내한하여 한국기업 공장 방문, 기술력 검증

거래 협상 (2012년 1월)

시제품 보여주고, 테스트 수행, 계약내용 협의

거래계약 체결 (2011년 1월) – 튜멘

계약금액 00만불 규모 수출 달성

목 차

성공 요인

원활한 커뮤니케이션

윈윈을 위한 양보

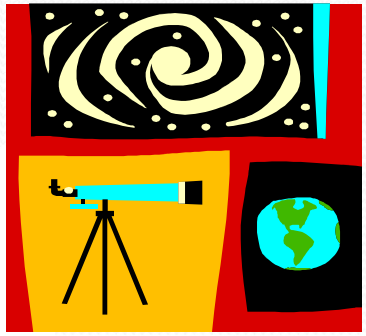
정보 공유, 지식 지원

실패 요인

제품성, 기술성

가격, 기술거래 조건

환경분석



INTERNATIONAL SCIENCE AND TECHNOLOGY CENTER ADVANTAGES OF PARTNERSHIP

David Cleave Executive Director of ISTC

cleave@istc.int

ISTC's History

- Founded in 1992 by the EU, Japan, USA, and Russia with current members also including Norway, Republic of Korea, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan and Tajikistan.
- ISTC has been one of the largest sponsors of R&D in the FSU supporting former defense scientists to redirect their R&D efforts to peaceful and market sustainable technologies.
- ISTC is currently headquartered in Moscow and has branch offices in Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan and Tajikistan.

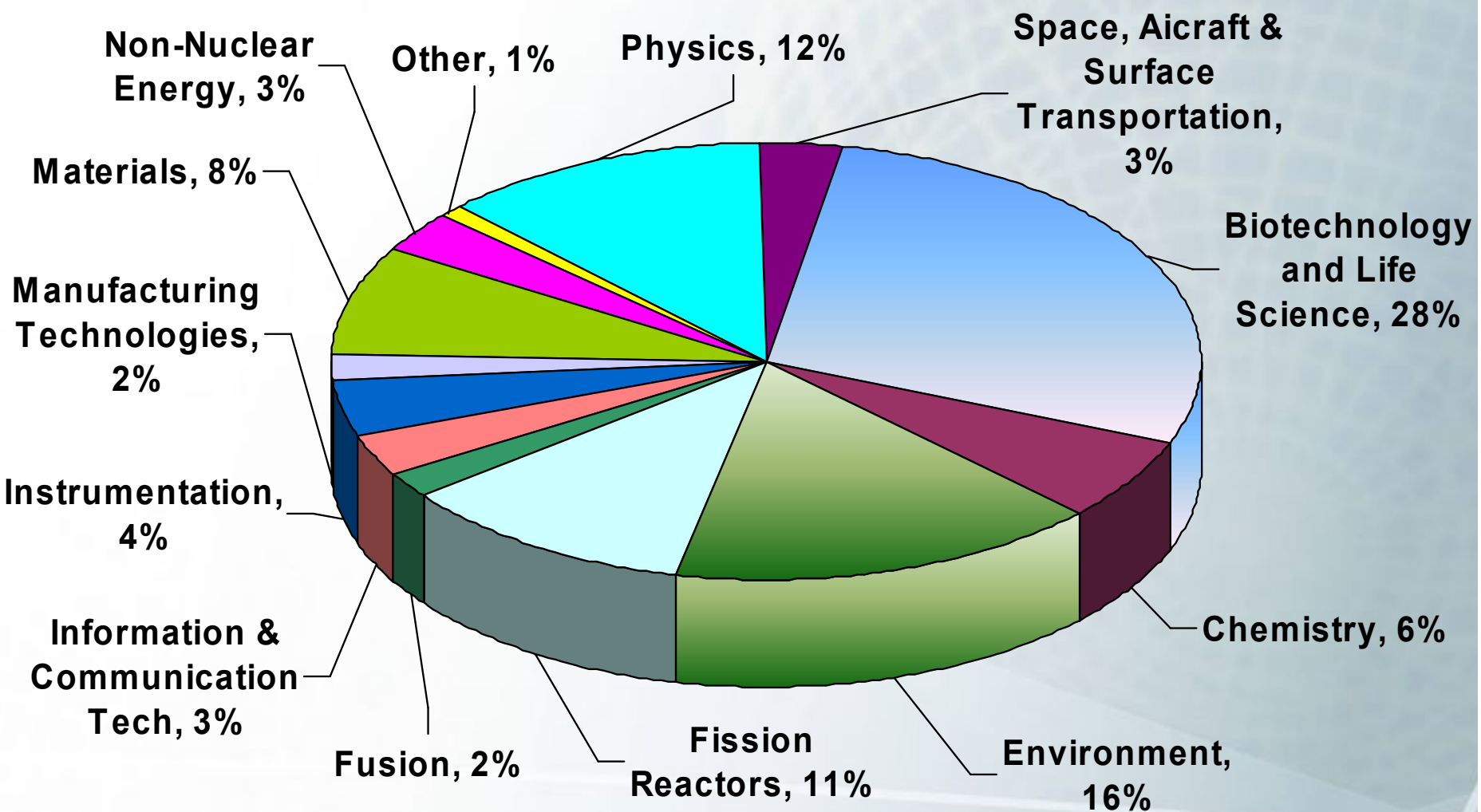
ISTC's Mission

- To support the nonproliferation efforts of our member countries by providing former Soviet weapons scientists, particularly those with knowledge and skills related to weapons of mass destruction opportunities to redirect their expertise to peaceful R&D fields.
- To facilitate interactions and collaborations between CIS and Georgian scientists with their global scientific counterparts.
- To support and manage R&D projects that address global problems and transition such research to market based economies for future sustainability.

Some of ISTC Activities

- Financially support, manage and audit R&D Projects at CIS and Georgian Institutes funded by governmental and non-governmental entities.
- Financially support and manage programs that provide CIS and Georgian scientists with: Travel Grants, Workshops, Seminars, Patent Support, Career Training and other activities.
- Provide Technology Match-Making services to Partners.

ISTC – Funding 1994-2013 Approaching 1 Billion USD



STC's Future

On June 5th 2014, the ISTC office in Astana, Kazakhstan was officially opened in preparation for the move of the main office from Moscow by the middle of 2015.

Develop new programs and activities in response to member countries' needs and priorities.

Plans to expand ISTC nonproliferation efforts and sustainable R&D support to new member countries.

Investigate and engage new sources of funding for R&D projects and programs.

vantages of Using ISTC:

- A proven record of more than 20 years of experience funding and managi R&D projects and activities at CIS/Georgian Institutes.
- A network of 100s of Institutes and 1000s of scientists in member countri with scienticific and technological expertise in many fields including: Biotechnology, Material Sciences, Energy Production, Nuclear Physics.
- Transparent mechanisms and procedures that have handled almost 1 Billion dollars for funded projects and activities in CIS/Georgia.
- Full service project planning and execution with on-site monitoring and audits.
- Customs- and duty-free imports of equipment for projects.
- Direct tax-free grant payments to R&D project recipients.
- Very competitive project labor and service fee costs.
- Free technology matching-making services for Partners.
- Intellectual Property Protection for project results.
- An international staff that is service oriented and responsive to Partners' needs.

www.istc.ru

PARTNERING with ISTC

www.istc.ru

ISTC's Partner Program

An ISTC Partner is a company, academic or scientific institution, governmental agency or other organization that is approved by our governing board and agrees to fund a research project and or other activities such as workshops, travel grants, seminars, training programs in CIS countries and Georgia.

ew of ISTC's Partners include:

) Partner projects with >$300 M in funding covering a wide range of technolo

www.istc.ru

hy Partners Work with ISTC

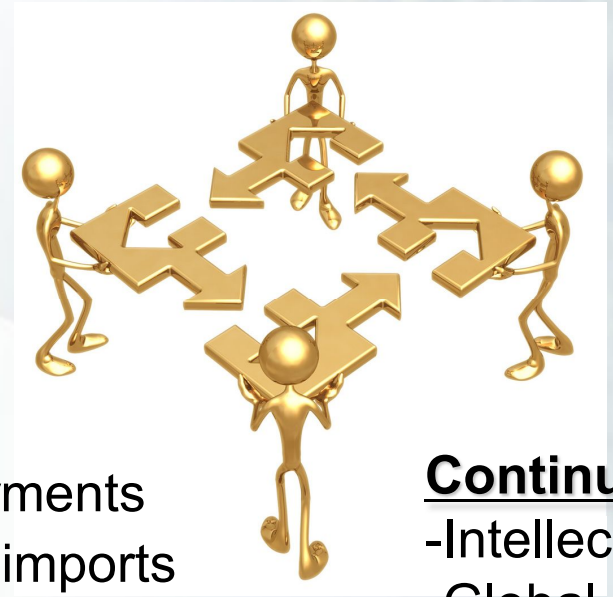
Professional Project Management

-Cross-Functional Bilingual Teams

-On-site monitoring and audits

Partnership with top scientists

-From 100s of qualified institutes with
1000s of scientists in CIS and Georg



Low Cost R&D

-Direct tax-free grant payments

-Customs- and duty-free imports

-Complete control of funds assured

Continuing Support

-Intellectual Property Rights Protec

-Global scientific exchange
(conference/travel/etc)

pact of ISTC Projects and Activities

- Redirection of 1000s of former Soviet weapons scientist by utilizing their expertise and research creativity for peaceful R&D that is focused on current global needs.
- >2800 basic and applied R&D projects resulting in 1000 of publications in international peer reviewed journals and 100s of Patents.
- Creation of new international scientific collaborations and networks between CIS/Georgian Institutes and scientists and their counterparts in the US, EU, Japan, Norway, Korea and other countries.
- Development of commercial and business oriented entities in CIS and Georgia that have resulted from ISTC projects, training programs and early-phase seed funding.

www.istc.ru

ANK YOU FOR YOUR ATTENTION!

l for more information about ISTC go to:
w.istc.int or contact:

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Krasnoproletarskaya 32-34
127473 Moscow
Russian Federation

E-mail: russo@istc.int
Tel: 7-495-982-3256
Fax: 7-499-978-4926
Website: www.istc.int

EURASTECH Corp.

Eurastech provides clients with a variety of services, including review and evaluation of data for commercializing technologies, consultation related with technology trade, development and distribution of technology transactions supporting system, and it is especially specialized in Russia.

EurasTech Corporation is a firm which seeks development and harmony of Europe and Asia through the medium of technology.

EurasTech provides clients with a variety of services, including review and evaluation of data for commercializing technologies, consultation related with technology trade, development and distribution of technology transactions supporting system, and it is especially specialized in Russia.

In the 21st century, an era of globalization, Eurasia containing the Far East will take a very important position in terms of economy, politics and culture.
Technological and human network and the ability of collecting information in this region will become an essential factor in enhancing national and corporate competitiveness in the future.
In accordance with this trend, EurasTech will make efforts to offer professional services with a view to increasing value of client's intellectual properties and thereby strengthening corporate competitiveness.
Thank you.

Eurastech corp.

CEO / Sun Young Lee

THANK YOU!

㈜유라스텍
АО Евраз Тех

EurasTech corp.,
Tech. Commercialization Team / Manager / Sang Hwa, Lee
bloodcon@eurastech.com / 82.2.454.9204(4)
Office 705, Kolon III B/D, Achasan-ro 49, Seongdong-gu, Seoul, Korea (133-110)