



KOREA-RUSSIA INDUSTRIAL HI-TECH FORUM 2014

# 한-러 기술포럼 및 기술매칭 상담회

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일시 : 2014년 11월 11일(화)

장소 : 베스트웨스턴 강남호텔

주관 : 중소기업진흥공단 주최 : (주)유라스텍

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# 한·러 기술포럼 및 기술매칭상담회 프로그램

시 간	번호	내 용	발표자 및 기관	비 고
09:00~ 10:00		접수 및 홍보물 배포(Registration)		
10:00~ 10:15		개회식(Opening Ceremony)		
10:00~ 10:10		발표자 및 VIP 소개(Introduction of Speakers & Guests)		사회자
10:10~ 10:15		인사말(Addresses to the Forum Participants)		중소기업진흥공단 본부장
10:15~ 12:30		Plenary session 1 / B2B상담 테마 1. 고급 제조기술의 보급 및 상용화		다이아몬드홀(포 럼) 에메랄드홀(B2B)
10:15~ 10:45	1	[기조연설] / 무선센서 네트워크를 이용한 에너지 저장의 설계 및 최적화 [Keynote Speech] / (Design and Optimization of Energy Harvesting Wireless Sensor Networks)	Vladimir Shakhov 러시아 과학아카데미 시베리아 지부 수학 및 물리학연구소 'ICMMG SB of RAS Institute of Computational Mathematics and Mathematical Geophysics'	광학 / 에너지 정보통신
10:45~ 11:05	2	나노의학기술: 비침습분자 유전학적 진단 방법 (Nanotechnology in Medicine: non-invasive molecular genetic diagnosi)	Andrey Toropovskiy 테스트제네 "TestGene" LLC	나노기술
11:05~ 11:25	3	신소재 및 신기술의 타분야 적용을 위한 트리 즈 방법론 (TRIZ-methodology for use of new materials and technologies in other fields of application)	Yury Danilovsky 젠쓰리 파트너스 'Gen3 Partners'	트리즈
11:25~ 11:40		휴 식(Coffee Break)		
11:40~ 12:00	4	중대하며 경제적인 인간활동의 부산물로서 본 질적인 수질변화의 주요인 (The Electric field – a powerful factor in the transformation of water in nature,economic and vital activity of people. Theoretical aspects and latest technological advances.)	Vitaly Andreev 전기환경기술그룹 'Electro Eco Technologies Group of companies'	전기전자
12:00~ 12:20	5	미래 나노의학 및 에너지 저장기술의 핵심요소 로서의 다기능 나노입자 (Multifunctional nanoparticles as a key factor for future nanomedicine and energy harvesting)	Atabaev Timur 우즈베키스탄 국립대학교 'National University of Uzbekistan'	나노기술
12:20~ 12:40	6	실험실 기술에서 대량생산으로 이행단계에서의 트리즈기법 사용 (Using TRIZ at the stage of transition from laboratory technology to mass production)	Vasily Lenyashin 젠쓰리 파트너스 'Gen3 Partners'	트리즈



12:40~ 14:00	중 식			
14:00~ 15:40	Plenary session 2 / B2B상담			다이아몬드홀(포 럼) 에메랄드홀(B2B)
	테마 2. 첨단 제조기술의 시장 흡수방법			
14:00~ 14:20	7	중소기업진흥공단 R&D 기술사업 소개	중소기업진흥공단 담당자	
14:20~ 14:40	8	내마모 고무를 신속히 식별하는 방법 (Method of rapid identification of wear-resistant rubber)	Oleg Olshansky 피아이알 'PIR Co.,Ltd'	금속/기계 자동차공학
14:40~ 15:00	9	주요 제품 설계기술 : 빅데이터 검색, 트리즈, 물리학, CAD (Key Product Design Technologies: Big Data Search, TRIZ, Physics, CAD)	Leonid Chechurin 상트페테르부르크 산업기술대학교 'Peter the Great St.Petersburg Polytechnic University'	트리즈
15:00~ 15:20	10	수처리의 복잡다양한 문제해결을 위한 전기-흡 착장비 실용화 (Applying Practice of Electro-Sorption Equipment for Solving Various Complex Issues of Water Treatment)	G. V. Andreev 유로텍스러시아 'Eurotex Russia company'	전기전자
15:20~ 15:40	11	공공 및 산업용 건물의 에너지 최적화(전기, 수 도, 가스 등)를 위한 과학데이터와 ISO 50001 의 사용 (Using Data Science and ISO 50001 to optimize energy (electricity, water, gas..) usage in public and industrial buildings)	Anton Tyukov 볼고그라드국립기술대학 Volgograd State Technical University	에너지
15:40~ 15:55	휴 식(Coffee Break)			
15:55~ 16:30	Q & A. Closing Remarks / B2B상담 Theme 3. Korea-Russia Technological Cooperation Policy Challenges and Demands 포토타임(Photo Time)			다이아몬드홀(포 럼) 에메랄드홀(B2B)
17:00~ 19:00	리셉션(Cocktail Reception)			



2014 •



TRIZ

2014 11



Theme 1.



## Dr. Vladimir Shakhov.



러시아 과학아카데미 시베리아지부 수학  
및 물리학연구소 선임연구원.

- 노보시비르스크 시베리아 정보통신대학 컴퓨터 시스템 학부  
조교수.
- 노보시비르스크대학 졸업 / 2000년 컴퓨터공학 박사학위  
취득.
- 최근 '정보학 문제' 저널의 부편집장 및 러시아 기초연구 재단  
프로젝트팀 리더로 활동 중.
- 70개 이상의 과학논문과 삼성전자로부터 할당받은 특허  
2개의 저자.
- 그의 과학연구결과는 러시아 과학아카데미의 주요성과 목록에 포함되어  
있음.
- 그는 Intel, 삼성전자, 로스탈레콤과 함께 프로젝트에 성공적으로 참여했음.
- 2005년~2008년, 2010년~2012년 성균관대학교(수원)의 교수로 초대되어  
연구 활동을 하였음.
- 주 연구 분야는 기술시스템, 효율적인 에너지소비, 네트워크 보안  
및 서비스 품질지원, 리스크 관리, 무선 네트워크 센서,  
소프트웨어 공학에 대한 메커니즘의 성능분석.





# Design and Optimization of Energy Harvesting Wireless Sensor Networks

Vladimir V. Shakhov

Institute of Computational Mathematics and Mathematical Geophysics

(formed Computer Centre)

Russian Academy of Science

Novosibirsk, Russia



# Outlines

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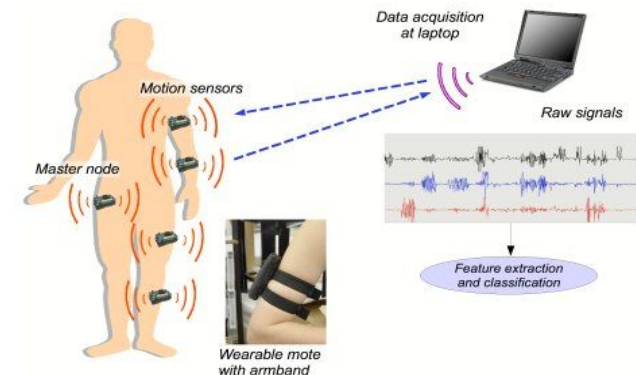
1. Introduction
2. Problems
3. Experiment Design Technique
4. Applications for Optical Technology
5. Tools for WSNs Security Supporting
6. WSNs Connectivity
7. Novel Concept of WSNs Design



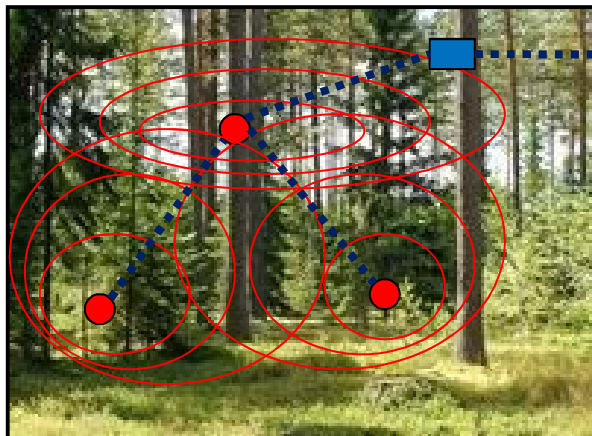
# Introduction

A **wireless sensor network** (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions

## medical diagnostics



## environmental monitoring



## smart home





# Applications

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1. **air pollution monitoring**
2. **water quality monitoring**
3. **landslide detection**
4. **forest fire detection**
5. **military applications**
6. **machine health monitoring**
7. **traffic and tracking**
8. **health care**
9. **smart home**
10. **etc**



# Prospect

WinterGreen Research:

- grow rapidly over the next years
- from \$789 million in 2012 to \$7 billion by 2019

## ZigBee Alliance:





# *Motivation*

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“Sensor networks can vastly enrich our understanding of how the world works, opening the door to entirely **new computing applications**”.



“In a few years, networked sensors and actuators will outnumber traditional electronic appliances. They will enable a plethora of **new services and applications** in industrial automation, asset management, environmental monitoring, medical and transportation business, and in a variety of safety and security scenarios”



“ With the standardization of IEEE 802.15.4 and ratification of the ZigBee standard, this field has received a significant new surge and is now realizing many **new and innovative applications** in home and building automation, industrial automation, health-care, security, and consumer markets”





# ***Problems***

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- A cost of sensor components is a **critical** consideration in the design of practical sensor networks.
- A cost of sensor network increases with sensor battery power.
- By this reason a battery power is usually a scare component in wireless devices. On the other hand, sensor lifetime depends on battery lifetime.

Thus, an efficient power consumption is an important direction of sensor networks investigations



# ***Lifetime and Sleeping***

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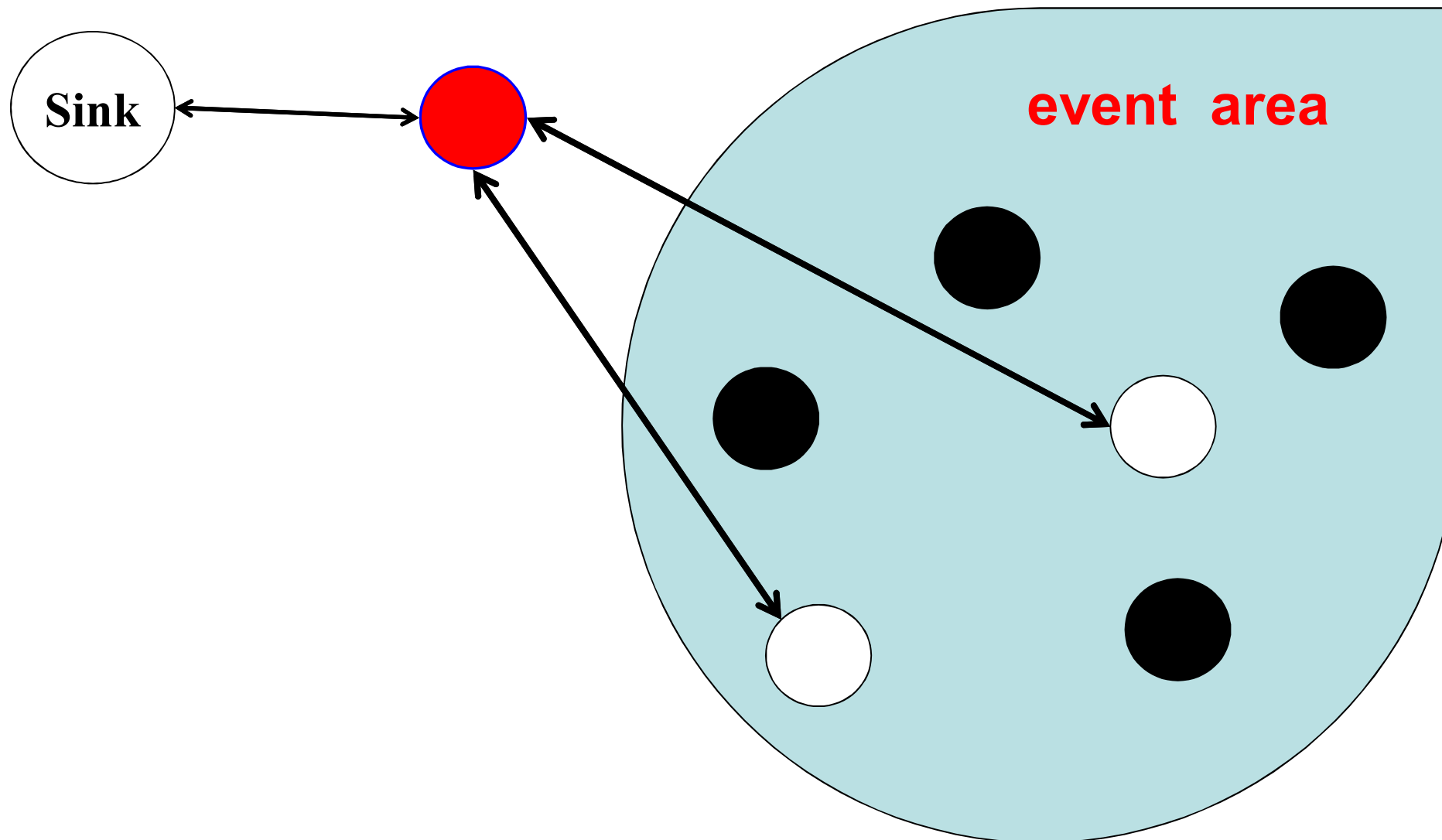
A widely employed *energy-saving approach* consists in placing sensors in sleeping mode. During *sleeping time* a sensor can not be used for data transmission or other services like environment monitoring.

With sleeping mode the sensor power consumption becomes low and the lifetime of a sensor increases. However, network reliability and performance degrades.

Thus, it is necessary to find a trade-off between sleeping time and network performance.



# Problem





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# ***Experiment Design Technique***

get a lot and save money



# Sensing Model (+Energy Harvesting)

The detection ability of sensor is defined as follows

*the binary sensing model*



*the prob sensing model*

$$P = \begin{cases} 1, & x < R \\ 0, & \text{otherwise.} \end{cases}$$

$$P = \begin{cases} 1, & x \leq R \\ e^{-\alpha(x-R)}, & \text{otherwise.} \end{cases}$$

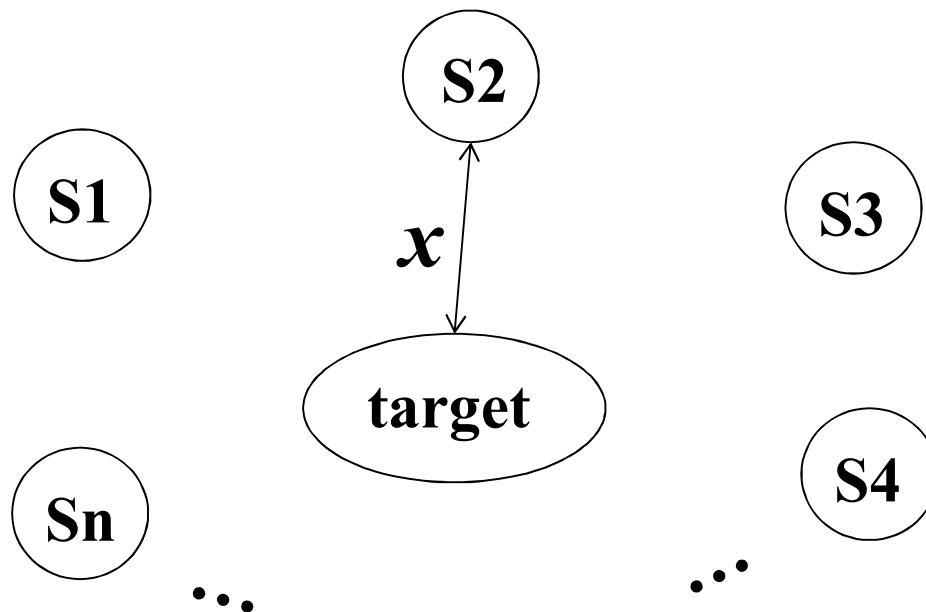
*Zhiyun Lin etc: An incremental deployment algorithm for wireless sensor networks using one or multiple autonomous agents. **Ad Hoc Networks** 11(1) (2013) 355-367.*

*I. Altinel etc: Binary integer programming formulation and heuristics for differentiated coverage in heterogeneous sensor networks, **Computer Networks** (2008) 2419 - 2431.*

*Q. Yang etc: Energy-Efficient Probabilistic Full Coverage in Wireless Sensor Networks, **Proceedings of IEEE Globecom**, CA, USA, 3-7 Dec. 2012, 609-614.*



# Motivation



$$P(n) = 1 - \left(1 - e^{-\alpha x}\right)^n \geq q$$

$$n \geq \frac{\ln(1 - q)}{\ln(1 - e^{-\alpha x})}.$$

Let  $q = 0.99$ ,  $x = 2$ ,  $\alpha = 1 \Rightarrow n_{opt} = 32$ ;      if  $\hat{\alpha} = 1.1 \Rightarrow \hat{n} = 40$

Other example: WSNs with duty cycle



# ***Experiment Design Technique***

Assume that the sensing quality is described by the following regression model

$$y = \eta(x, \theta) + e$$

Let us define the experimental design:

$$\varepsilon(N) = \begin{pmatrix} x_1, \dots, x_n \\ r_1, \dots, r_n \end{pmatrix} \quad \sum_{i=1}^n r_i = N$$

The Fisher information matrix

$$M(\varepsilon(N)) = \sum_{i=1}^n \omega(x_i) r_i (\nabla \eta(x, \theta))^T \nabla \eta(x, \theta)$$

$M^{-1}$  equals the covariance matrix of  $\theta$  estimations



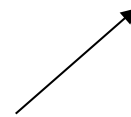
# ***Problem (non-linear regression)***

$$\hat{\theta} = f(\theta)$$

However:

$$\max M(\varepsilon(N)) \Rightarrow x_{opt} = g(\theta)$$

$$y = \eta(x_{opt}, \theta) = Const$$



**Focus, concrete value**



# ***D-optimal Design***

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The D-optimal design  $\varepsilon^*$  is obtained as the solution of the optimization problem as follows

$$\begin{aligned} & \max_{\varepsilon_N} \det M(\varepsilon(N)), \\ & \sum_{i=1}^n r_i \leq N, \\ & x \in \Omega_x. \end{aligned}$$

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$$\varepsilon^* = \begin{pmatrix} x_1 \\ N \end{pmatrix}, \quad x_1 = \arg \max_{x \in \Omega_x} \left( \omega(x) \left( \frac{\partial \eta(x, \theta)}{\partial \theta} \right)^2 \right); \quad \frac{\omega'_x(x)}{\omega(x)} = - \frac{\eta''_{\theta x}}{\eta'_g}$$



# ***D-optimal Design***

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Assume,  $\omega(x) = \text{Const} > 0$ ;

$\left(\eta'_\theta(x, \vartheta)\right)^2$  is a monotonic decreasing function of  $x$

Hence,

$$x_1 = \arg \max_{x \in \Omega_x} \left( \left( \frac{\partial \eta(x, \theta)}{\partial \theta} \right)^2 \right) = \min \{x : x \in \Omega_x\}$$

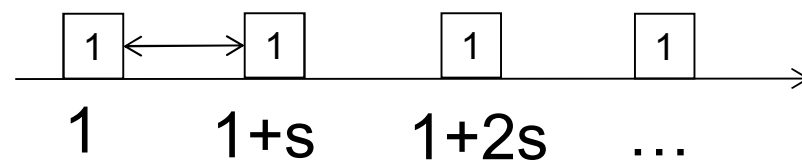
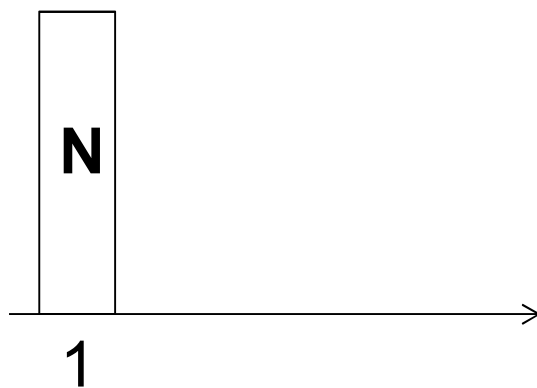


# Performance Analysis

$$\eta(x, \theta) = e^{-\alpha x}$$

Assume,  $\alpha = 1$ ,  $\omega(x) = \text{const}$ ,  $x \geq 1$ ,  $N=100$ .

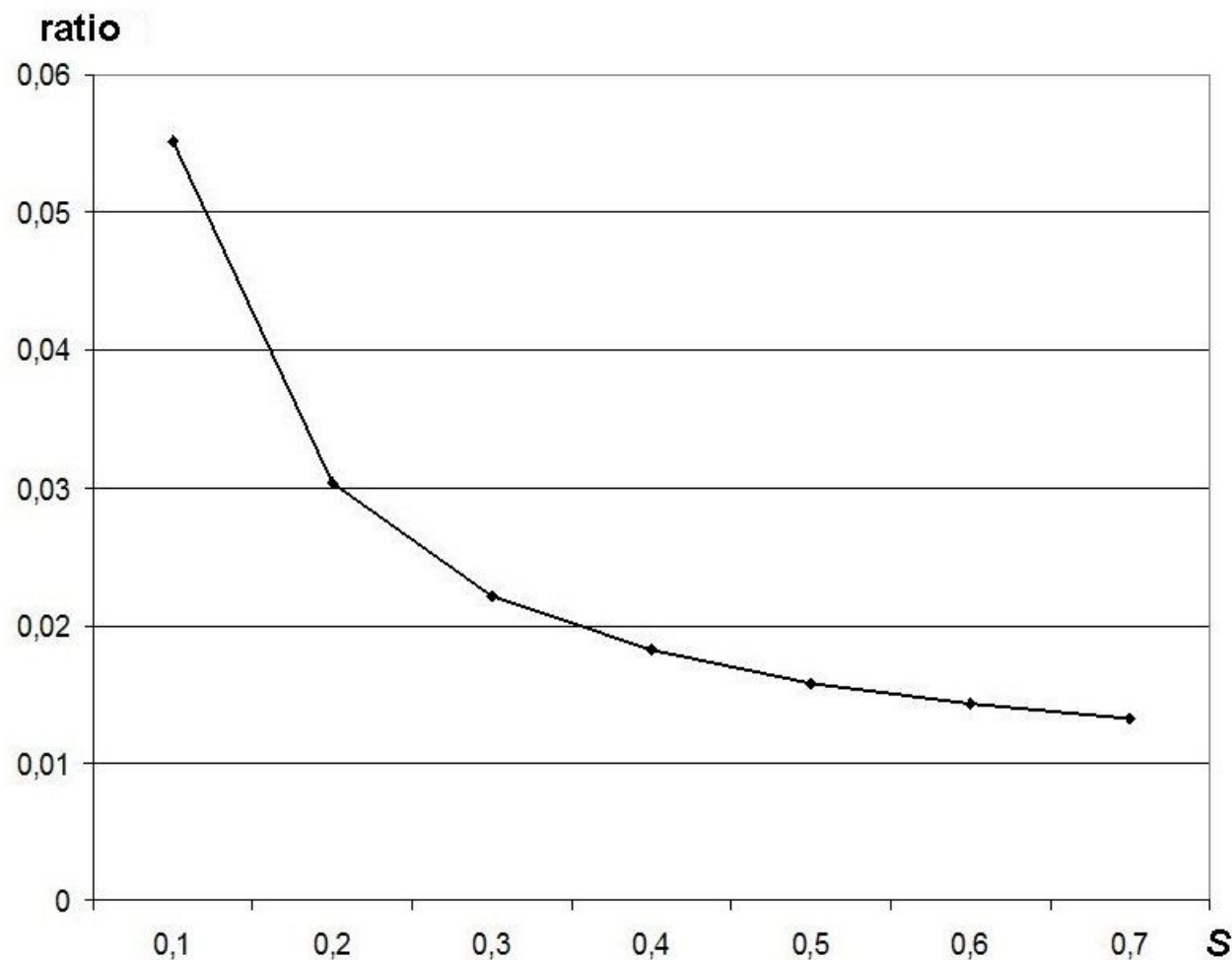
$$\varepsilon^* = \begin{pmatrix} x_1 = 1 \\ N = 100 \end{pmatrix} \quad \text{vs} \quad \varepsilon(N) = \left\{ x_1, \dots, x_N \right\}, x_i = 1 + (i-1)s, i = 1..N$$





# Performance Analysis

$$\frac{D(\varepsilon^*)}{D(\varepsilon(N))}$$





# Application for Optical technology



US008570514B2



US007574253B2

(12) **United States Patent**  
**de Veer et al.**

(10) **Patent No.:** **US 8,570,514 B2**  
(45) **Date of Patent:** **Oct. 29, 2013**

(54) **OPTICAL SYSTEM POLARIZER  
CALIBRATION**

(75) Inventors: **Johannes D. de Veer**, Menlo Park, CA  
(US); **Leonid Poslavsky**, Belmont, CA  
(US); **Guorong V. Zhuang**, Santa Clara,  
CA (US); **Shankar Krishnan**, Santa  
Clara, CA (US)

(73) Assignee: **KLA-Tencor Corporation**, Milpitas,  
CA (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 290 days.

(21) Appl. No.: **13/164,130**

(22) Filed: **Jun. 20, 2011**

(65) **Prior Publication Data**  
US 2012/0320377 A1 Dec. 20, 2012

(51) **Int. Cl.**  
**G01J 4/00** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **356/366**

(58) **Field of Classification Search**  
USPC ..... 356/366, 369  
See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Roy M Punnoose

(74) Attorney, Agent, or Firm — Luedeka Neely Group, P.C.;  
Rick Barnes

(57) **ABSTRACT**

A method to calibrate a polarizer in polarized optical system  
at any angle of incidence, by decoupling the calibration from  
a polarization effect of the system, by providing a calibration  
apparatus that includes a substrate having a polarizer dis-  
posed on a surface thereof, with an indicator on the substrate  
for indicating a polarization orientation of the polarizer, load-  
ing the calibration apparatus in the polarized optical system  
with the indicator in a desired position, determining an initial  
angle between the polarization orientation and a reference of  
the polarized optical system, acquiring spectra using the  
polarized optical system at a plurality of known angles  
between the polarization orientation and the reference of the  
polarized optical system, using the spectra to plot a curve  
indicating an angle of the polarizer in the polarized optical  
system, and when the angle of the polarizer is outside of a  
desired range, adjusting the angle of the polarizer, and repeat-  
ing the steps of acquiring the spectra, and plotting a curve  
indicating the angle of the polarizer.

**1 Claim, 4 Drawing Sheets**

(12) **United States Patent**  
**Edney et al.**

(10) **Patent No.:** **US 7,574,253 B2**  
(45) **Date of Patent:** **Aug. 11, 2009**

(54) **SIGNAL PROCESSING USING NON-LINEAR  
REGRESSION WITH A SINUSOIDAL MODEL**

(75) Inventors: **Paul A. Edney**, Evanston, IL (US);  
**Joseph T. Walsh, Jr.**, Evanston, IL (US)

(73) Assignee: **Northwestern University**, Evanston, IL  
(US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 1020 days.

(21) Appl. No.: **10/672,863**

(22) Filed: **Sep. 26, 2003**

(65) **Prior Publication Data**  
US 2005/0070791 A1 Mar. 31, 2005

(51) **Int. Cl.**  
**A61B 6/00** (2006.01)

(52) **U.S. Cl.** ..... **600/476; 600/407; 600/408;**  
**600/425; 600/473; 382/128; 382/130; 382/131;**  
**382/132; 702/66; 702/70; 702/71; 702/75;**  
**702/76**

(58) **Field of Classification Search** ..... 600/476,  
600/407; 382/128, 130–132; 702/66, 70,  
702/71, 75, 76

See application file for complete search history.

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\* cited by examiner

Primary Examiner—Brian Casler

Assistant Examiner—James Kish

(74) Attorney, Agent, or Firm—McAndrews, Held & Malloy,  
Ltd.

(57) **ABSTRACT**

A method for processing signals, such as a tomography sig-  
nal, in the time domain provides both high spatial resolution  
and high frequency resolution but at low cost. The method  
uses non-linear regression with a sinusoidal model to fit a sine  
wave to a portion of the signal that is less than a full cycle of  
a wave of the signal.

**18 Claims, 2 Drawing Sheets**

**A non-linear regression is treated**



# ***Application for Optical technology***

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## ■ **Optical system polarizer calibration**

US 8797534 B2

Assigned : Kla-Tencor Corporation

$$\eta(x, \theta) = A + B \cos(x - \vartheta)$$

## ■ **Signal processing using non-linear regression with a sinusoidal model**

US 7574253 B2

Assigned : Northwestern University

$$\eta(x, \theta) = A \sin(Bx + \vartheta)$$

Proposed method increases accuracy up to 60%



# Summary

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- Efficient Experiment Design Technique for non-linear regression is offered.
- The D-optimal design criterion is considered.
- The proposed approach being implemented allows to minimize experiments costs for sensing quality estimation, reduce the network traffic related to the considered experiments, improve energy consumption and the energy harvesting schedule for wireless sensor networks.



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# ***WSNs Security***

Method and Models (Mathematical Tools)  
Simulation Tools



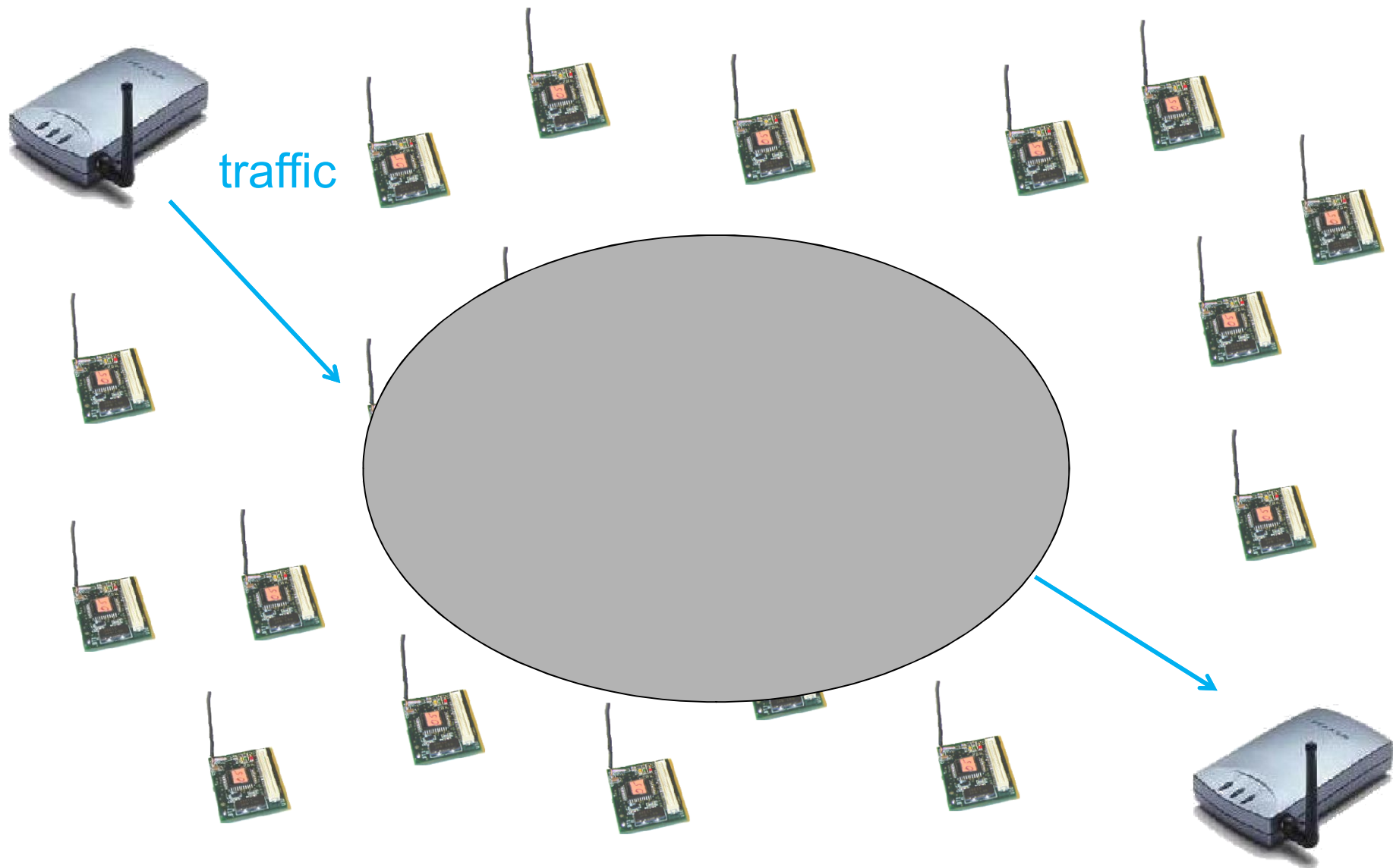
# WSNs Attacks Taxonomy

Protocol layer	Attacks	Defenses
Physical	<u>Jamming</u>	Detect and sleep Route around jammed regions
	Node tampering or destruction	Hide or camouflage nodes Tamper-proof packaging
Link/MAC (medium access control)	Interrogation	Authentication and antireplay protection
	Denial of sleep	Authentication and antireplay protection Detect and sleep Broadcast attack protection
Network	Spoofing, replaying, or altering routing-control traffic or clustering messages	Authentication and antireplay protection Secure cluster formation
	Hello floods	Pairwise authentication Geographic routing
	Homing	Header encryption Dummy packets
Transport	SYN (synchronize) flood	SYN cookies
	Desynchronization attack	Packet authentication
Application	Overwhelming sensors	Sensor tuning Data aggregation
	Path-based DoS	Authentication and antireplay protection
	Deluge (reprogramming) attack	Authentication and antireplay protection Authentication streams

**Depletion of batteries?**

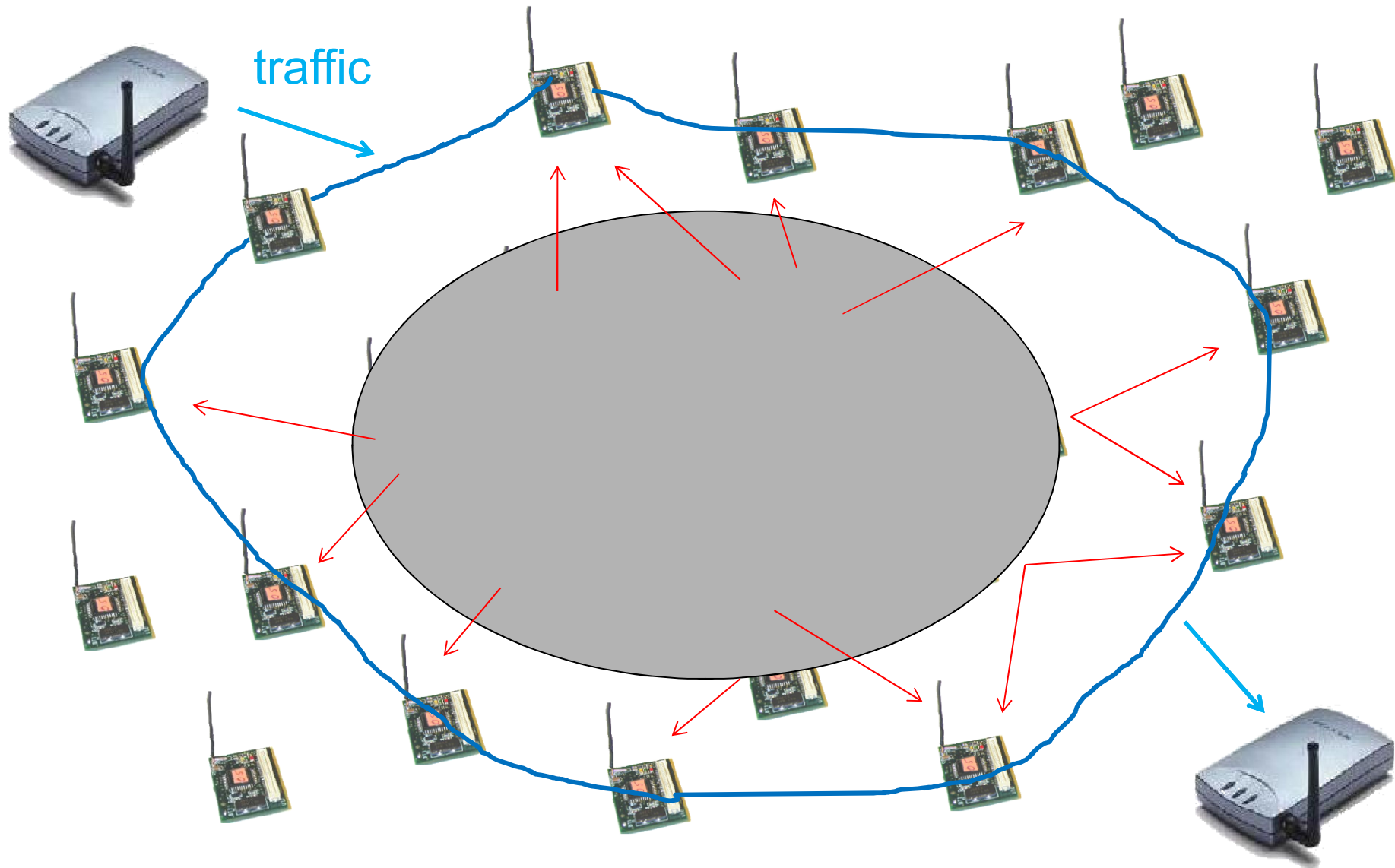


# ***Jamming***



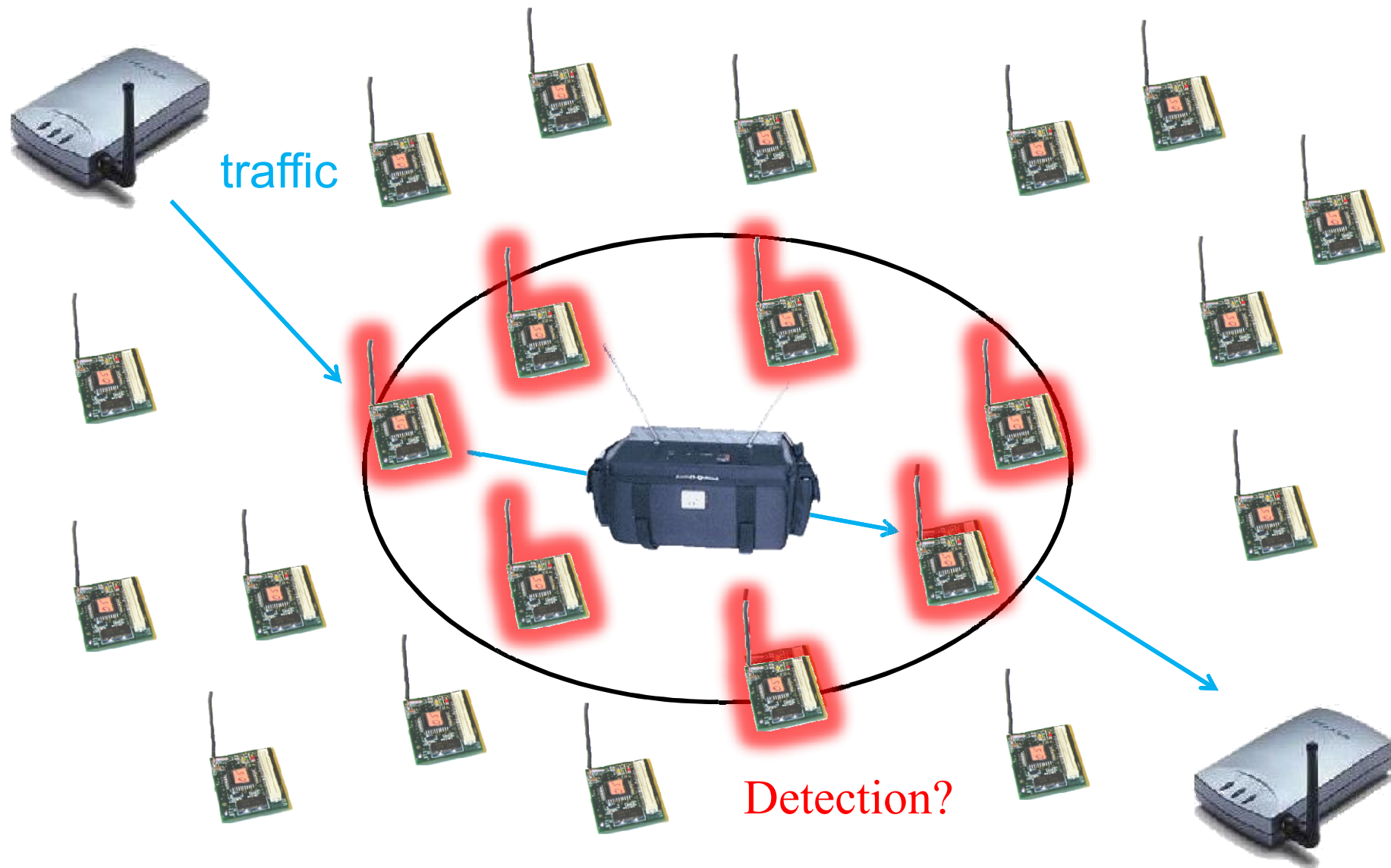


# Counteracting



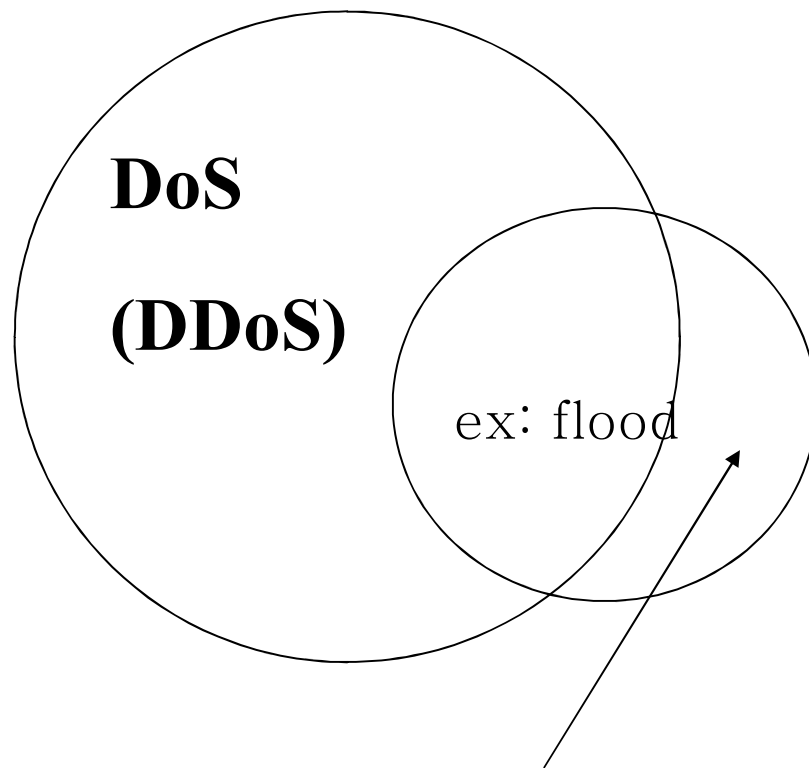


# ***Relaxed Jamming***

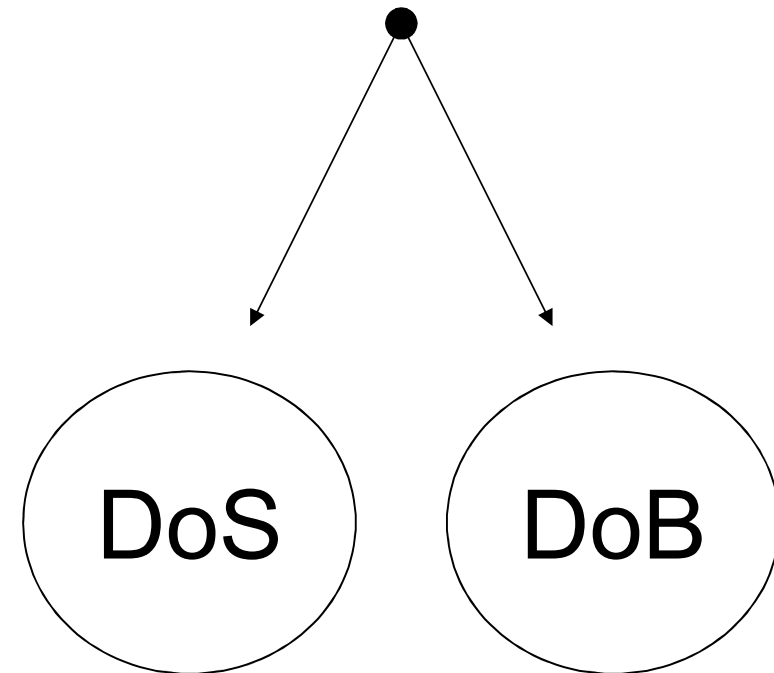




# DoB: Depletion of Battery



**Battery Exhausting**



**New type of intrusion**



# Patents Search

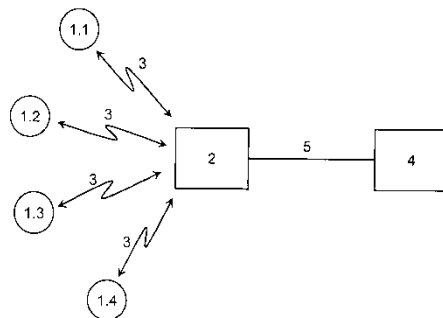
**NEC**

**ETRI**  
www.etri.re.kr

**EATON**

(19) United States  
(12) Patent Application Publication  
(10) Pub. No.: US 2007/0067631 A1  
(41) Pub. Date: Mar. 22, 2007

(54) METHOD FOR AUTHENTICATION  
(51) Int. Cl. H04L 9/00 (2006.01)  
(52) U.S. Cl. 713/18  
(57) ABSTRACT  
A method for authentication between at least two nodes within a network, preferably a wireless sensor network, is disclosed. The sending node comprises a hash function, possibly a cryptographic hash function, to generate a hash value of the data to be transmitted. The hash value is then transmitted to the receiving node, which also generates a hash value of the received data. The two hash values are compared to determine if the data was received correctly.



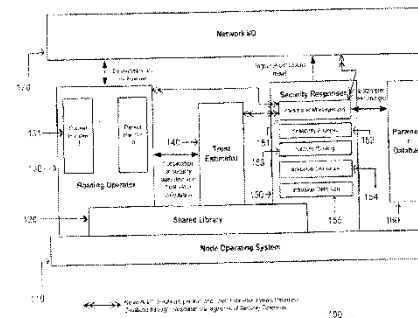
authentication,

trust estimator, secure key,

encoding and decoding messages

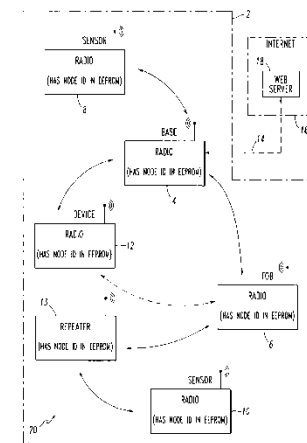
(19) United States  
(12) Patent Application Publication  
(10) Pub. No.: US 2008/0084294 A1  
(41) Pub. Date: Apr. 10, 2008

(54) WIRELESS SENSOR NETWORK AND ADAPTIVE METHOD FOR MONITORING THE SECURITY THEREOF  
(51) Int. Cl. G08B 1/08 (2006.01)  
(52) U.S. Cl. 340/539.22  
(57) ABSTRACT  
The present invention relates to a sensor network having nodes and a method for monitoring the security thereof. The sensor network includes a base station and a plurality of sensor nodes. The base station includes a security module for monitoring the security of the sensor network. The security module includes a security module for monitoring the security of the sensor network. The security module includes a security module for monitoring the security of the sensor network.



(19) United States  
(12) Patent Application Publication  
(10) Pub. No.: US 2006/0159260 A1  
(41) Pub. Date: Jul. 20, 2006

(54) METHOD AND COMMUNICATION SYSTEM EMPLOYING SECURE KEY EXCHANGE FOR ENCODING AND DECODING MESSAGES BETWEEN NODES OF A COMMUNICATION NETWORK  
(51) Int. Cl. H04L 9/00 (2006.01)  
(52) U.S. Cl. 380/44  
(57) ABSTRACT  
A method and communication system for exchanging a secure key between nodes of a communication network. A first node, such as a base station, sends a first message to a second node, such as a mobile station, over the communication network. The first message includes a first key. The second node sends a second message to the first node over the communication network. The second message includes a second key. The first node and the second node use the second key to encode and decode messages.





# Intrusion Detection

A sequence of random values  $\xi$  is under observation:

$$\dots \xi_{t-2}, \xi_{t-1}, \xi_t, \xi_{t+1}, \xi_{t+2}, \dots$$

At a time moment  **$t$**  a distribution of  $\xi$  is changed.

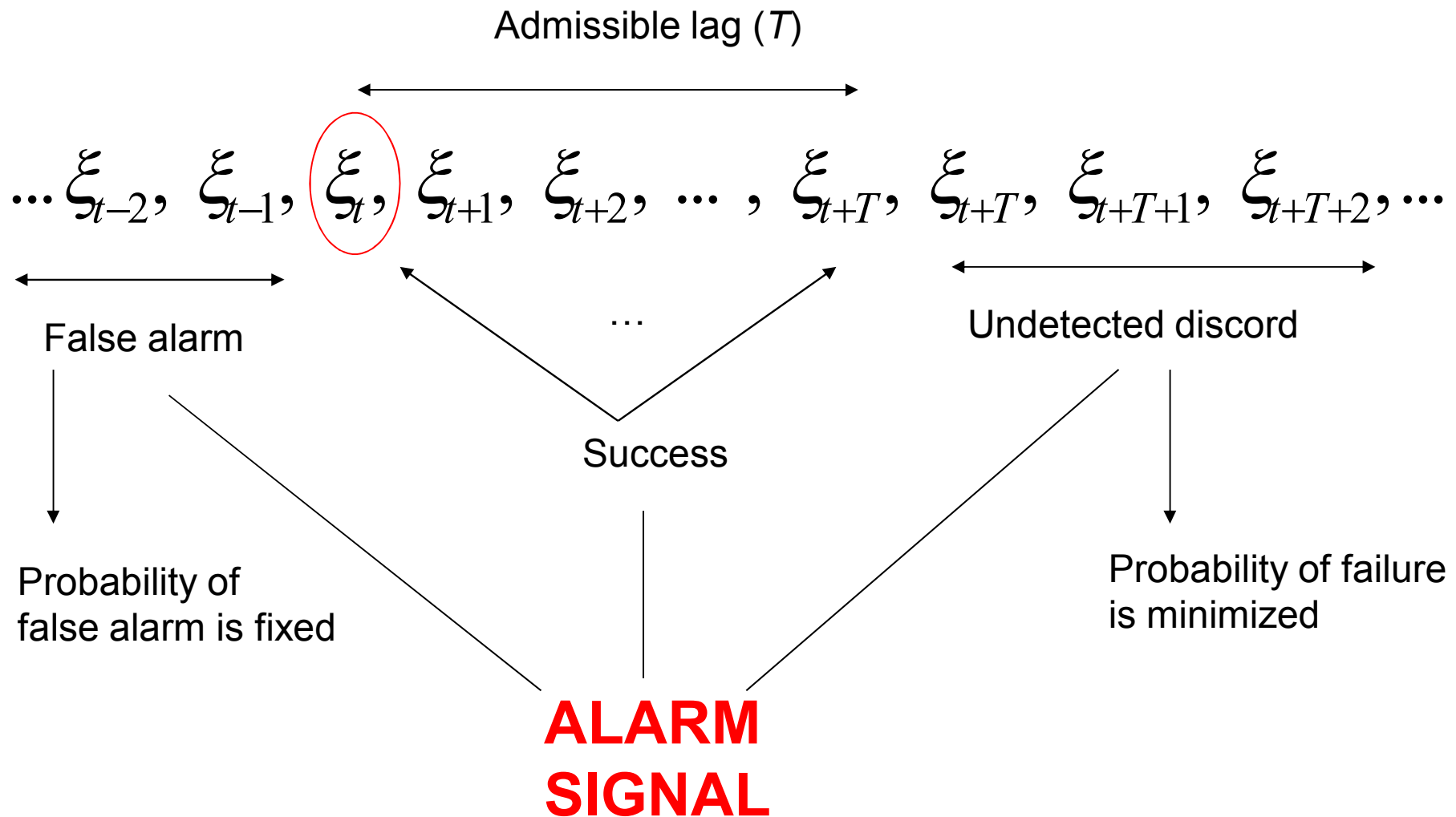
Moment  **$t$**  is unknown.  **$t$**  is a **discord moment**.

An observed parameter can be noise level, Bit Error Ratio, energy consumption or other parameter, which is changed under the intrusion.

To define discord moment point-of-change detection technique has to be used (CUSUM algorithm)



# Intrusion Detection





## *Summary*

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The novel specific type of intrusion exists.

Traditional defense schemes cannot be applied

Recommended counteracting methods are

- implementation of multilevel independent power control for mobile terminals and also,
- effective monitoring based on the methods of discord detection.



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# ***Tradeoff Between Energy Harvesting Duration and Reliability in WSNs***

Method and Models (Mathematical Tools)  
Simulation Tools



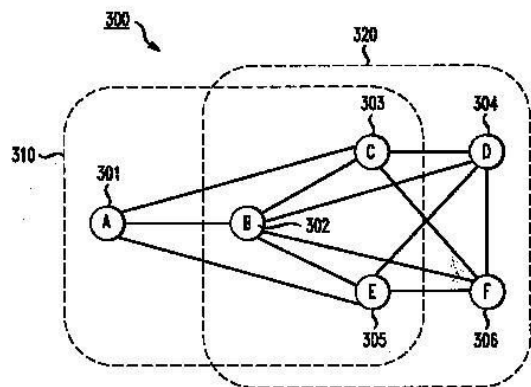
# Patent Search

(19) United States  
(12) Patent Application Publication (10) Pub. No.: US 2007/0058664 A1  
Kim et al. (43) Pub. Date: Mar. 15, 2007

(54) METHOD AND APPARATUS FOR LIFETIME MAXIMIZATION OF WIRELESS SENSOR NETWORKS  
(75) Inventors: Seung-Jun Kim, Plainsboro, NJ (US); Xiaodong Wang, New York, NY (US); Mahamud Masrurin, Plainsboro, NJ (US)  
Correspondence Address: NEC LABORATORIES AMERICA, INC., 4 INDEPENDENCE WAY, PRINCETON, NJ 08540 (US)  
(73) Assignee: NEC LABORATORIES AMERICA, INC., Princeton, NJ (US)  
(21) Appl. No.: 11/277,179  
(22) Filed: Mar. 22, 2006  
Related U.S. Application Data  
(60) Provisional application No. 60/717,211, filed on Sep. 15, 2005.

Publication Classification  
(51) Int. Cl. H04L 12/413 (2006.01)  
(52) U.S. Cl. 370/447; 370/458

(57) ABSTRACT  
A method and apparatus for distributed routing at the network layer of a network is disclosed that integrates connection selection properties from the MAC layer. In one embodiment, an energy constraint is used in routing at the network layer of a network to determine a first parameter representing the optimal maximum lifetime of a sensor network. If a network link for a transmission is idle, the node may then contend at the MAC layer of the network for a transmission slot across that link. During this contention period, each node is assigned a priority parameter that is used to represent the probability of a transmission colliding with another transmission across a link in a contention region. As a result of this contention period, network traffic is transmitted from source nodes.

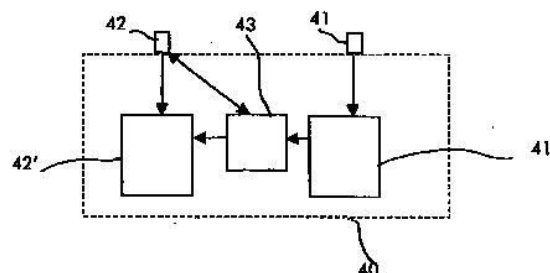


(19) United States  
(12) Patent Application Publication (10) Pub. No.: US 2005/0208966 A1  
David et al. (43) Pub. Date: Sep. 22, 2005

(54) METHOD FOR CONTROLLING THE SLEEP MODE ON A MOBILE TERMINAL, CORRESPONDING MOBILE TERMINAL, AND CORRESPONDING RADIO ACCESS NOISE  
(75) Inventors: Klaus David, Warburg (DE); Matthias Hildebrandt, Kassel (DE); Gertel Cristoforo, München (DE); Rolf Sigle, Rosenheim (DE); Jose Diaz Carreira, Valencia (ES)  
Correspondence Address: SUGHRU MION, PLLC, 2100 PENNSYLVANIA AVENUE, N.W., SUITE 800, WASHINGTON, DC 20037 (US)  
(73) Assignee: ALCATEL  
(21) Appl. No.: 11/880,587  
(22) Filed: Mar. 16, 2005

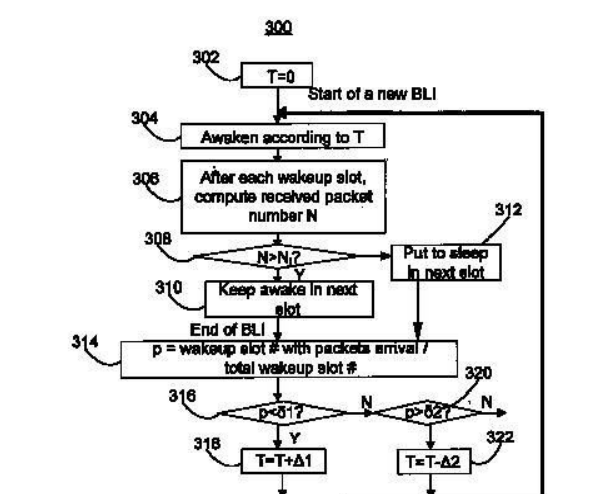
Foreign Application Priority Data  
Mar. 17, 2004 (EP) 04290730.3  
Publication Classification  
(51) Int. Cl. H04M 1/00  
(52) U.S. Cl. 455/553.1

(57) ABSTRACT  
The present invention relates to a method for controlling sleep mode in a terminal comprising at least two network interfaces. According to the present invention, the method comprises the steps of:  
Switching off one of the two interfaces;  
Activating the switched off interface for a predefined time window upon reception of a predefined signaling message on the other interface.



(19) United States  
(12) Patent Application Publication (10) Pub. No.: US 2006/0242328 A1  
Gao et al. (43) Pub. Date: Oct. 26, 2006

(54) POWER MANAGEMENT FOR WLAN  
(75) Inventors: Zihao Gao, Beijing (CN); Richard Yang, Morris Plains, NJ (US); Ashish Khoshdel, Woodinville, WA (US); Shihong Li, Redmond, WA (US)  
Correspondence Address: WOODCOCK WASHBURN LLP (MICROSOFT CORPORATION), ONE LIBERTY PLACE - 46TH FLOOR, PHILADELPHIA, PA 19103 (US)  
(73) Assignee: Microsoft Corporation, Redmond, WA  
(21) Appl. No.: 11/891,958  
(22) Filed: Mar. 29, 2005  
Publication Classification  
(51) Int. Cl. G06F 15/26 (2006.01)

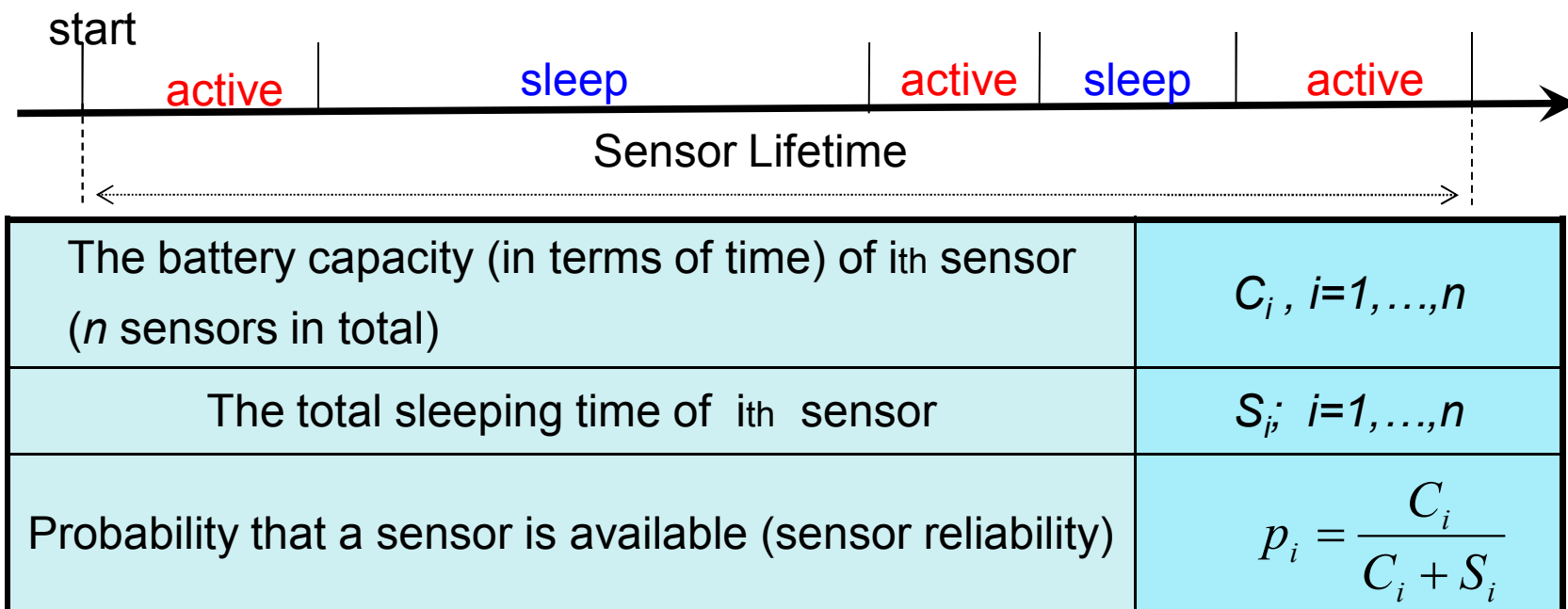


network connectivity is not considered.



## Proposed method description

- The method for establishing of relationship between sensor reliability and sensor battery capacity.

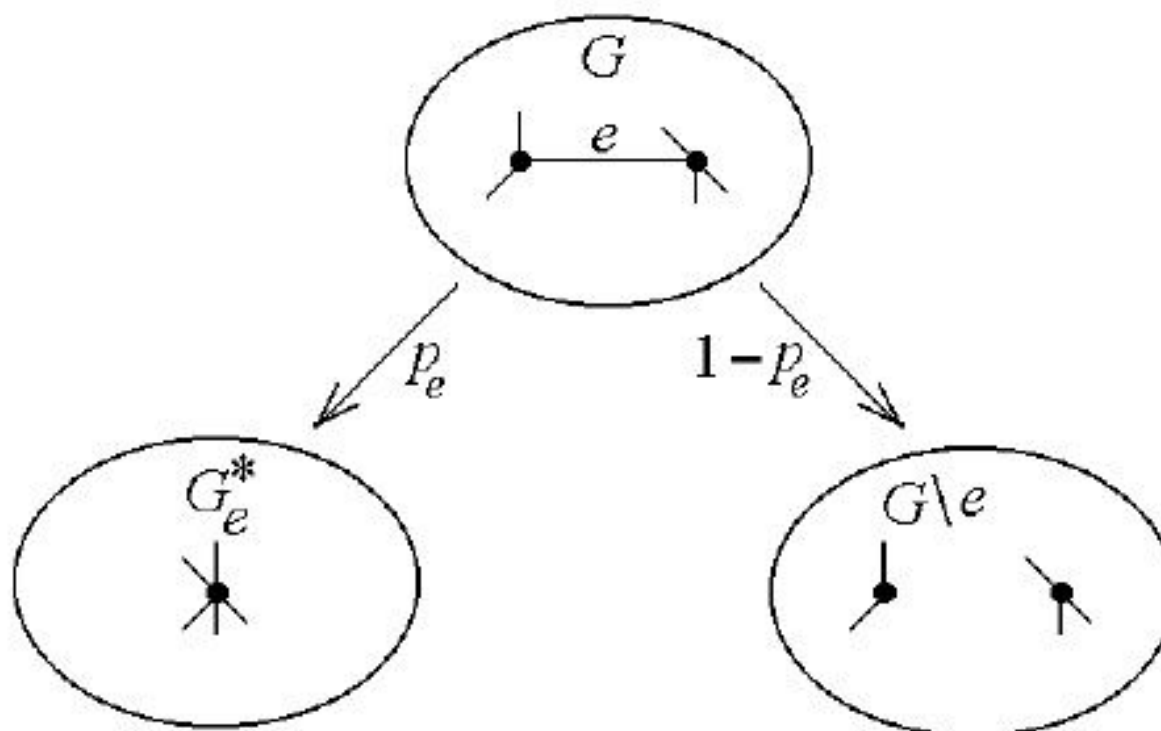


- If sleeping time is maximized then the capacity of sensor battery is reduced. It also reduces a cost of sensor networks.



# Factoring Method

$$R(G) = p_e R(G_e^*) + (1 - p_e) R(G \setminus e)$$



Moore-Shannon Method



# ***Proposed method description***

## ■ Designations

- ▶  $G(V,E)$  : a graph (a model of network topology)
- ▶  $R$  : the reliability polynomial for a the graph  $G$
- ▶  $\alpha$  : a required level of reliability (if it is given)
- ▶  $A$  : a total admissible cost of batteries (if it is given)

fixed capacity of sensor battery, sleeping time is controlled variable	both parameters are controlled	reliability maximizing under limited resources
$\sum S_i \rightarrow \max,$ $R(S_1, \dots, S_n) \geq \alpha$	$\sum (C_i + S_i) \rightarrow \max,$ $R(C_1, \dots, C_n, S_1, \dots, S_n) \geq \alpha.$	$R \rightarrow \max,$ $\sum C_i \leq A.$



# Patent

(19) United States  
 (12) Patent Application Publication (10) Pub. No.: US 2009/0216349 A1  
 KWON et al. (43) Pub. Date: Aug. 27, 2009

(54) METHOD AND SYSTEM FOR EXTENDING LIFETIME OF SENSOR NODES IN WIRELESS SENSOR NETWORK

(75) Inventors: Dae Hyung KWON, Seoul (KR); Sun Gi Kim, Seoul (KR); Kang Young Moon, Yongin-si (KR); Hyunseung Choo, Gwacheon-si (KR); Vladimir V. Shakhov, Suwon-si (KR)

Correspondence Address:  
 THE FARRELL LAW FIRM, LLP  
 290 Broadhollow Road, Suite 210E  
 Melville, NY 11747 (US)

(73) Assignees: SAMSUNG ELECTRONICS CO., LTD., Suwon-si (KR); SUNKYUKWAN UNIVERSITY, Seoul (KR)

(21) Appl. No.: 12/390,031

(22) Filed: Feb. 20, 2009

(30) Foreign Application Priority Data  
 Feb. 21, 2008 (KR) 10-2008-0015679

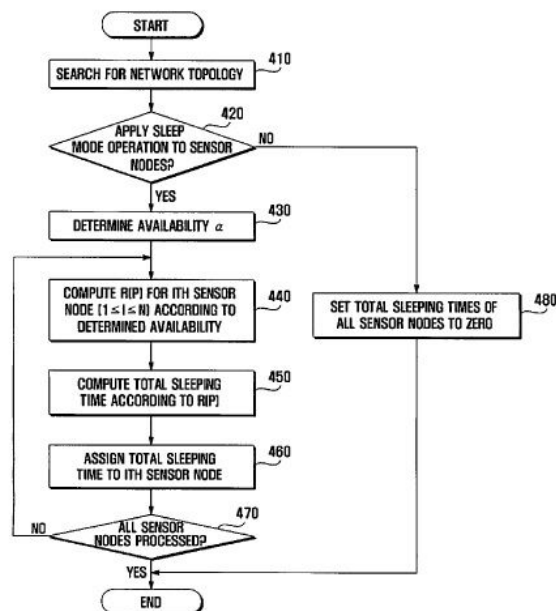
Publication Classification  
 (51) Int. Cl. G06F 1/32 (2006.01) G05B 13/02 (2006.01)  
 (52) U.S. Cl. 700/33; 713/310  
 (57) ABSTRACT

A method and system are provided that extend the lifetime of sensor nodes in a wireless sensor network while ensuring network availability. An availability level is set for ensuring network connectivity corresponding to importance of network connectedness. An operation probability that a sensor node is in operation is calculated. A total sleeping time of the sensor node is calculated that minimizes the operation probability while maintaining the availability level.

## Method and system for extending lifetime of sensor nodes in wireless sensor network

US20090216349 A1

Assigned: Samsung Electronics





# ***Problem***

---

## ***Tradeoff Between Energy Harvesting Duration and Reliability in WSNs***

A sensor node randomly comes to a restoration mode and returns to a working mode (MAC).

Let  $p$  be the probability of the node reliability (availability).



# *Tradeoff*

---

If the sensors transmission range is increased then the energy harvesting period has to be increased and  $p$  is decreased. However, the number of links between sensor nodes increases.

And vice-versa, if the sensors transmission range is reduced then the energy harvesting period can be reduced. Hence,  $p$  is increased and, at the same time, the number of links between sensor nodes decreases.



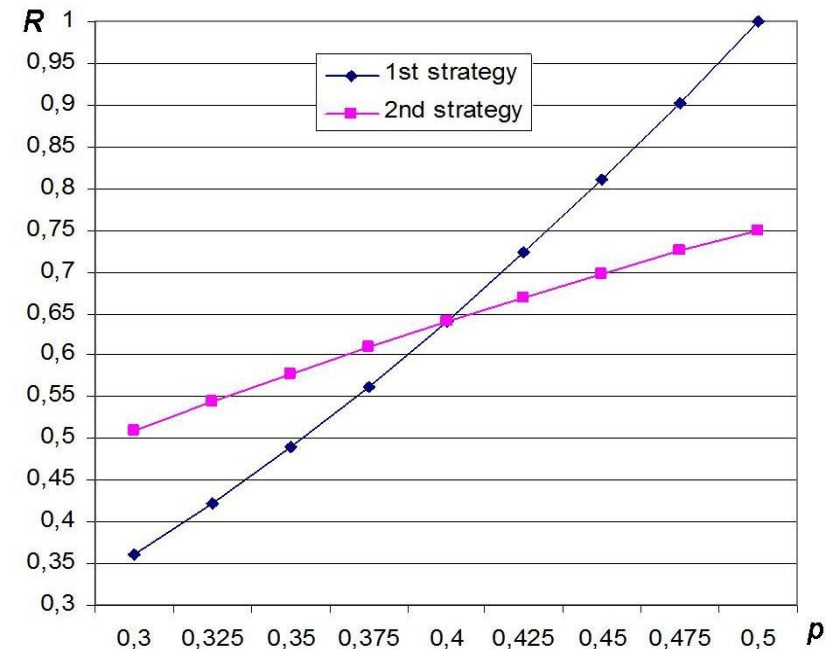
# Tradeoff

$$R(G(n, m(p), p(S))) \rightarrow \max_S .$$

$$r = \arg \max_{r \in \Omega_r} R(G(n, m(r), p(r))).$$

**+ Algorithm for this one**

**+ Algorithm for  
sinks placements**





# Summary

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- Reliability concept is considered
- NP-hard, however it is possible within a reasonable time to obtain the lower and upper network reliability bounds and make a decision about the reliability (or unreliability) of the network
- An attractive potential area of proposed approach is novel MAC protocols for WSNs.



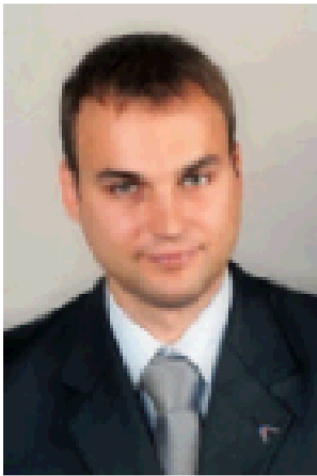
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*Thank you for the attention*

*여러분의 관심에 감사드립니다*



Dr. Andrey Toropovskiy.



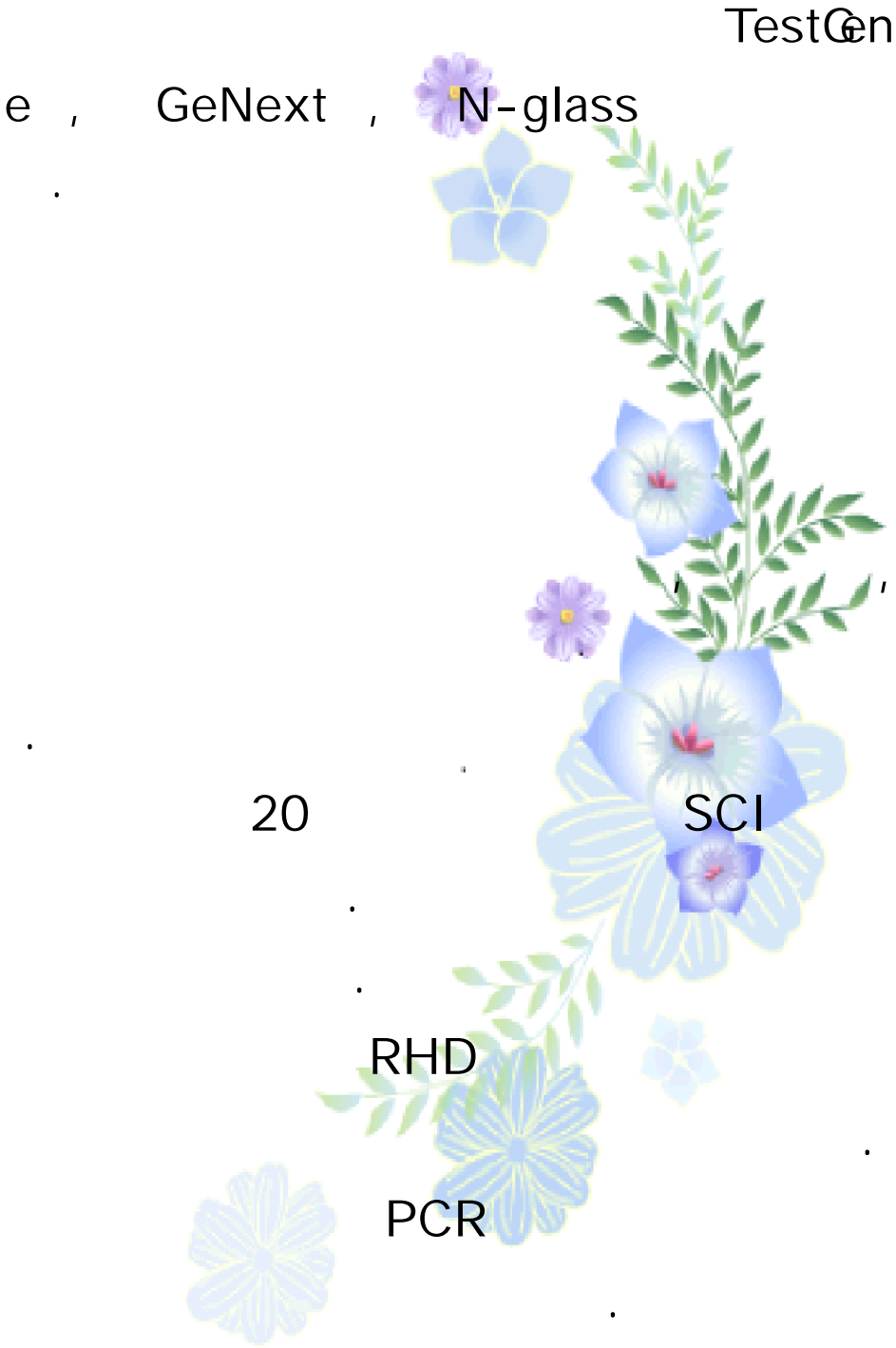
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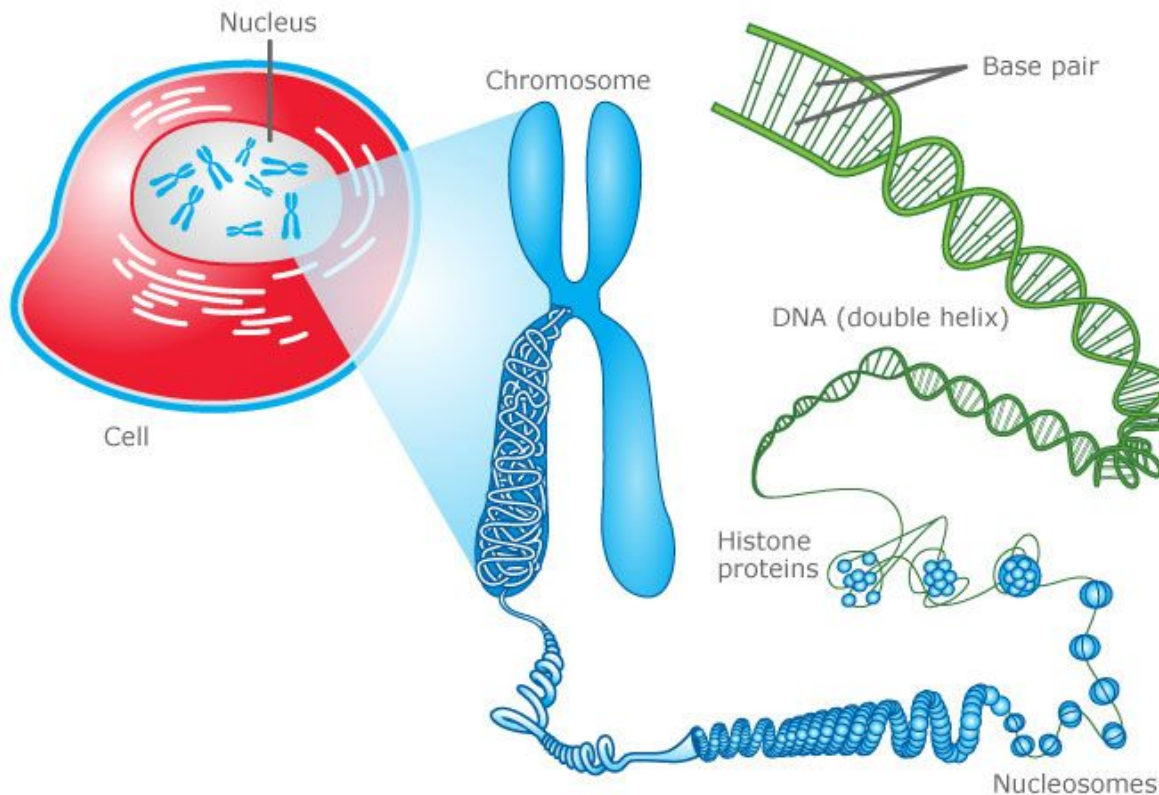
# Nanotechnology in Medicine: non-invasive molecular genetic testing

Andrey Toropovskiy, MD,PD



# DNA, general facts

**Deoxyribonucleic acid (DNA)** is a molecule that encodes the genetic instructions used in the development and functioning of all known living organisms and many viruses.



## Human DNA:

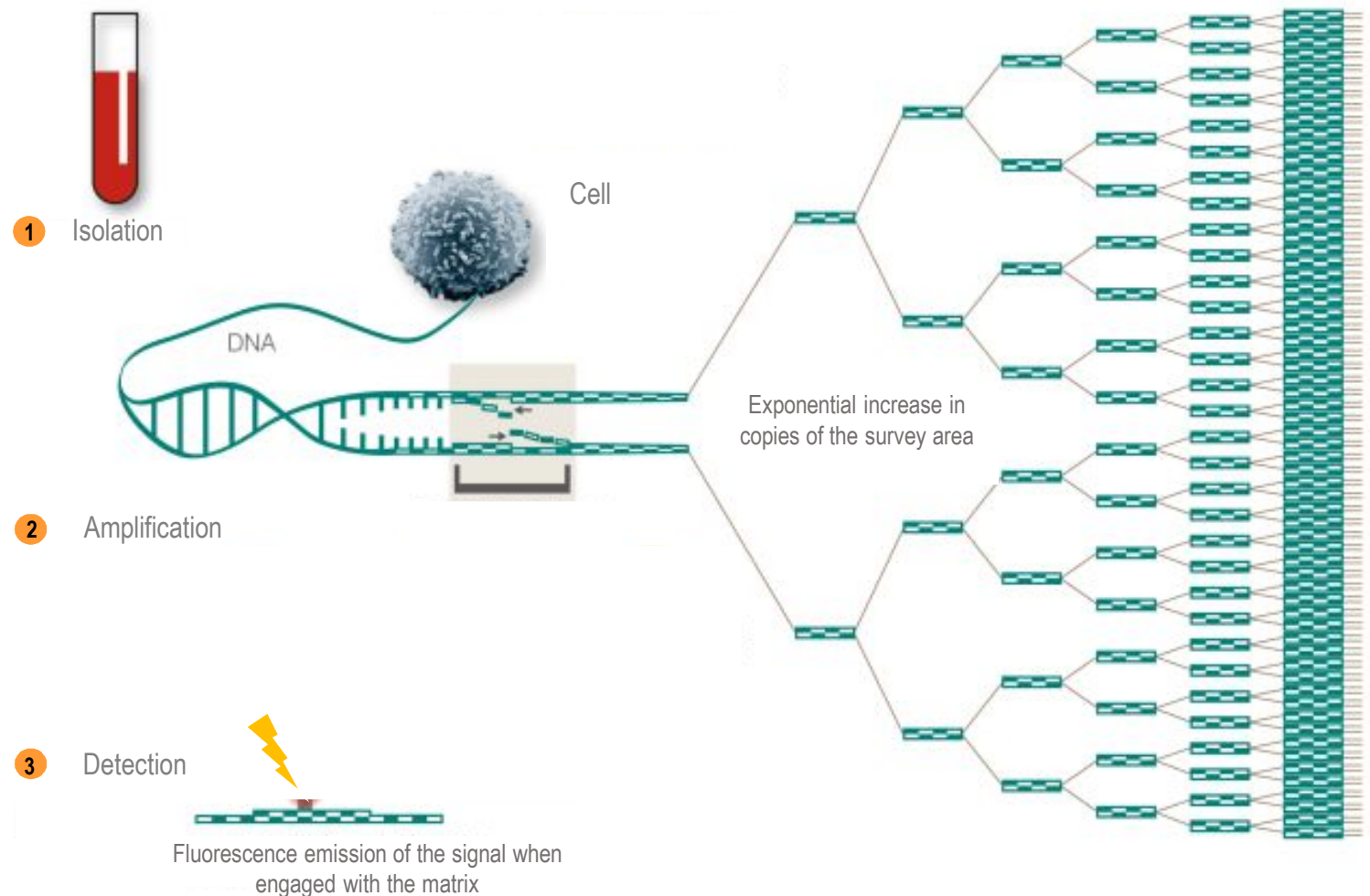
- Size of each nucleotide is 0,33 nm
- Width 2,2-2,4 nm
- 3,1 milliard b.p.
- 1,04 m length
- 20 000 —25 000 active genes
- Only 1.5% of the total genetic material encodes a protein or functional RNA
- Basic (genomic) DNA of human divided into 23 pairs of chromosomes: 22 pairs of autosomal chromosomes and a pair of sex chromosomes
- Genes are distributed unevenly across the chromosomes
- About 1% of the human genome is occupied by the inserted genes of retroviruses



# Polymerase chain reaction (PCR)

Polymerase chain reaction (PCR) is a method of molecular biology, allowing to achieve a substantial increase in low concentrations of specific nucleic acid fragments (DNA) in the biological material (sample).

- Based on the natural process amplification of the DNA in cells of the living organism
- The first publication by the PCR technique appeared in November 1985 in the journal Science
- After 8 years after that for the invention of PCR Kary Mullis received the Nobel Prize
- Produced using a thermostable polymerase





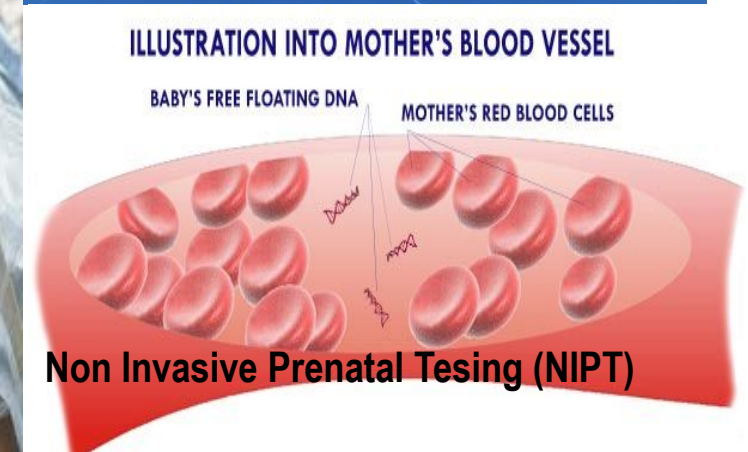
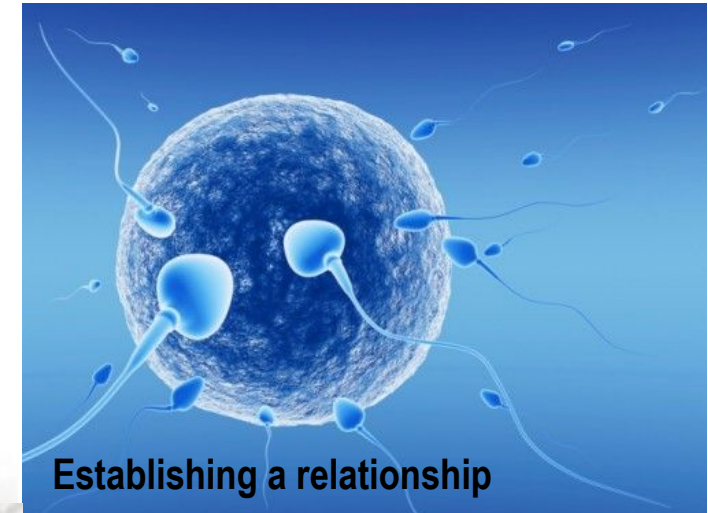
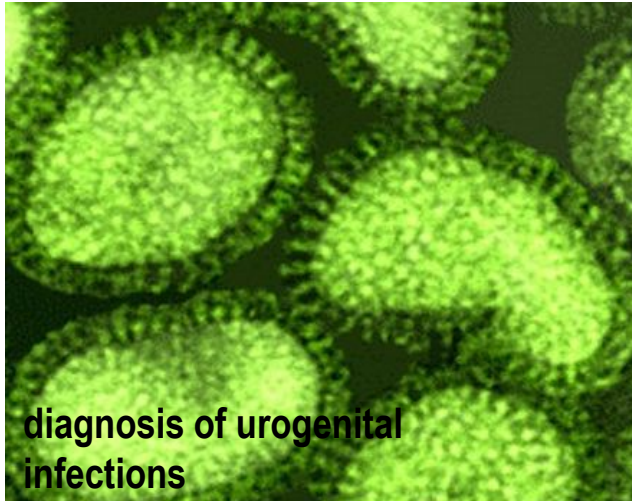
# Polymerase chain reaction (PCR)

Works in any field of medicine





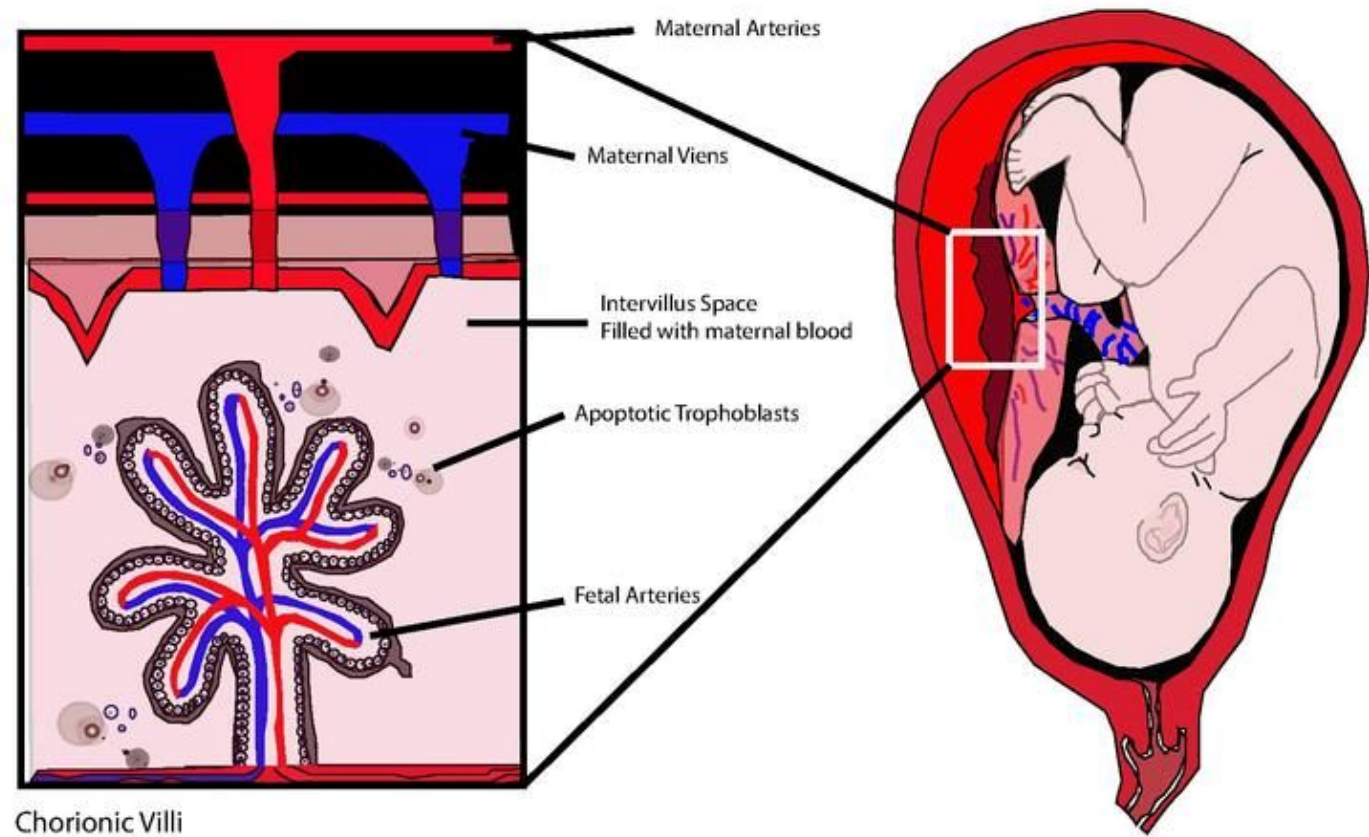
# The polymerase chain reaction at reproductive medicine





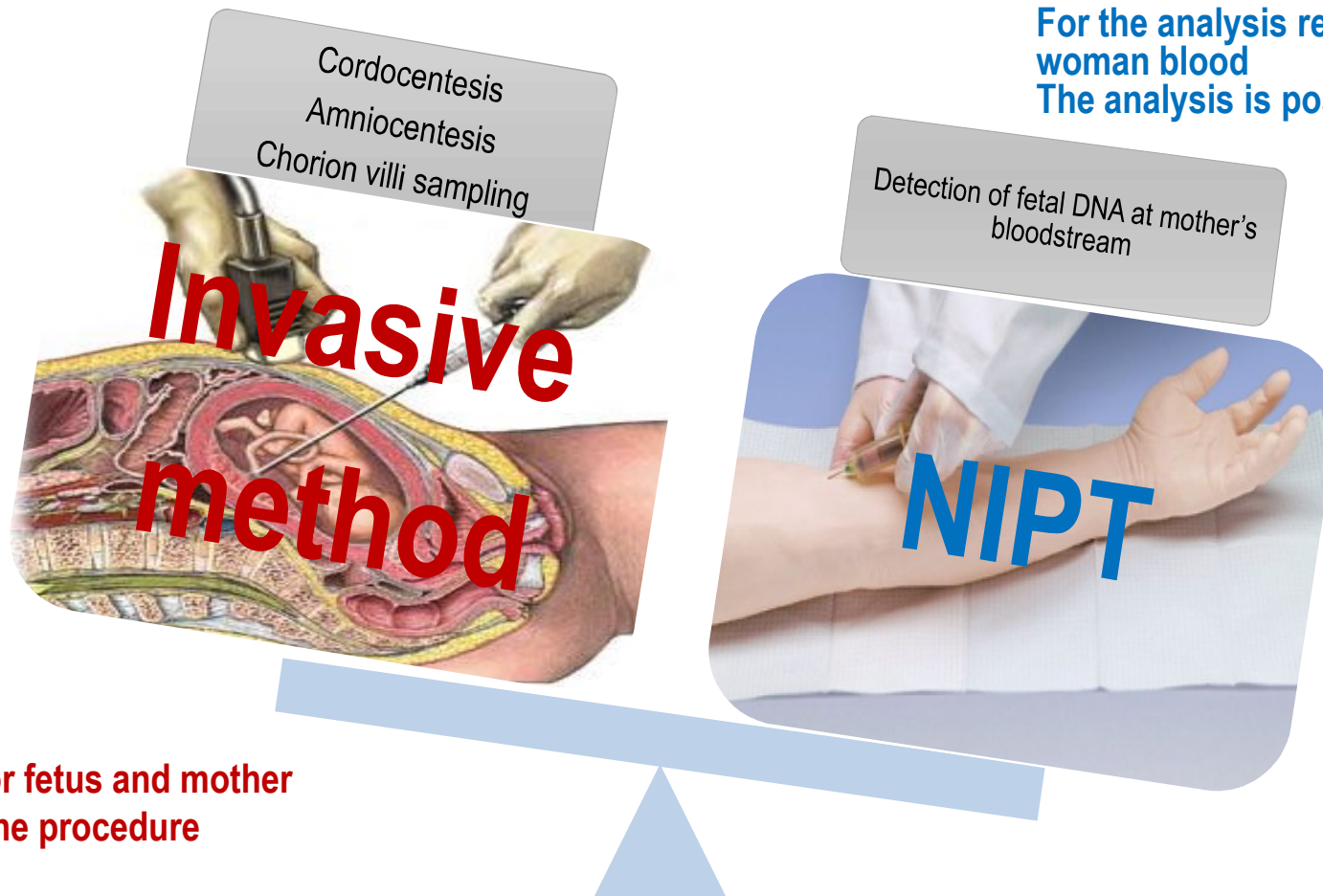
# Non Invasive Prenatal Testing

- NIPT is based on the analysis of fetal genetic material that enters the mother's bloodstream.
- D.Lo et al in 1997 found a small amount of fetal DNA present in the mother's bloodstream during pregnancy.
- Mainly formed due to the death of placental cells - the trophoblast
- Fetal DNA can be detected already in the fourth week of pregnancy
- CcfDNA concentration increases during the term of pregnancy. fragments
- Fetal Cellular RNA (ccfRNA) is also detected in the bloodstream and can be extracted therefrom for subsequent diagnostic.





# Non Invasive Prenatal Testing



For the analysis requires only 7 ml of pregnant woman blood  
The analysis is possible with the 7th week

1 % fetal loss  
3% serious injury or fetus and mother  
the complexity of the procedure



# Non Invasive Prenatal Testing



©2010, Illumina Inc. All rights reserved.



## Kits for NIPT is produced by TestGene LLC

- **"Test-RHD"** - test system for non-invasive detection of fetal gene rhesus with the 10th week of pregnancy;
- **"Test-SRY"** - test system for non-invasive fetal sex determination from the 7th week of pregnancy by mother's blood;
- **Kits of reagents for DNA extraction from biological materials;**



**Products of nanotechnology category "B"**

Patented <http://www.eapo.org/ru/patents/reestr/patent.php?id=19861>



# «TestGene»



- Founded in 2012 in Dimitrovgrad
- 8 employees, including 3 Candidate of Sciences
- Own laboratory in nanocenter
- Affiliate laboratory in Moscow
- Placed on the market more than 100 products in the field of molecular genetics
- Continue to develop new products



# Methodics of TestGene kits for NIPT

To take  
woman's blood



To isolate  
DNA



To perform  
test

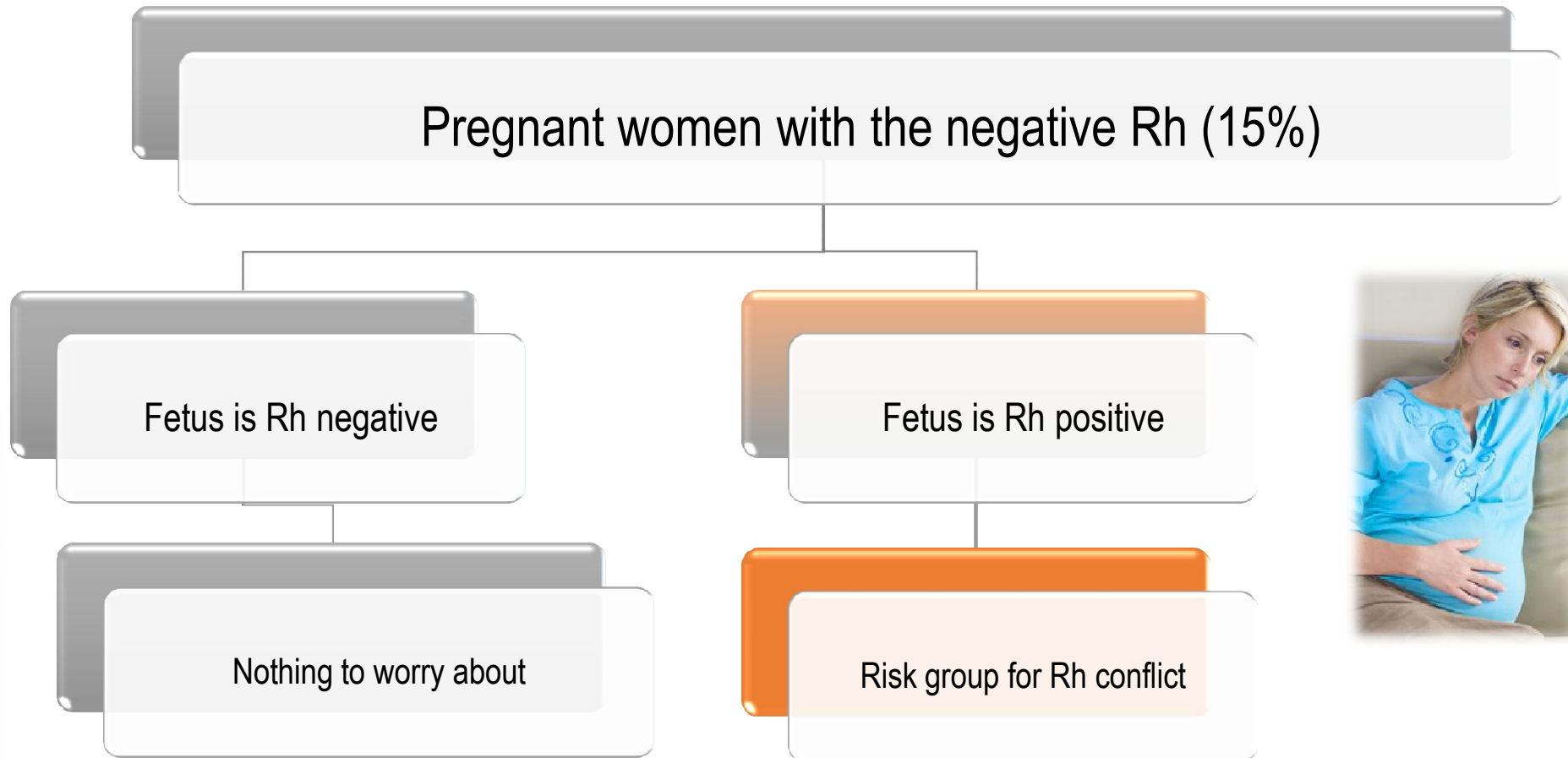


The whole test is about 3 hours





# Fetal RHD testing





# All Rh-negative pregnant women



Analysis for the presence of antibody titer 1 every month throughout pregnancy



Administration of anti-Rhesus immunoglobulin in the absence of antibody titer at 28 weeks of pregnancy and within 72 hours after birth



Ultrasound with Rh sensitization starting 20 weeks of pregnancy every 4 weeks, with the 32nd-every every 14 days

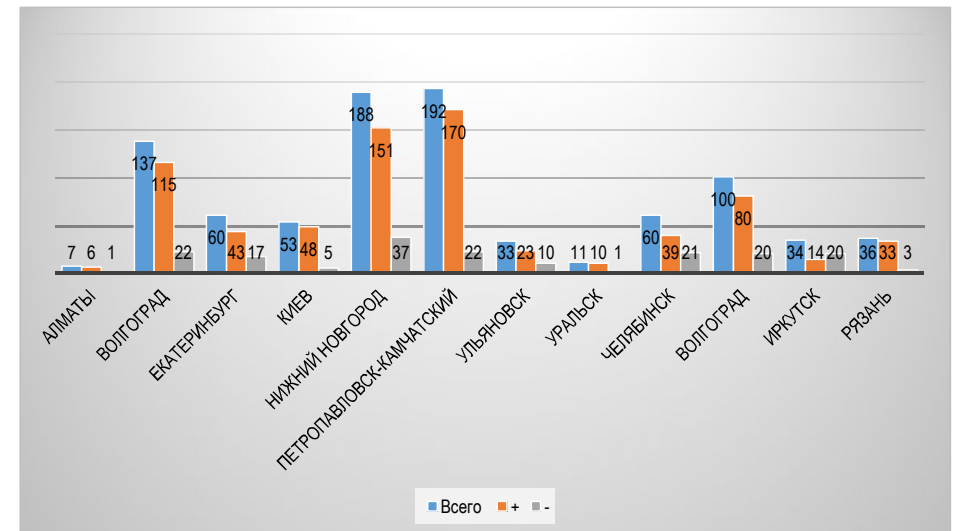
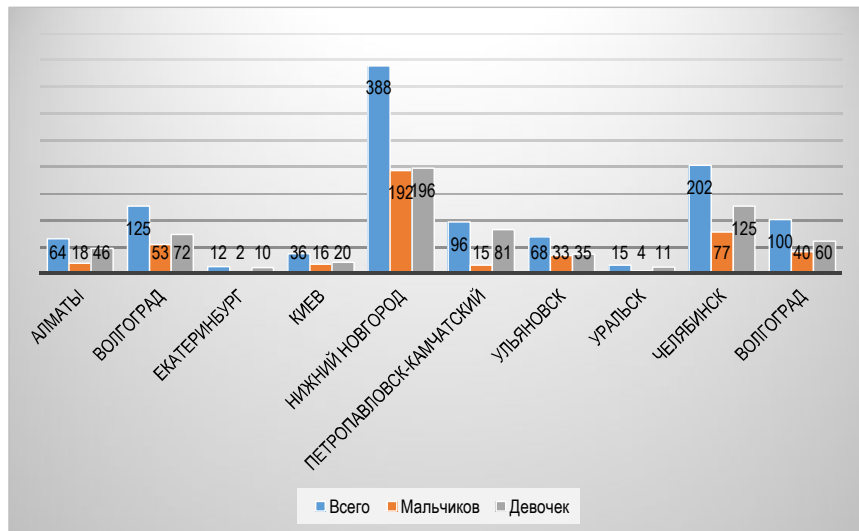
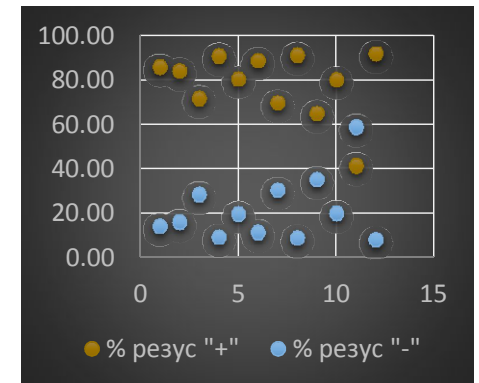


The issue of timing and method of delivery



We have estimated an independent investigation into the distributed 12 large remote laboratories

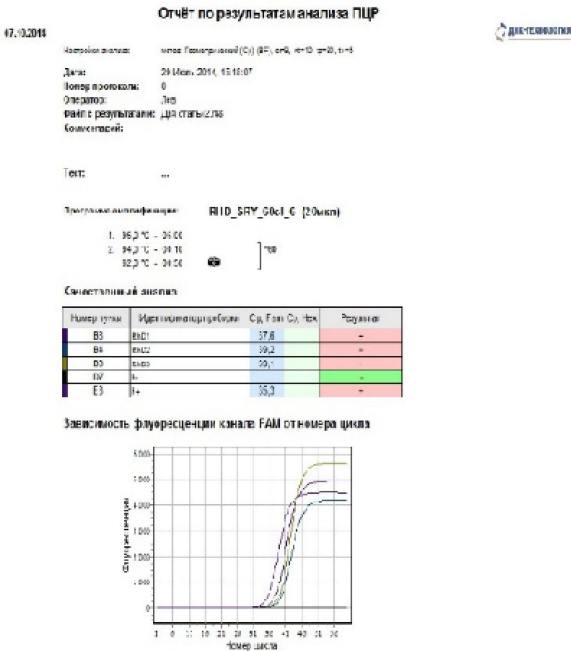
	Анализ SRY	Анализ RHD
Total	1106	911
SRY detected	450 (40,69%)	
SRY not detected	656 (59,31%)	
No matches among the identified SRY	2 (0,18%)	
No matches among the not identified SRY	5 (0,45%)	
RHD detected		672 (73,77%)
RHD not detected		239 (26,23%)
No matches among the identified RHD		7 (0,77%)
No matches among the not identified RHD		10 (1,09%)
Total mismatch analyzes	7 (0,63%)	17 (1,86%)



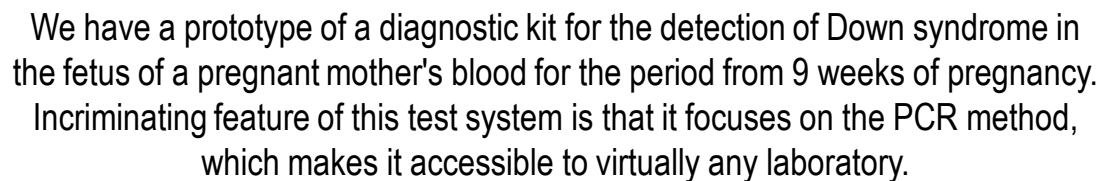


# Diagnostics parameters were estimated

	SRY	RHD
The diagnostic accuracy	99,37%	98,14%
Specificity	99,1%	98,84%
Number of false positives	0,18%	0,77%
Number of false negatives	0,45%	1,09%







*Box & Whisker Plot*

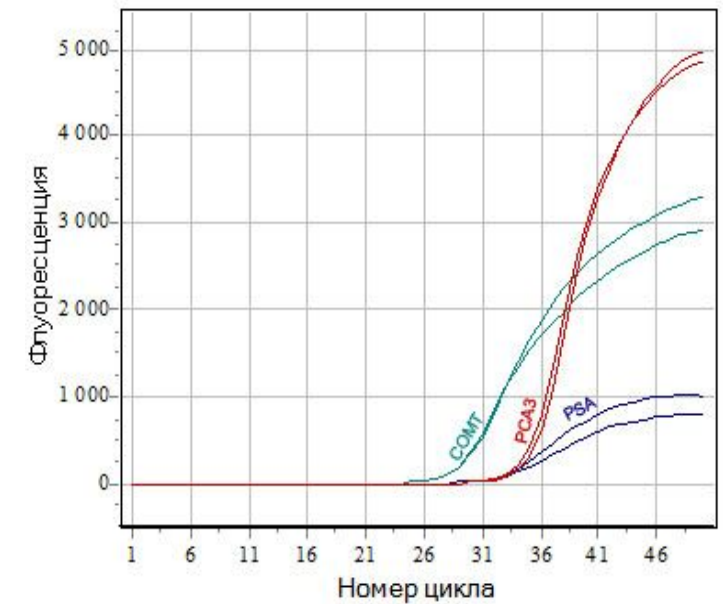
Category	Min	Q1	Median	Q3	Max
200	29,9	30,6	31,35	31,85	32,3
300	29,5	30,3	30,45	30,85	31,2



# Non-invasive prostate cancer detection



© Fedorova.com



Also we are developing own test system for early non-invasive diagnosis of prostate cancer by analyzing the expression level of the gene PCA3. We have also produced a prototype test system.



# Social significance

"Innovation should be available"



- **"Test-RHD» - helps to take timely action to save the lives of babies across Russia**
- **"Test-SRY» - is particularly important for families who are at risk of manifestation of the disease, sex-linked**
- **"DNA-plasma" - qualitatively isolated DNA - the key to reliability of analysis results**
- **Continue to develop innovative, as well as import substitution products available to all segments of the population**
- **Team TestGen updated gifted and promising professionals**





# Thank you for your attention!



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mob. +7 9278 015 333  
mob. +7 917 621 4444  
director@testgen.ru  
www.testgen.ru





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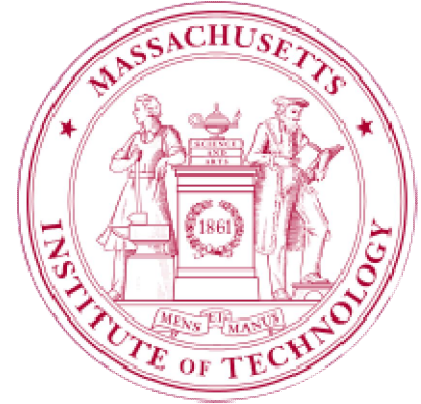
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# TRIZ

300







# Methods of search for new areas of application of technologies

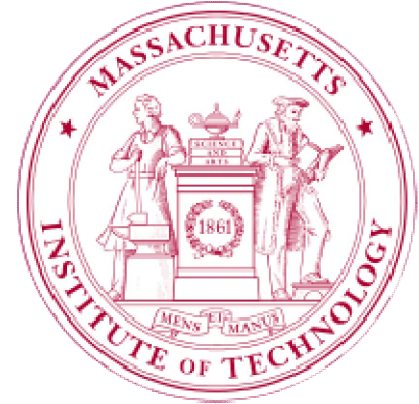
Yu.Danilovsky (Gen 3 Korea), S.Ikovenko (MIT)

Any university developments need monetization through the use in industry.

Any companies are interested in obtainment of new selling markets for their products (materials, processes, design solutions and servicing).

All this could be achieved on the platform of TRIZ approaches. Here are examples.





# Methods of search for new areas of application of technologies

Yu.Danilovsky (Gen 3 Korea), S.Ikovenko (MIT)

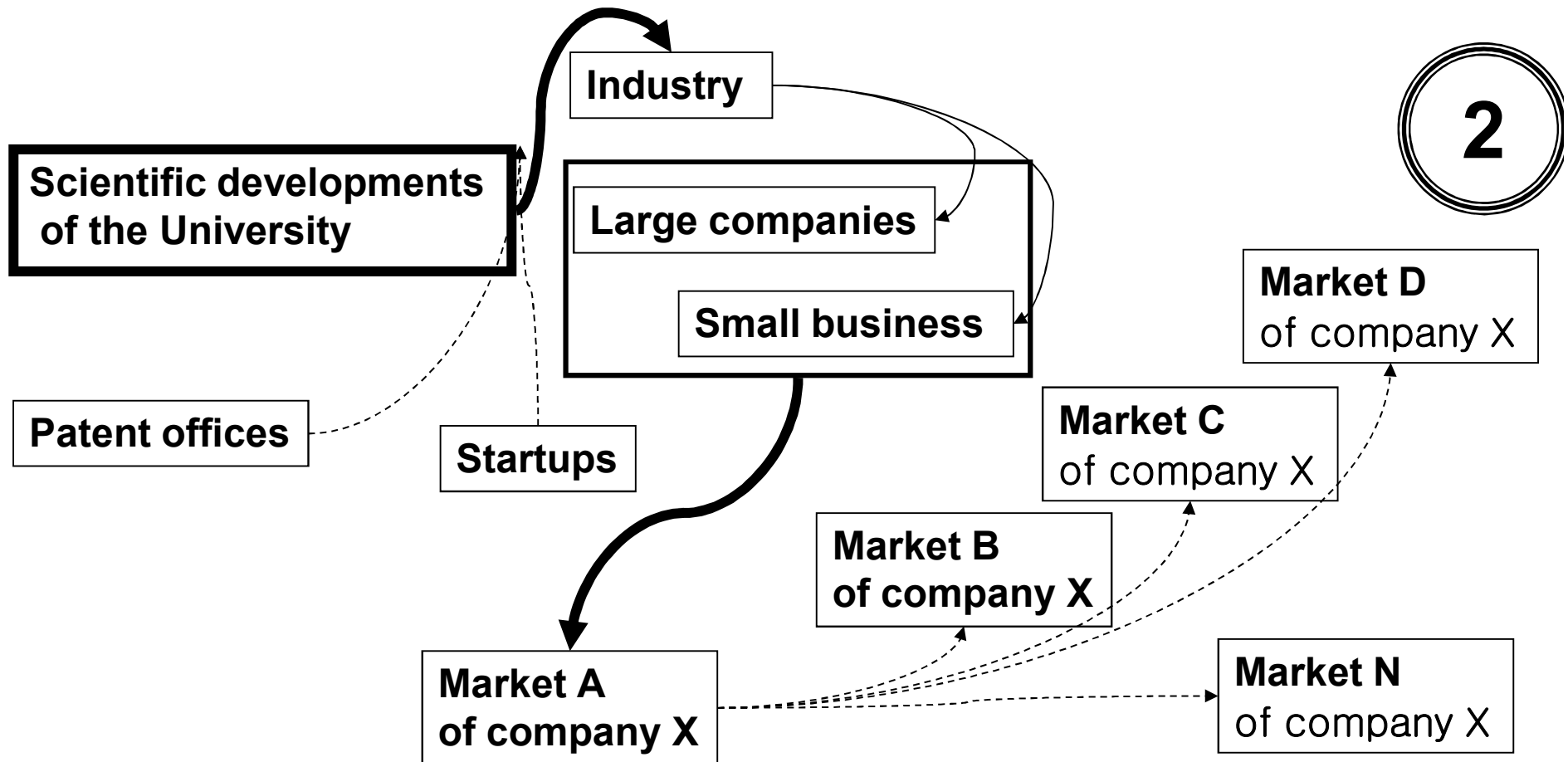
Any university developments need monetization through the use in industry.

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All this could be achieved on the platform of TRIZ approaches. Here are examples.



# Vital character of the topic



- Any university developments need monetization through the use in industry.
- Any companies are interested in obtainment of new selling markets for their products (materials, processes, design solutions and servicing).



# Resource and Function Approach in Analysis



**Substances**

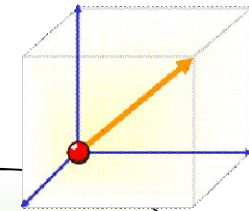
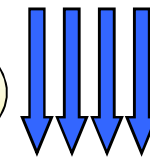


**Time**

Resources of system evolution

**Types  
of energy**

MATCHEM



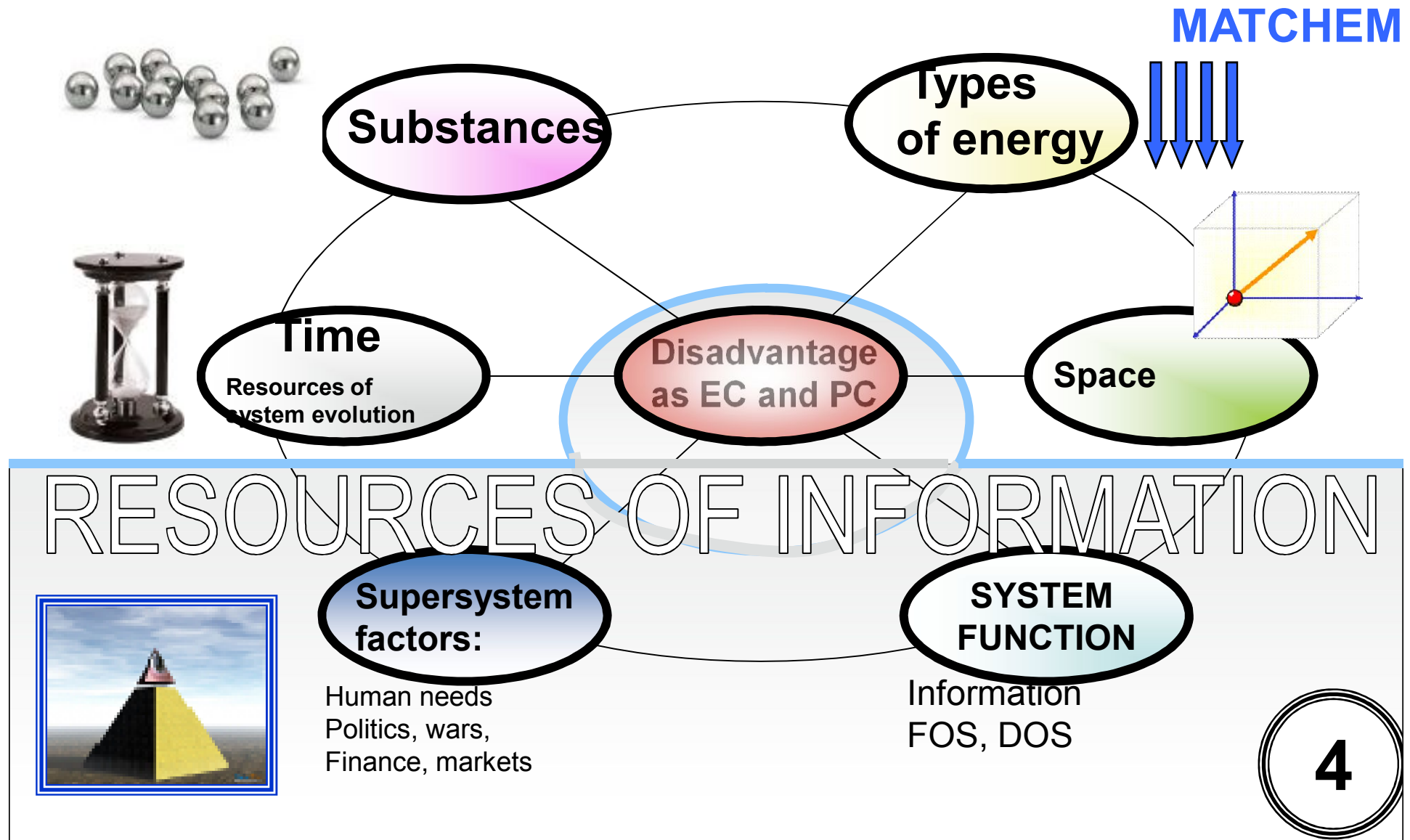
**Space**

- THESE ARE CONVENTIONAL FUNDAMENTAL CATEGORIES OF PHYSICS, ON WHICH TRIZ-CONSULTING ARE BASED. (MATERIAL RESOURCES OF ENGINEERING EVOLUTION)

**3**



# Resource and Function Approach in Analysis





# 4 languages of describing objects, materials, processes, design solutions

Language  
of parameters

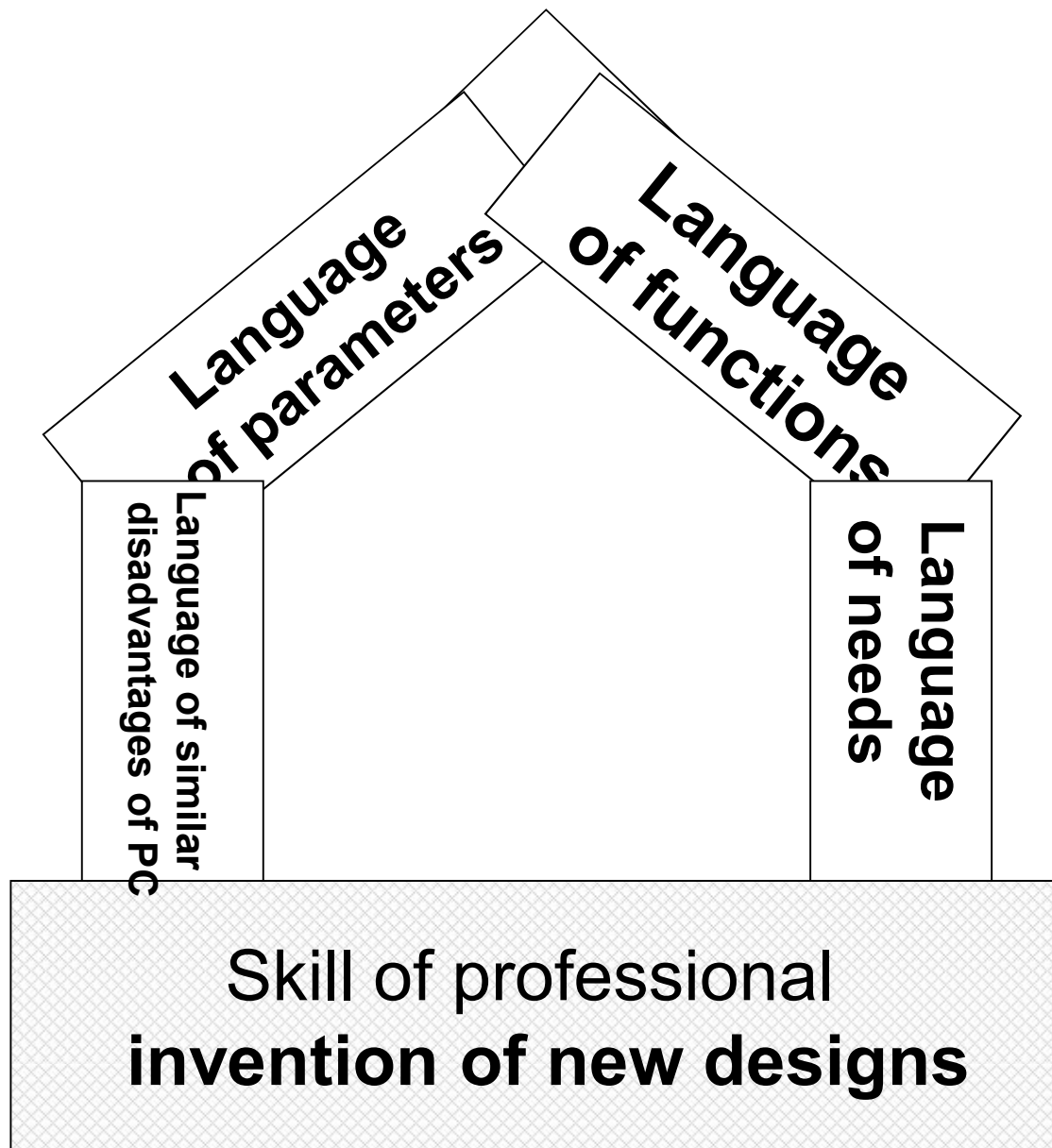
Language of  
(Engineering)  
functions

Language of  
similar  
disadvantages  
(PC and EC)

Language of needs



# 4 languages are supported by the basis



- For each of the used description languages there are developed reference databases of examples (cases), which help to find new areas of application.



## Select parameter for improvement

### 1. Вещества

2. Масса (кг)
3. Количество вещества (моль)
4. Плотность (кг/м<sup>3</sup>)
5. Концентрация (моль/м<sup>3</sup>)
6. Производительность (кг/м<sup>3</sup>)
7. Вязкость (пуаз)
8. Твёрдость (Виккерсу, Бринеллю, Роквеллу)
9. Слётживаемость (сек)

### 10. пространство

11. Длина (м)
12. Площадь (м<sup>2</sup>)
13. Объём (м<sup>3</sup>)
14. Плоский Угол (радиан)
15. Телесный угол (стерадиан)

### 16. Время (сек)

17. Время до основного процесса (сек)
18. Время после основного процесса (сек)
19. Время на перезарядку (сек или %)
20. Время работы без заправки (подзарядки, сек)
21. Время на ремонт (сек)
22. Полное время работы системы на отказ
23. Частота (герц)
24. Скорость (м/сек)
25. Скорость вращения (обороты в секунду)
26. Ускорение (м/сек<sup>2</sup>)

### 27. Энергия (джоуль)

28. Затраты энергии до основного процесса (джоуль или %)
29. Затраты энергии после основного процесса (джоуль или %)
30. Затраты энергии на зарядку системы (джоуль или %)
31. Затраты энергии на переключение режимов (джоуль или %)
32. Сила (ньютон)
33. Мощность (ватт)
34. Давление (паскаль)
35. Температура (кельвин)
36. Теплопроводность (ватт/м.кельвин)
37. Теплоёмкость (джоуль/кельвин)

38. Электрический заряд (кулон)
39. Разность потенциалов (вольт)
40. Сопротивление (ом)
41. Электроёмкость (фарад)
42. Магнитный поток (вебер)
43. Магнитный поток (вебер)
44. Магнитная индукция (тесла)
45. Индуктивность (генри)
46. Электрическая проводимость (сиemens) (siemens) (См)(S)(Ом<sup>-1</sup>)
47. Активность радиоактивного источника (беккерель)
48. Поглощённая доза ионизирующего излучения (грей)
49. Эффективная доза ионизирующего излучения (зиверт)(sievert)(Зв)(Sv)(Дж/кг = м<sup>2</sup>/с<sup>2</sup>)
50. Активность катализатора (катал)(katal)(кат)(kat)
51. Световой поток (люмен)(lumen)(лм)(lm)(кд·ср)
52. Освещённость люкс (lx) (лк) (lx)(лм/м<sup>2</sup> = кд·ср/м<sup>2</sup>)
53. Оптическая сила линзы – диоптрия
54. Информация (бит) потери информации
55. Плотность информации (бит/м<sup>2</sup> или м<sup>3</sup>)
56. Уровень сложности системы (количество элементов)
57. Наличие вредных связей
58. Возможность замены направления процесса
59. Уровень универсальности системы (количество категорий покупателей)
60. уровень требований к точности изготовления (высокий, низкий)
61. Безотказность — свойство объекта непрерывно сохранять работоспособное состояние в течение некоторого времени или наработки. [1]
62. Ремонтопригодность — свойство объекта, заключающееся в приспособленности к поддержанию и восстановлению работоспособного состояния путем технического обслуживания и ремонта. [1]
63. Долговечность — свойство объекта непрерывно сохранять работоспособность от начала эксплуатации до наступления предельного состояния, то есть такого состояния, когда объект изымается из эксплуатации.
64. Сохраняемость — свойство объекта сохранять работоспособность в течение всего периода хранения и транспортировки.
65. Живучесть — свойство объекта сохранять работоспособность при отказе отдельных функциональных узлов.

## PhC Physical contradiction

Посмотреть  
Примеры  
прототипов из  
старых  
проектов

Следующий пример

7



# Resolving a PC – the temperature should be high and low through “harmonization”



Fragment of reference database on physical contradictions

**Macro – micro**

ФП: Температура должна быть и большая и маленькая

1.2.1 «перчатка для сковородки»

Physical Contradiction easy example  
Surface in the glass of tea must be warm, because I like warm tea, but glass of tea must be cold, because warm surface of glass is danger for peoples.

Solution 1

«COLD»  
«WARM»

24 매개물 이용 (Intermediary)

36 36. Фазовые переходы

24 24. Принцип посредника

ФП: Температура должна быть и большая и маленькая

5.1.1 «матрешка»

«гессенский тигель». XVI века. С его помощью был открыт алюминий

7) 중첩 (Nested doll)

7. Принцип «матрешки»

ФП: Температура должна быть и большая и маленькая

5.3.3. «комбинация агрегатных состояний»

35) 물성치 변화 (Parameter changes)

35 35. Изменение физ.-хим. состояния

24 매개물 이용 (Intermediary)

24 24. Принцип посредника

ФП: Температура должна быть и большая и маленькая

Воздушное охлаждение на фольксвагене «Жук»

1.1.4. «вещество из внешней среды бесплатно»

24 매개물 이용 (Intermediary)

24 24. Принцип посредника

ФП: Температура должна быть и большая и маленькая

5.2.3. «вещество как поле»

6) 6. Принцип функциональности

Decision / Решение

Можно регулировать температуру перемещением линзы

3) 국부적 품질 (Local quality)

3. Принцип местного качества

24 매개물 이용 (Intermediary)

24 24. Принцип посредника

ФП: Температура должна быть и большая и маленькая

1.1.4. «вещество из внешней среды бесплатно»

Эффект Ранка

1.1.4. «вещество из внешней среды бесплатно»

24 매개물 이용 (Intermediary)

24 24. Принцип посредника

Separation of a compressed gas into a hot stream and a cold stream  
The vortex tube, also known as the Ranque-Hilsch vortex tube, is a mechanical device that separates a compressed gas into hot and cold streams.

ФП: Температура должна быть и большая и маленькая

1.1.4. «вещество из внешней среды бесплатно»

Evaporative cooler

Heat insulation  
Cool humid air  
Air duct to home  
Vibration absorber  
Blower motor  
Hot Dry Outdoor Air  
Wood wool evaporative pads  
Overflow tube  
Ball float valve to Tap water

Water distribution lines  
Blower  
Wood wool evaporative pads  
Recirculating water pump  
Water pump screen

36 36. Фазовые переходы

24 24. Принцип посредника

ФП: Температура должна быть и большая и маленькая

5.3.3. «комбинация агрегатных состояний»

Image 1: Typical steam-heated kettle reboiler for distillation towers

Reboiler vapor to tower

Liquid level

Steam

Condensate

36 상변환 (Phase transitions)

36. Фазовые переходы

24 매개물 이용 (Intermediary)

24 24. Принцип посредника

ФП: Температура должна быть и большая и маленькая

5.3.3. «комбинация агрегатных состояний»

Кислород (дросселирование) Азота даёт температуру -40°

Можно регулировать Температуру изменением Скорости истечения газа

1.1.4. «вещество из внешней среды бесплатно»

36 상변환 (Phase transitions)

36. Фазовые переходы

24 매개물 이용 (Intermediary)

24 24. Принцип посредника

8

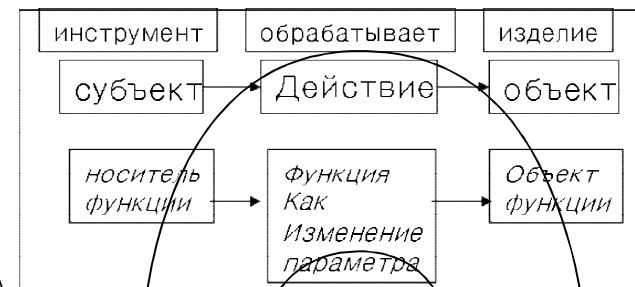


# Furnish a description of the operation principle of your product consisting of three words only

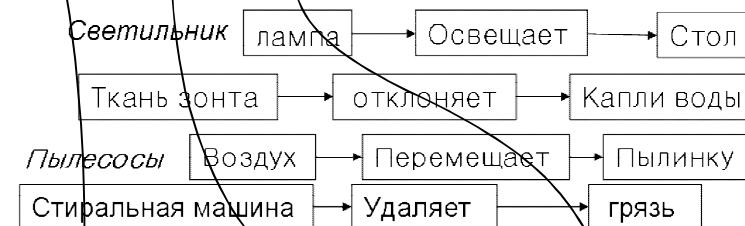
- Select an appropriate verb from the list:

100 удобных глаголов для функционального анализа, включая «40 глаголов Федосова» из работы 2009ого года	
Двигать, перемещать, толкать, вращать, вставлять, ударять, шевелить, трясти, нажимать, размешивать, тянуть, стукнуть, бить, ставить, помещать, бросать, излучать	перемещать
Добавлять, присоединять, прикреплять, доливать, досыпать, наполнять, примешивать, пришивать, приклеивать, приваривать, соединять, связывать, дозировать, разбавлять, Увлажнять, информировать, окрашивать	Добавлять
Удалять, отделять, стирать, фильтровать, очищать, искл. чать, вычёркивать, извлекать, добывать, выкапывать, экстрагировать, выпаривать, выталкивать, обрезать, изнашивать, испарять, разделять, изолировать,	убирать
Удерживать, держать, хранить, сохранять, задерживать, фиксировать, останавливать, контролировать, хранить, содержать, ограничивать	удерживать
Изменять направление движения, отражать, предохранять от удара, создать турбулентность, реверберировать, воздействовать, отклонять, отталкивать, отбрасывать, препятствовать, преграждать, укорять, тормозить, направлять	Отражать- отклонять
Превращать - Изменять параметры агрегатных состояний вещества по классификации Б.Злотина МАТХЕМ Растягивать, деформировать, изгибать, разгибать, формовать, сжимать, растягивать, смять, разрушать, разжигать, раздробить, молотить, разбивать, растереть в порошок, превратить в пудру, упрочнять, дросселировать, нагревать, плавить, охлаждать, таять, возгонять, конденсировать, окислить, восстановить, растворить, наэлектризовать, заземлить, размагнитить, фокусировать, измерять	превращать

## Function-Oriented Search



## Simplest examples:



Посмотреть  
Примеры  
прототипов из  
старых  
проектов

9

Следующий пример



# Function-Oriented Search and REVERCE FOS



Similar function in different systems can be a reason for transferring the solution from area 1 to area 2 and from area 2 to area 1



# Disadvantage-Oriented Search

1. **Вредные вещества**
2. Наличие расходных материалов
3. Маленькая производительность
4. Низкая энергонасыщенность вещества
5. Необходимость убирать вещества
6. Необходимость с регулировать потоки веществ
7. **Вредные поля** (маленькая помехоустойчивость)
8. Большой вес
9. Большое суммарное Энергопотребление
10. Большое энергопотребление при включении
11. Большое энергопотребление при переключении
12. Много движущихся частей
13. **Пространство** Большие габариты при переноске
14. Большие габариты при хранении
15. Форма не согласована с НС
16. Банальная форма и цвет
17. Маленькая дистанция пробега (доставки)
18. Отсутствует мобильность
19. **Маленькая Долговечность** (время жизни)
20. Большое время перезарядки
21. Маленькое время автономной работы
22. Плохая эргономичность (малое время до возникновения усталости)
23. Низкая скорость процесса (большое время исполнения)
24. Большое время овладения умением работать (сложность в обучении)
25. **Нет исправительной функции**
26. Низкая ремонтпригодность
27. Мало дополнительных функций
28. Много дополнительных функций (ненадёжность)
29. Требуется наличие дополнительных систем
30. Большая стоимость подготовки производства
31. Большая стоимость ремонта
32. Большая стоимость расходных материалов

See examples  
of prototypes  
from old projects

Next example

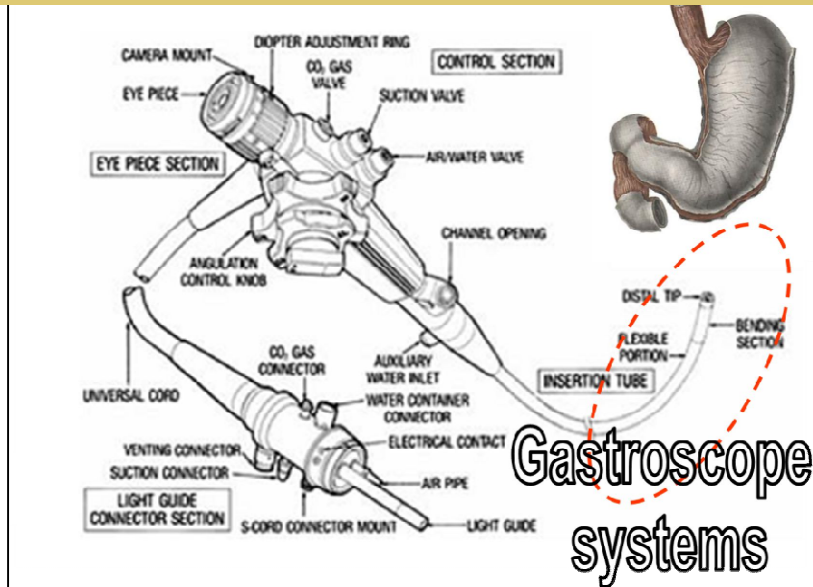
**DESCRIBE YOUR PERSONAL  
CLAIMS TO THE PRODUCT**

- **Select the appropriate  
DISADVANTAGE from the  
list:**

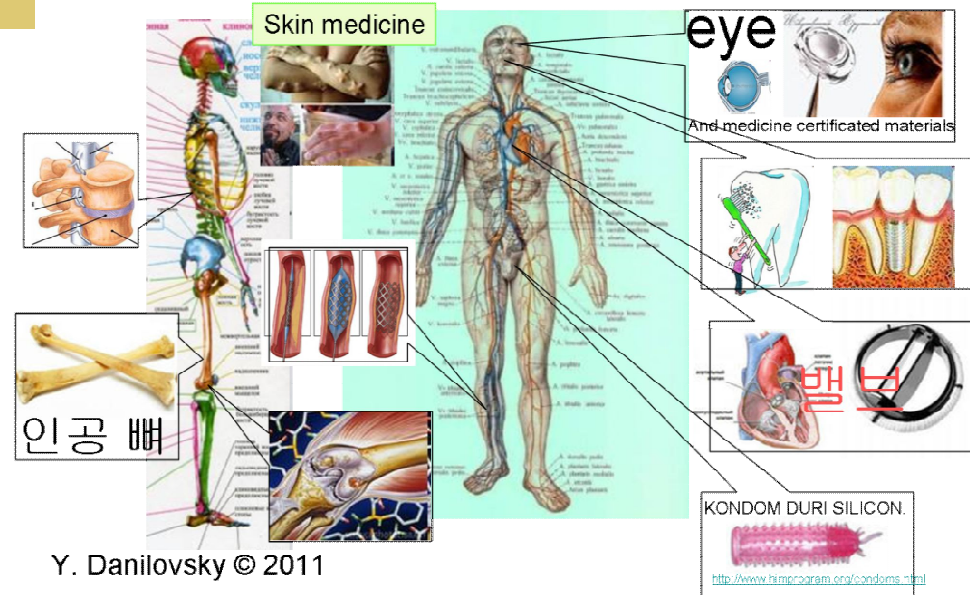
11



Where can we find a similar disadvantage –  
SUBSTANCES, WHICH ARE  
HARMFUL FOR THE HUMAN?



Search of materials for medicine instruments  
(approach DOS: Disadvantage Oriented Search)



## Disadvantage Oriented Search

[http://www.alibaba.com/trade/search?SearchType=product&silicone+rubber&country=&catId=4131&index=1&product\\_ons&showAllCategories](http://www.alibaba.com/trade/search?SearchType=product&silicone+rubber&country=&catId=4131&index=1&product_ons&showAllCategories)

### nontoxic silicone rubber in Korea

Related Searches: medical grade silicone rubber, lowes liquid silicone rubber, Bore...

Category: Mechanical Parts & Fabrication

Products: Mechanical Parts & Fabrication Services > "nontoxic silicone rubber" > 405 Products found

Filters: ESCROW, Gold Supplier, Audited Supplier, Online

Group Products by Supplier

Supplier Location: China (Mainland) (451), Hong Kong (14)

Business Type: Manufacturer (455), OEM Service Offered (455), Buyer User Offered (117), Design Service Offered (215), Trading Company (342), More...

Min. Order: [input field]

Confirm

Need Help? Contact Us

**Idea 1**

• More 400 suppliers. Let's select it...

<http://www.optometric.com/article.aspx?article=100541>

### Artificial material for eye

*List of suppliers of substances*

- How Your Patients Will Benefit From the Latest Lens Technology
- MARC R. BLOOMENSTEIN O.D., F.A.A.O. Scottsdale, Ariz.
- <http://www.optometric.com/article.aspx?article=100541>
- Trademark (Producer)
- ReZoom (Advanced Medical Optics)
- Tetraflex (Lenstec)
- Synchrony (Visiogen)
- AcrySof ReSTOR (Alcon)
- Crystalens 5-0 (Eyeonics)
- STAAR Toric (STAAR Surgical)
- AcrySof Toric (Alcon)
- Verisyse (AMO)
- Visian ICL (STAAR Surgical)
- Tecnis (AMO)
- AcrySof IQ (Alcon)
- SofPort AO (Bausch & Lomb)

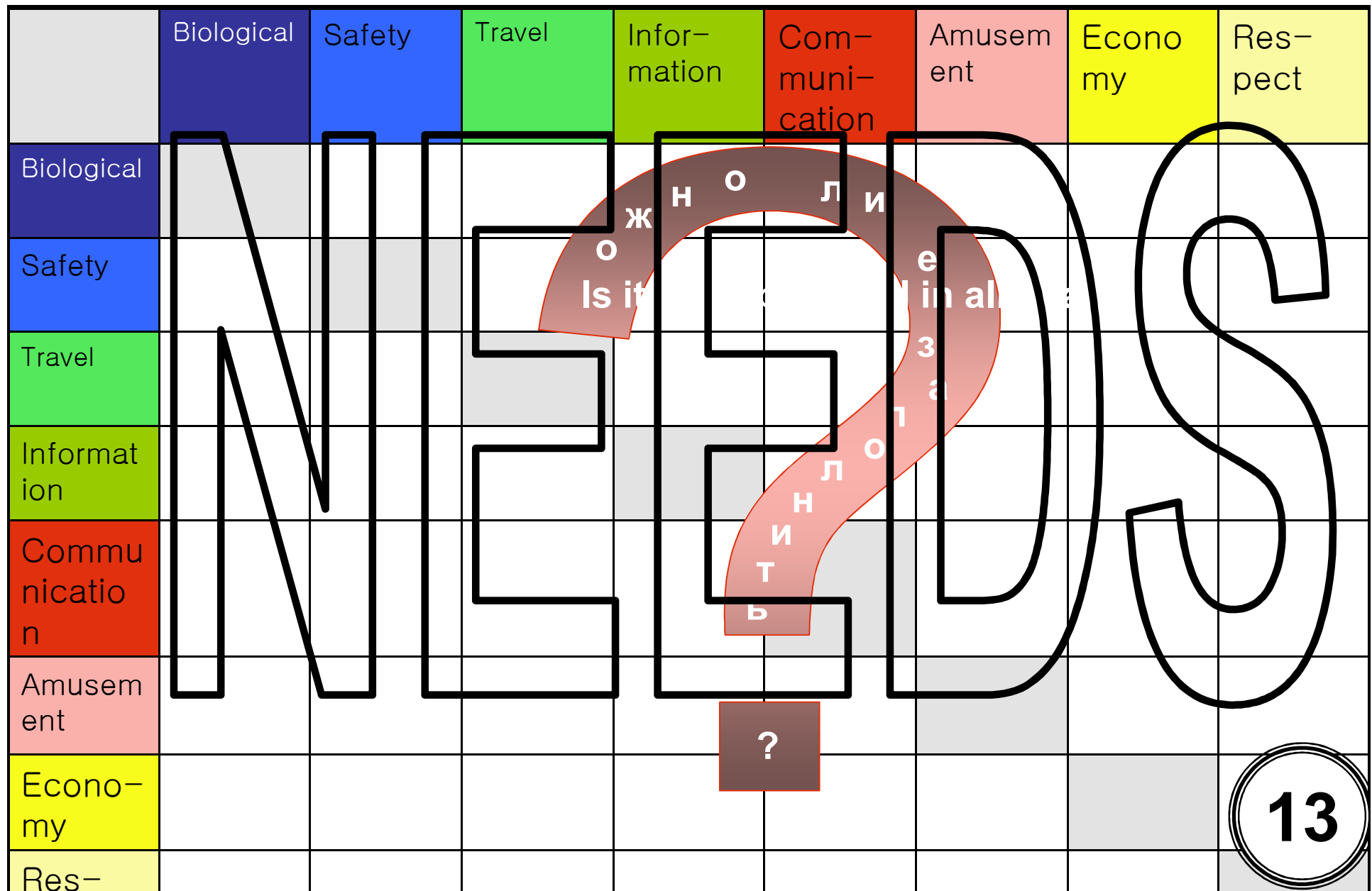
**Idea 2**

**2**

**12**



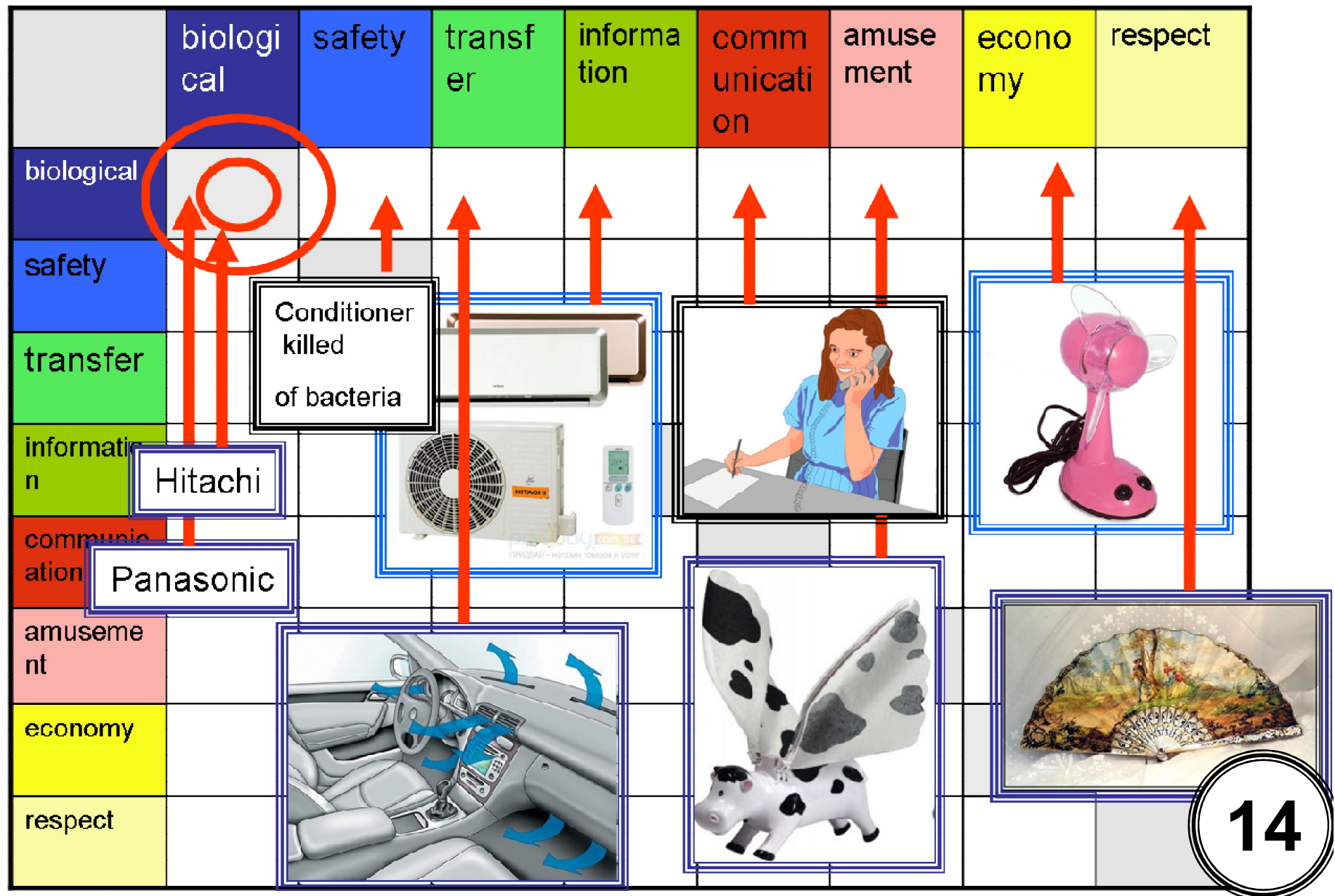
## Morphology, integration of needs





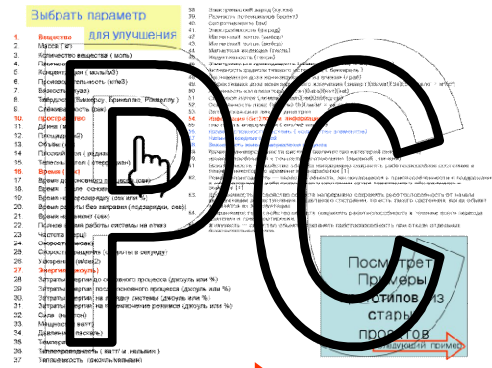
# Needs

## Morphology of association of needs

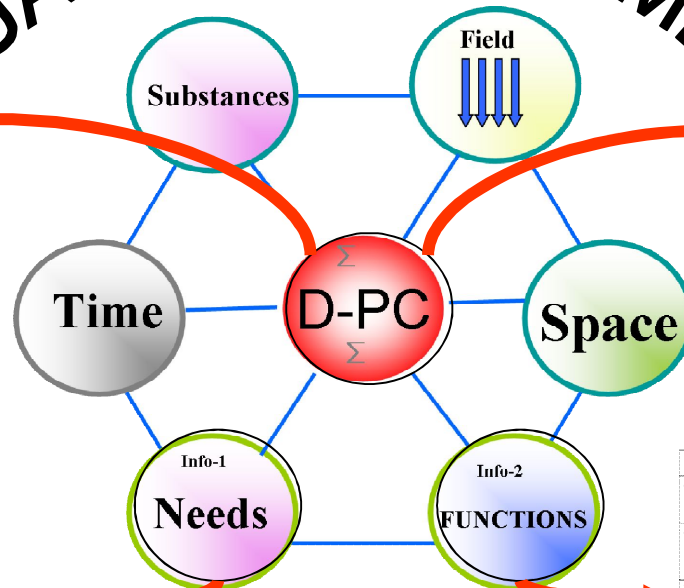




# All tools are interconnected by a resource approach



LANGUAGE OF PARAMETERS

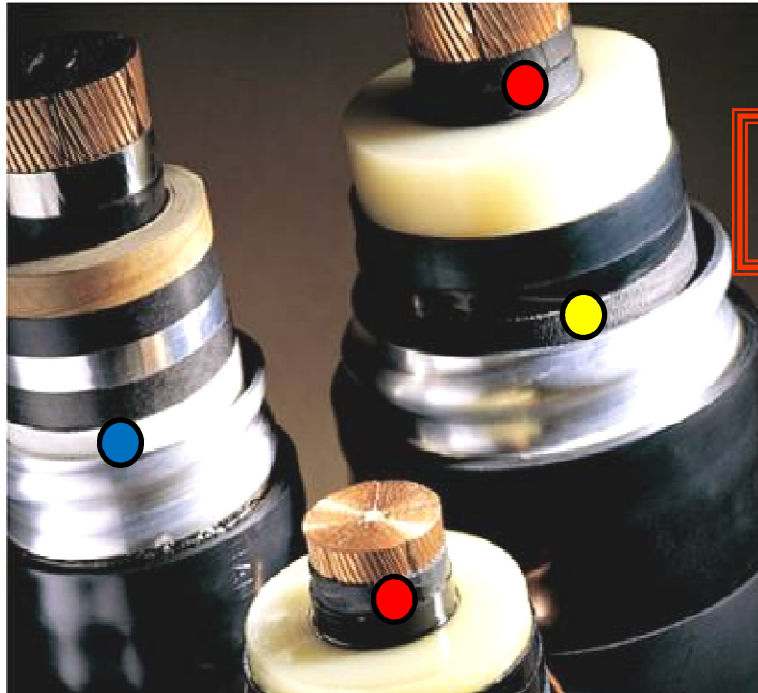


15





# Language of parameters and engineering functions EXAMPLE



The company manufactures film for cables

It looks for new sales markets

- Semi-conductive Tapes (Conductor Shield Tapes)

- Semi-conductive Tapes (Insulation Shield Tapes)

- Non-conductive Tapes

- **PARAMETERS,** which are important for using in other fields
- Electric conductivity (earthing)
- Resistance to water
- Resistance to tearing
- Elasticity

## • FUNCTIONS

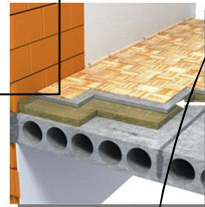
- Earthing of surfaces (removal of charges)
- Retain the water (hold water or air)
- Increase of temperature
- Vary the color
- Move the gas
- Drying
- Evaporation
- Moisture removal
- Increase/Decrease surface



### 1. 정전기 방지용 '바닥재 접착제'

전도성 코팅제를 장판용 접착제로 이용

내구성	접착성	심미성
방정전기	항균성	발열성



전도성 접착제  
(러시아 제품)

전자기기의  
일반적 바닥 디자인

#### Needs

정밀한 전자기기를 제조하거나 사용하는 장소에서는 사람과 바닥간의 마찰로 정전기가 발생되어 전자기기에 고장이 유발될 수 있음

0/91

#### Concept

로이포스 전도성 코팅제를 전자기기가 되어있는 장소 바닥에 칠하고 장판을 덮어 정전기 방지 (접착성분 혼합)

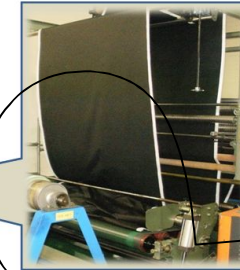
나=우리

1

### 2. 정전기 방지용 바닥재

전도성 전을 바닥재로 사용

내구성	접착성	심미성
방정전기	항균성	발열성



2

#### Needs

주유소 등 정전기로 인해 대형사고가 발생할 수 있는 장소에는 정전기 방지 대책이 필요

1/91

#### Concept

로이포스 전도성 원단을 바닥재로 활용하여 정전기를 방지함으로 정전기로 인한 사고를 방지할 수 있음

나=우리

### 3. 정전기 방지용 벽지

전도성 전을 벽지로 사용하여 정전기 방지

내구성	접착성	심미성
방정전기	항균성	발열성



정밀 전자기기 제조/사용 Room



의료실

3

#### Needs

정밀한 전자기기를 제조하거나 사용하는 장소에서는 벽에서도 정전기가 발생되어 전자기기에 고장이 유발될 수 있음

2/91

#### Concept

로이포스 전도성 원단을 벽지로 활용하여 정전기를 방지함으로 정전기로 인한 고장을 방지할 수 있음. 검은 색이 적당치 않다면 미관을 위해 커버층을 덧씌울 수도 있음

나=우리

- Reverse FOS approach
- “WHERE ELSE do we use the function “earthing” (remove field) ?
- 1 – in creating floor for electric equipment
- 2 – in earthing the surfaces at filling stations
- 3 – in “clean” rooms



# Where is the function “heat” important? ( 4 and 7)

## Where is the function dry (remove water) important? (5 and 6)

### 4. 전도성 침대, 소파, 이불

전도성 천을 침대나 소파, 이불 등에 사용하여 정전기 방지

내구성	접착성	심미성
방정전기	항균성	발열성

4



#### Needs

기존의 침대나 소파, 이불은 정전기가 발생하기 쉬워서 불쾌감을 유발하고 건강에도 안 좋을 수 있음.

#### Concept

이불을 전도성 천으로 하면 정전기를 방지하여 불편한 상태에서 접촉할 수 있음. 이러한 용도로 PE 자체의 내구성과 항균성 등이 잘 맞을 수 있음. 미관상 문제가 있다면 커버층 추가 가능

### 7. 면발열을 이용한 난방 시스템

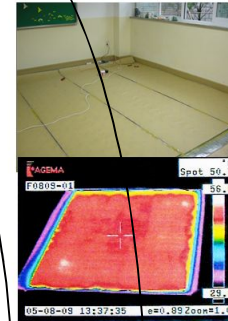
면발열체를 장판 밑에 까는 구조의 난방시스템

내구성	접착성	심미성
방정전기	항균성	발열성

#### 장점

- 간편하고 저렴한 시공
  - 기존 바닥마감 위에 신속 간편하게 설치
  - 보일러실, 배관 등 별도 시설 불필요
- 친환경, 건강, 쾌적
  - 유해요소 없음 (매연, 유독가스, 소음, 전자기파 등)
  - 원적외선 방출, 전자파 차단, 곰팡이나 냄새 제거
- 높은 에너지 효율
  - 전기열선이나 기름보일러보다 수십 % 저렴
  - 급속 난방, 부분 난방 가능

7



#### Needs

기존 난방장치인 기름 보일러 등은 배관 등 설치가 번거롭고 비싸며 환경이나 건강에도 안 좋으며 비싸다. 전기열선 방식도 전기료가 많이 든다.

#### Concept

로이포스 전도성 코팅제가 임해진 원단을 장판 밑에 전극, 전선과 함께 설치하여 전기난방시스템으로 활용

## PC – there should be water and there shouldn't be water

### 5. 발열 건조 우산

면발열 천을 우산천으로 이용하여 발열 건조

내구성	접착성	심미성
방정전기	항균성	발열성

5



특허출원가능

#### Needs

젖은 우산은 펴서 오랜 시간 놔둬야 건조할 수 있으며, 건조하기 전까지 여러 곳에 물을 흘리거나 문질 수 있어서 번거롭고, 세균이 번식할 수 있음.

#### Concept

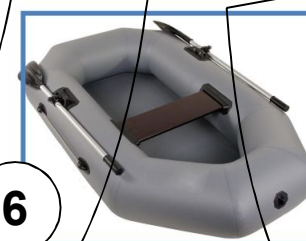
로이포스 전도성 원단을 우산 천으로 활용하여 전류를 흘릴 수 있도록 회로를 구성하여 발열로 건조된 우산을 쉽게 건조시킨 뒤 습한 날씨에 사용하지만 위험방지설계가 필요

### 6. 발열건조식 물놀이용품

면발열 천을 물놀이 튜브, 보트 등에 이용하여 발열 건조

내구성	접착성	심미성
방정전기	항균성	발열성

6



특허출원가능



#### Needs

물놀이 튜브나 보트는 물속에서 오래 사용하면 건조하기가 어렵고, 물이 튜브나 보트에 묻어 있으면 냄새가 나고 곰팡이가 생길 수 있음

#### Concept

로이포스 전도성 원단을 튜브나 보트의 천에 부착하고 전류를 흘릴 수 있도록 회로를 구성하여 발열로 물을 쉽게 건조시킴

# NEEDS

18



## 9. 면발열 및 감온변색성을 이용한 플래카드

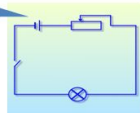
플래카드 등에 면발열체와 감온변색성 물질을 써서 온도에 따라 두 가지 이상의 이미지를 표현

내구성	접착성	심미성
방정전기	항균성	발열성



9

특허출원가능



Исходное состояние Подогрев состояния Измененное состояние

### Needs

기존 플래카드는 고정된 한 가지 이미지 밖에 나타낼 수 없음

### Concept

플래카드의 천을 면발열체로 만들고 감온변색성 (Thermochroic) 물감을 써서 이미지를 그리면 Off상태의 이미지와 On(가열)상태의 이미지가 서로 다르도록 만들 수 있음.

8/91

나=우리

## 10. 면발열 및 감온변색성을 이용한 벽지

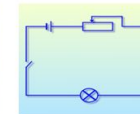
벽지에 면발열체와 감온변색성 물질을 써서 온도에 따라 두 가지 이상의 이미지를 표현

내구성	접착성	심미성
방정전기	항균성	발열성



10

특허출원가능



### Needs

기존 벽지는 고정된 한 가지 이미지 밖에 나타낼 수 없음

### Concept

면발열체로 만들고 감온변색성 물감을 써서 이미지를 그리면 Off상태의 이미지와 On(가열)상태의 이미지가 서로 다르도록 만들 수 있음. 또한 가끔 가열하면 벽에 습기나 곰팡이도 방지 가능함.

9/91

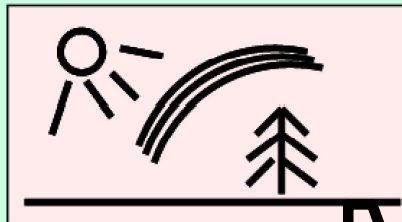
나=우리



Where is the function  
“vary color” (inform) important? ( 9 and 10)

## 32) 색변화(Color changes)

32



32. Изменение цвета

19

NEEDS



# Language of parameters, engineering functions and needs EXAMPLE



- Example of search for new application areas for TECHNICAL VELVET
- VELVET

## Needs

- Safety
- Amusements

## • PARAMETERS

- Dielectric permeability
- Porosity
- Non-transparency  
прозрачность

## • FUNCTIONS

- Hold substance

- Hold field
- Add field
- Reflect substance

20



NEEDS – amusements, creation of pictures on high-quality fabric

## Idea 1: material for printing



Resource analysis

**Important resource 1:** good material for printing

**Important resource 2 :** porous material

(it can be some filter or system for collecting and holding some substances)

# NEEDS

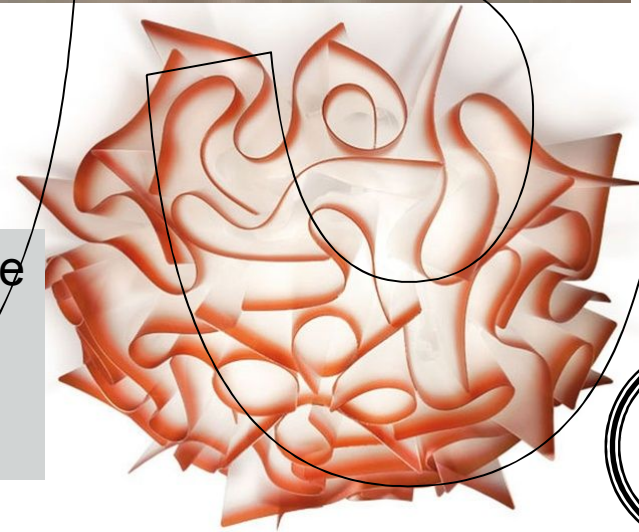


## Idea 2: Lampshades

Resource analysis



Material for lampshades



Search some new design for using velvet

# NEEDS



EXPENSIVE WALLPAPER FOR RESTAURANT

## Idea 3: Wallpapers for walls made of fabric



Resource analysis

# NEEDS

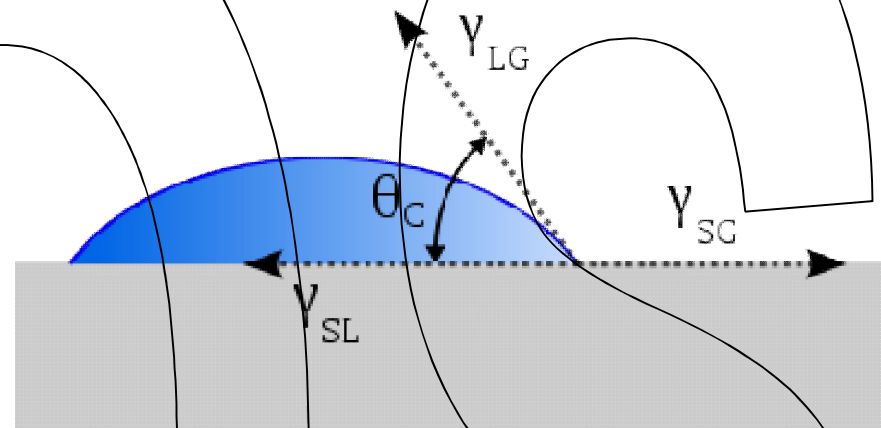
23



# Hydrophobic

## 소수성 and special substances for enhancing hydrophobic features of clothes

- 소수성(疏水性, 하이드로포빅) 물 분자와 쉽게 결합되지 못하 성질을 의미한다. 일반적으로 크성을 띠지 않으면 소수성을 띤다. 또한 소수성의 물질은 물과 섞이지 못하여서 그 물질의 위에 표면장력 때문에 동그랗게 물방울이 생긴다
- 생물학에서의 소수성 [편집]
- 세포막을 이루고 있는 인지질이 나 세제와 같은 물질은 친수성인 머리 부분(인산기)과 같은 산기)과 소수성인 꼬리 부분(탄화수소)을 가지고 있는 것도 있다.



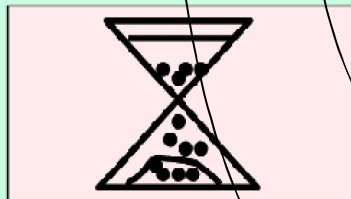
<http://www.obuvkosmetica.ru/products/79>



Existing product  
In market  
Cost \$7

31) 다공성 물질(Porous materials)

31



31. Капиллярно-пористые материалы

[http://en.wikipedia.org/wiki/Hydrophobic\\_effect](http://en.wikipedia.org/wiki/Hydrophobic_effect)

<http://en.wikipedia.org/wiki/Hydrophobe>

<http://ko.wikipedia.org/wiki/%EC%86%8C%EC%88%98%EC%84%B1>



## CONSTRUCTION FABRICS FOR WATER RETENTION

**Idea 4:** material for blocking the spread of water in construction area

[http://www.penta-don.ru/vodoottalkivaushaya\\_propitka.php](http://www.penta-don.ru/vodoottalkivaushaya_propitka.php)



**25**

- Suggestion: we can use our fabric (velvet) together with special liquid from construction area for blocking spread of water



Construction fabrics for stopping fire

## Idea 5: Construction area: increase of resistance to fire

Some Russian company as example:



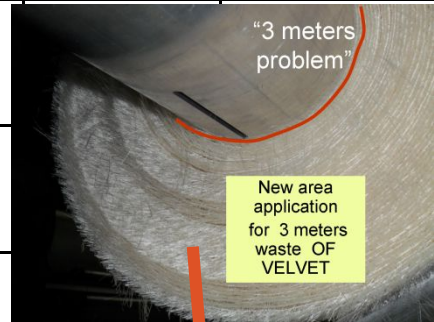
<http://www.stroyip.ru/goods/security/53/product-243236.html>

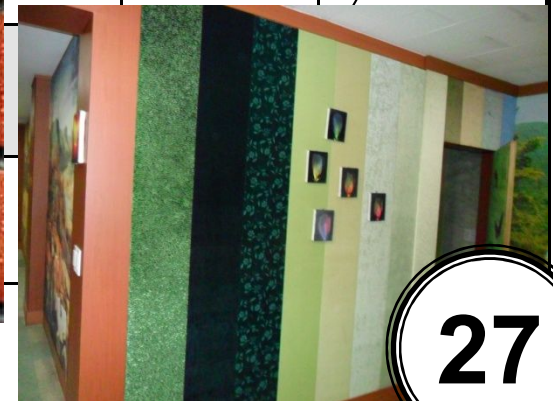


- It is a product, which exists in every market. It is necessary to try several experiments with these substances



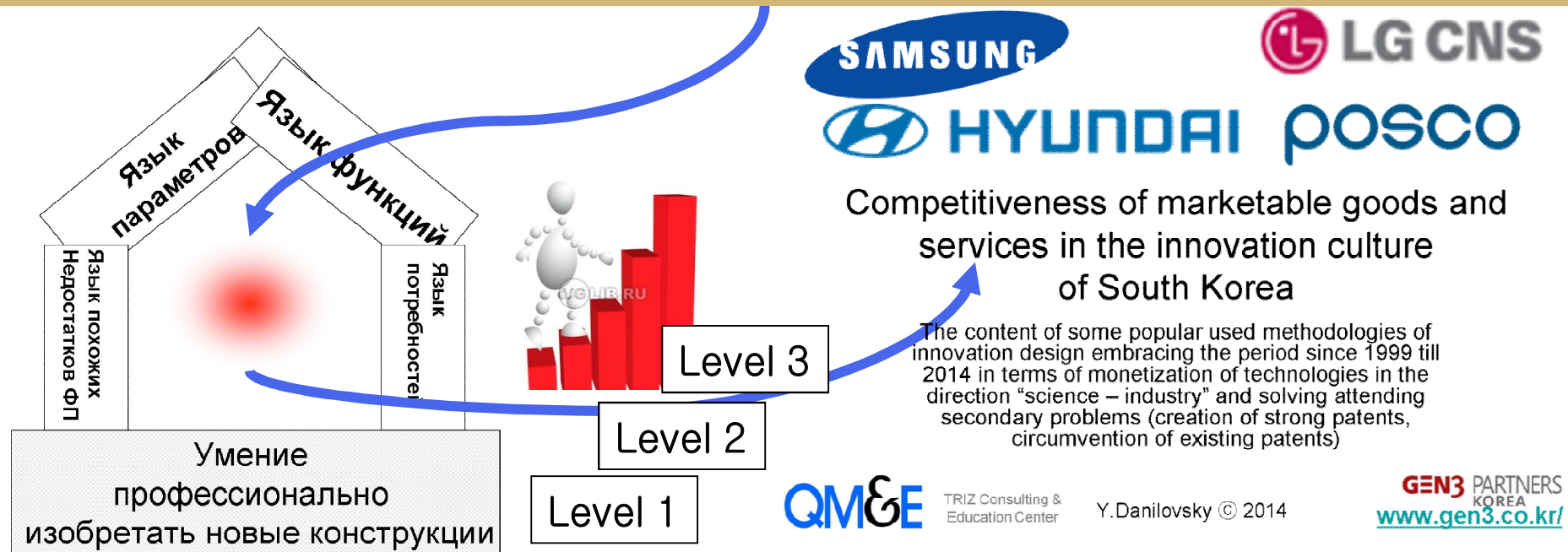
# Resources of human needs as a trend of needs integration: two needs can be met in one technology...

	biologic al	safety	transfer	informa- tion	commun ication	amusem ent	econom y	respect
biological								
safety								
transfer								
informatio n	Lampshades	Fire-resistant fabric HYDRO-INS ULATION			Pictures on fabric		Manufacturing g of TV sets	Expensive velvet wallpaper
communic ation								
amusemen t								
economy								
respect								





# HOW TO TEACH OTHERS TO DO THIS? “Increase of competitiveness of products and of TRIZ”



- In order to learn to quickly find new application areas for technologies, substances, existing des solutions, it is necessary to get a fundamental education according to MATRIZ programs. Welcome to the “**courses of evaluating technologies**” using TRIZ as an applied science.





## Competitiveness of marketable goods and services in the innovation culture of South Korea

The content of some popular used methodologies of innovation design embracing the period since 1999 till 2014 in terms of monetization of technologies in the direction “science – industry” and solving attending secondary problems (creation of strong patents, circumvention of existing patents)



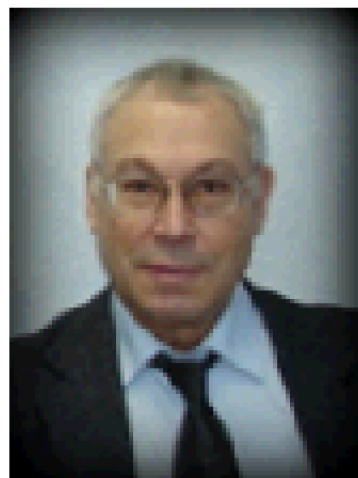
TRIZ Consulting &  
Education Center

Y.Danilovsky © 2014

**GEN3** PARTNERS  
KOREA  
[www.gen3.co.kr/](http://www.gen3.co.kr/)



Dr. Vitaly Andreev.



EET

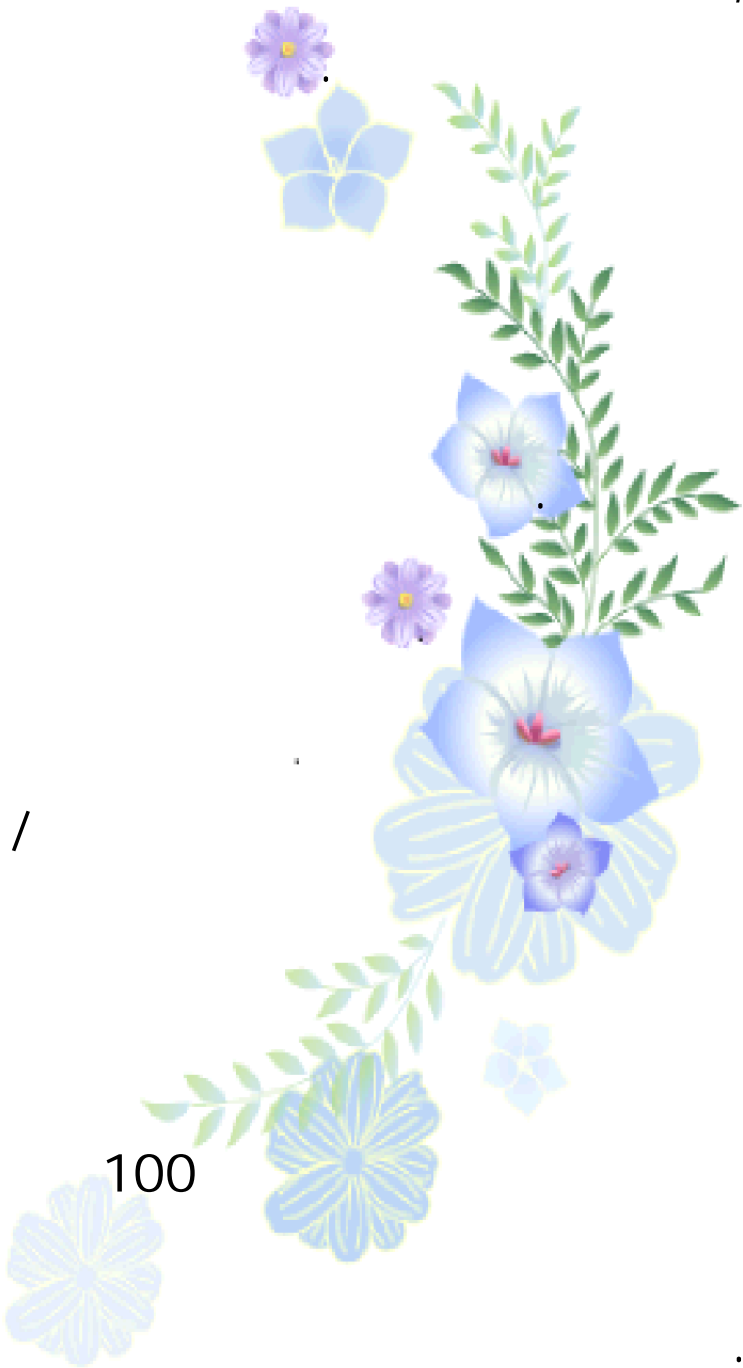
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2

- 20
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*Genuine Purified Water*

*from ELECTROCONDITIONING, "ELECON" and "CASCADE"*

The Electric field - a powerful factor in the transformation of water in nature, economic and vital activity of people.

Theoretical aspects and latest technological advances

*V.S.Andreev*

**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# FUNDAMENTAL PHYSICAL INTERACTIONS

Particle-carrier	Radius of influence, m	Relative force	Kind of the "charge"
graviton	$\infty$	1	mass
boson	$10^{-15}$	$10^{25}$	weak isospin
photon	$\infty$	$10^{36}$	electric charge
gluon	$10^{-18}$	$10^{38}$	color charge

**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# What we mean when speaking about “water treatment”?

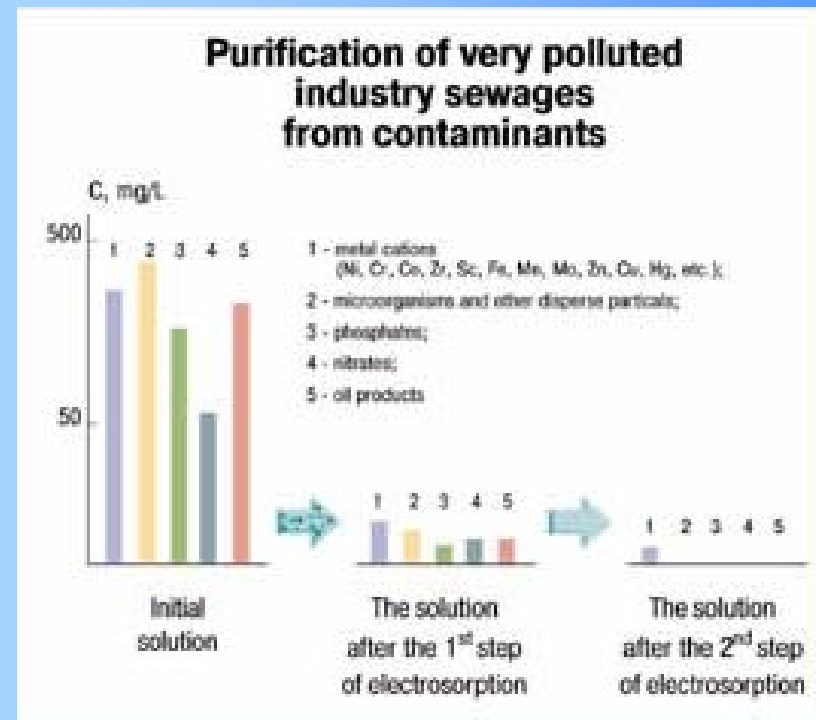
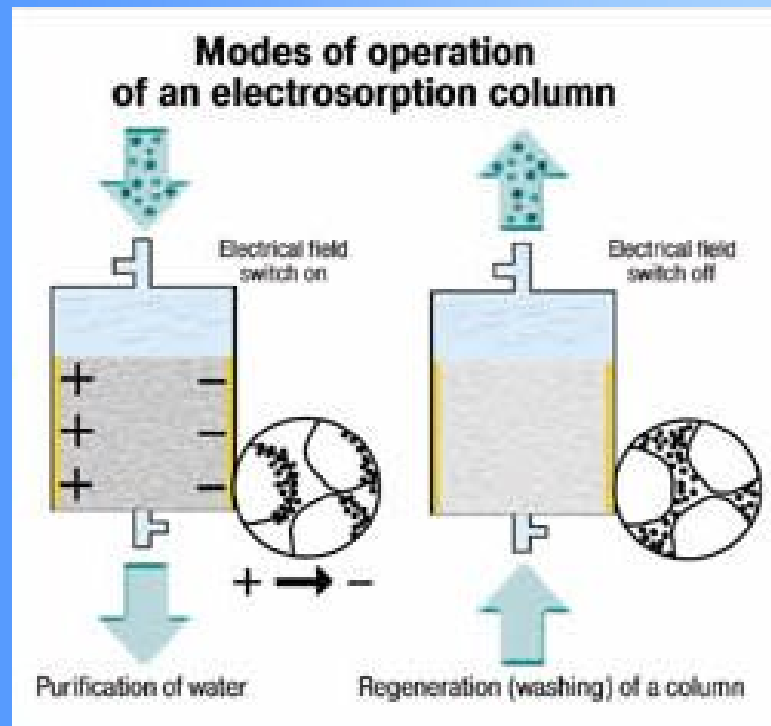
- 1) Wide variety of tasks purification potable water from impurities, undesirable from the point of view of the final consumption of water. There may be both drinking and domestic water supply, and the use of treated water for various processes in the industry.
- 2) Sterilization of potable water, i.e., elimination microorganisms from it. This problem is largely closed with the previous one.
- 3) Tasks 1.2, but formulated for water recycling (swimming pools, cooling of equipment network, premises heating, etc.).
- 4) Sewage treatment and disposal. Purification of domestic and industrial wastewater.
- 5) Restructuring of water in order to improve its characteristics in respect consumer health, medical and economic purposes.
- 6) Targeted change in the properties of microorganisms suspended in water for "Electro-biochemical mechanism of electro-adaptation of cells to stress," that accompany almost all technological operations we have found in the industrial cultivation and practical use of microbiological agents in the economy.

**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# FOR UNDERSTANDING OF THE MAIN IDEAS OF WATER ELECTROCONDITION



**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





## More effective system *ETT* for regenerating wash of electroconditioners “CASCADE”®



Traditional systems  
for backwashing  
filters with automatic  
multiport valve, which  
creates many  
problems



New system for  
pulsating back  
wash

**NEW APPROACH TO WATER TREATMENT**  
*7 significant technological processes in 1 device*





# **The main groups of physical and chemical factors that are essential in carrying out the processes of electrically controlled sorption**

---

- 1. Distribution of the electric field and the currents in the working chamber filled with the granular packing and purified water;***
- 2. Interaction of water molecules and contaminants between themselves and with the granular packing materials in an external electric field;***
- 3. Interaction between electric charges and the molecules of water pollutants on electrodes and electrode regions.***

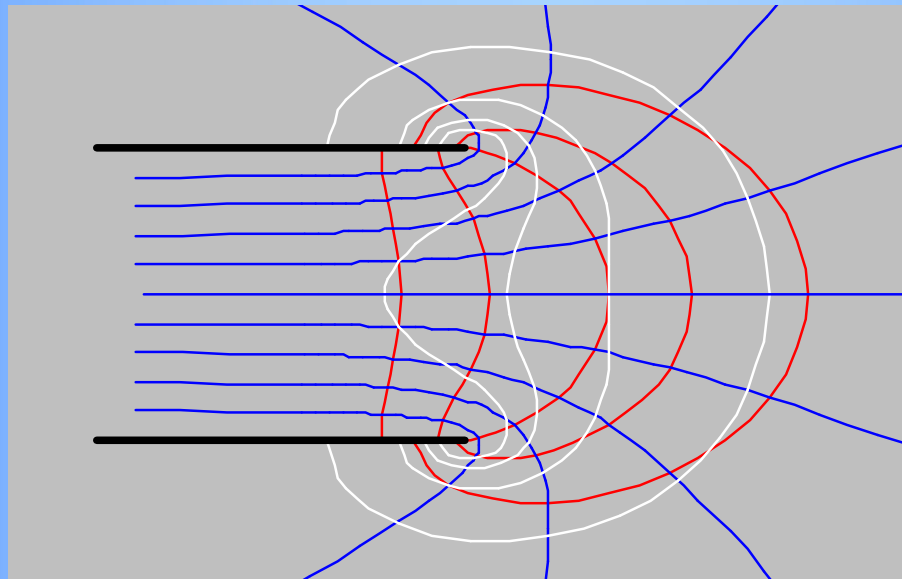
**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# For understanding of scientific background of water electrocondition

Distribution of electrical field (red lines) on the edges of two plate electrodes (black lines):  
blue lines – equipotential lines, white – lines of equal field intensity (from left to right 0,9; 0,7;  
0,5 and 0,3 rate from the value in the middle of the space between electrodes)



A working chamber contains only two plane-parallel electrodes  
(*simplest case*)

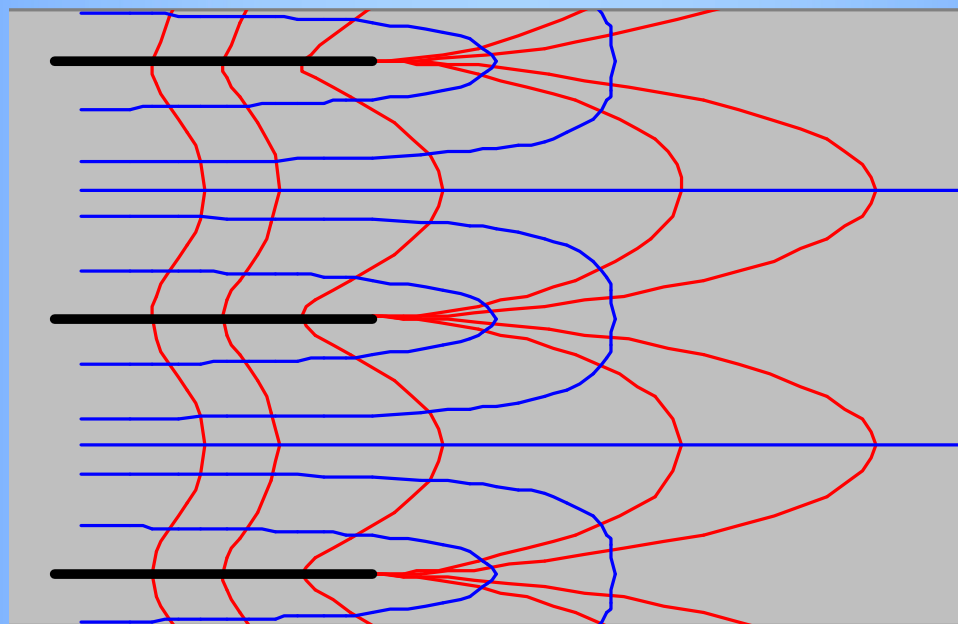
**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# For understanding of scientific background of water electrocondition

Electrical field distribution (red lines) at the edges of anodes and cathodes (black lines): blue lines - equipotentials



A working chamber contains several plane-parallel electrodes

**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# Insoluble anodes which are used in electrochemical processes

Types of anodes	Disadvantages
Anodes based on graphite	Low mechanical strength of graphite
Metal anodes (nickel, stainless steel, iridium, platinum)	High cost
Composite anodes (platinum group metals or oxides of various metals MnO <sub>2</sub> , Co <sub>3</sub> O <sub>4</sub> , RO <sub>2</sub> , etc..)	High cost

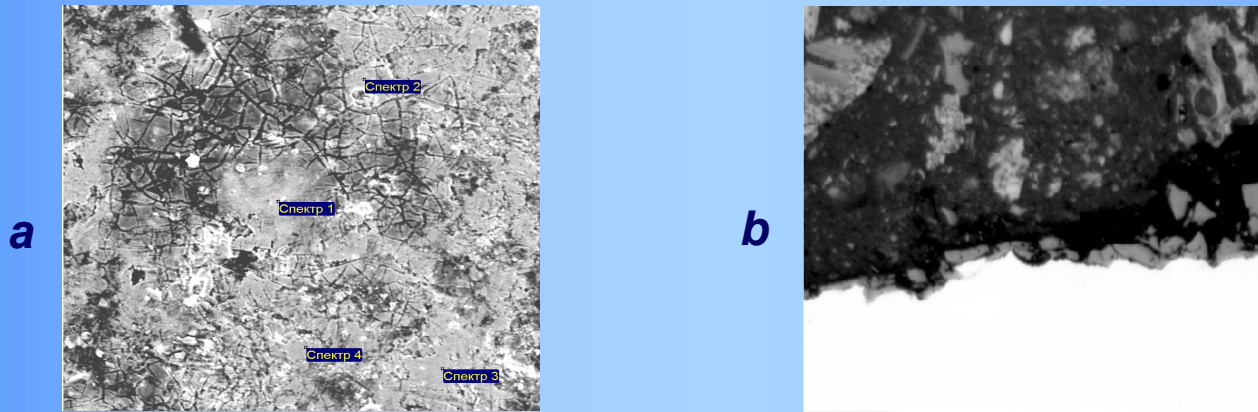
**ORTA anodes** - titanium anodes with an active coating of ruthenium dioxide and titanium. **Advantages:** high catalytic properties, the corrosion resistance of the coating under anodic polarization, low electrical resistivity (50  $\mu\Omega/\text{cm}$ ) and good mechanical properties

**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# THE METHOD OF THERMAL DECOMPOSITION (PYROLYSIS) OF RUTHENIUM SALTS



The surface appearance of the coating produced by thermal decomposition (pyrolysis) ruthenium salts; a) exterior surface, and b) a cross section covering x1000.

## Disadvantages of the method

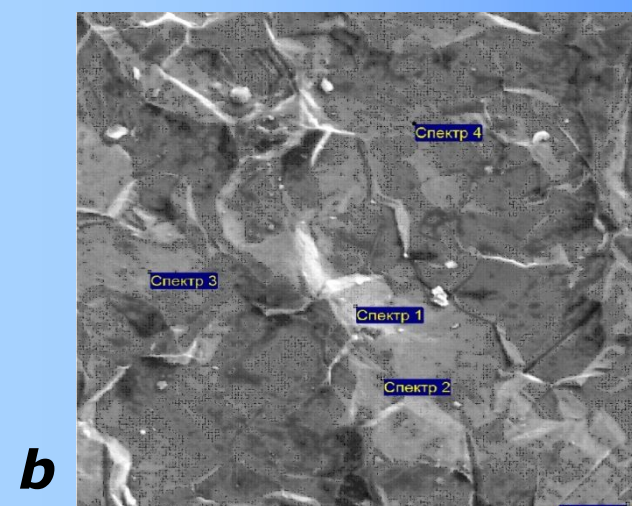
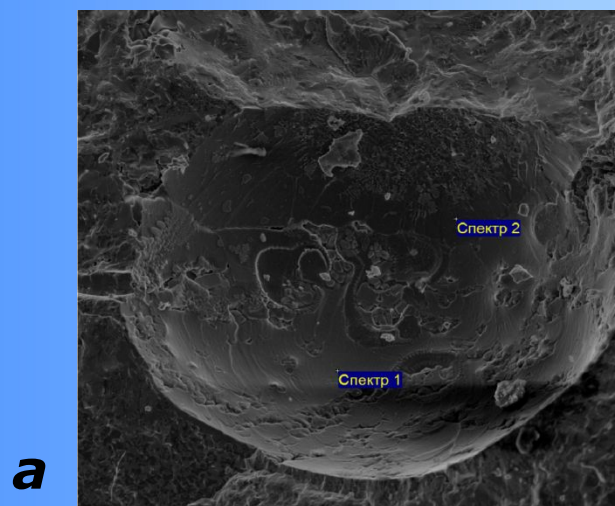
- a. Manual or mechanical "spread made" solution;
- b. Multi-stage heat treatment process;
- c. Low adhesion of the coating to the substrate;
- d. A sufficiently high porosity of the coating;
- e. Infringement of the mechanical integrity and reducing the corrosive properties of the active coating at the pH > 4.5-5.0.

**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





## Exterior view of the active coating (magnetron deposition; 30% RuO<sub>2</sub> + 70% TiO<sub>2</sub>)



Spectrum	Ti	Fe	Co	Ru	Total, %
Spectrum 1	41.03	1.76	1.77	55.44	100.00
Spectrum 2	97.89			2.11	100.00
Spectrum 3	38.73	0.94	0.87	59.47	100.00
Spectrum 4	89.28			10.72	100.00
Spectrum 5	49.18	2.14	2.23	46.45	100.00
	68,1	0,98	0,97	34,8	100,00

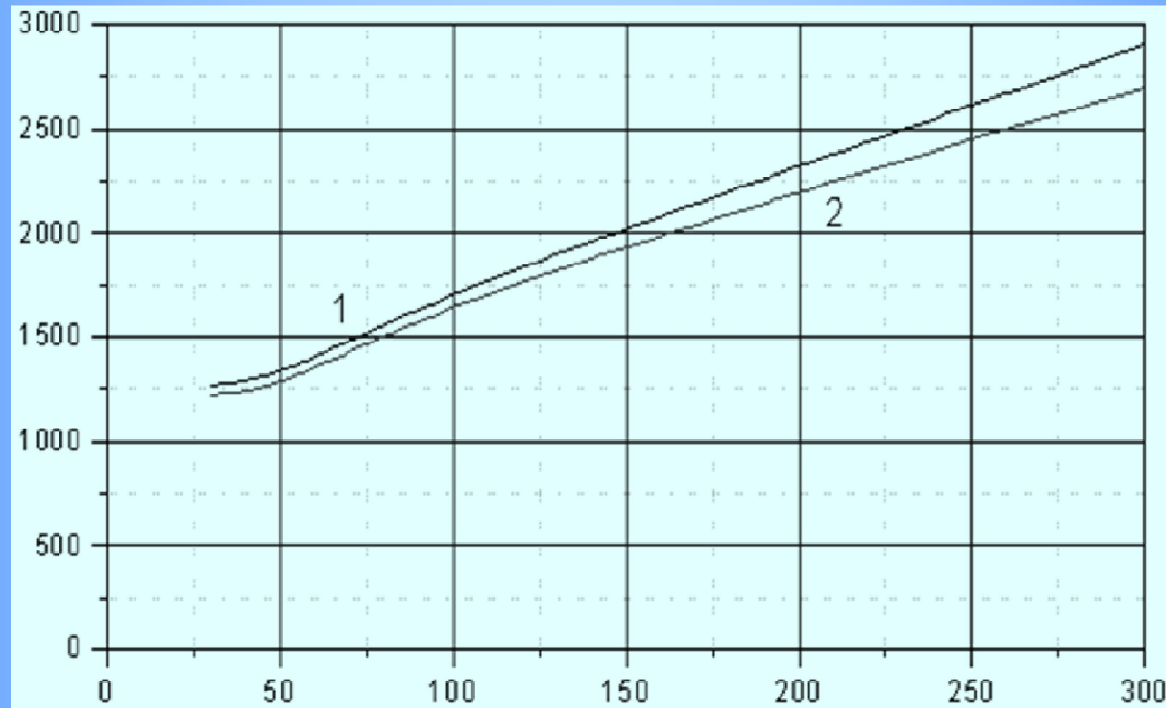
**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





## Polarization curves for the anode with an oxide-coated (1) and the reference anode plate (2).

Potential with respect to silver chloride electrode, mV



The current density in mA/cm²

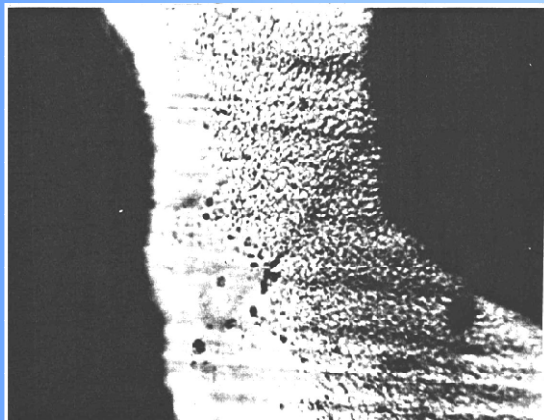
**NEW APPROACH TO WATER TREATMENT**  
**7 significant technological processes in 1 device**





# Scientific background of water electrocondition

**Electrosorption of microparticles on the granular beds, as the theoretical analysis shows, essentially differ in cases highly and slightly polarizable materials**



**Photomicrography on the left (enlargement x 500, the intensity of electrical field is 3000 V/m, acts from left to right) illustrates the effect of considerable electrosorption of enteric bacillus cells on the granules of ferroceraamics T-10 000 (plant «Coulomb», Russia).**

**Photomicrography on the right (the same conditions) illustrates considerably less dipolephoretic focusing of cells due to superposition of external electrical field on the granules of the porous glass, trademark "Bio-Glass-500" (firm "Pharmacia", Sweden)**

***NEW APPROACH TO WATER TREATMENT***  
***7 significant technological processes in 1 device***





**The intensity of the electrosorption process depends on a number of factors that must be considered in the synthesis of technological schemes of water treatment, namely:**

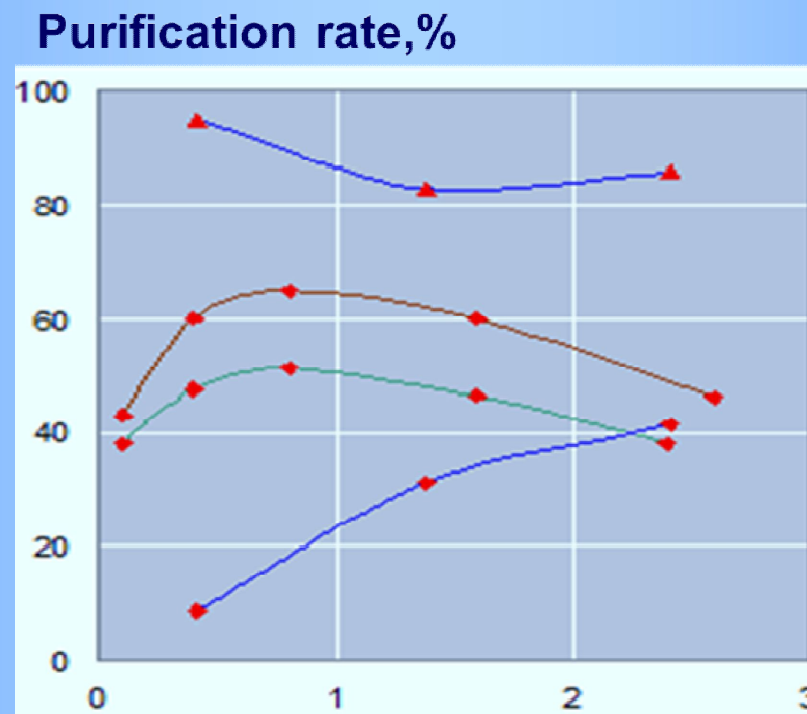
- a) Strength of macroscopic electric field between electrodes and in other areas of the working chamber electrosorption apparatus;
- b) Local gradient of the field strength between the granules packing;
- c) Mixed picture of the hydrodynamic forces in the packing;
- d) Flow rate of water passing through the working chamber;
- f) Effective height of packed bed;
- g) Temperature and pH of the medium;
- h) Initial concentration of the substances removed from the water and the ionic strength (ion concentration) of the medium;
- i) Composition of components contaminating the specimen water;
- j) Electrical and biochemical properties of the microbial cells, which are present in the water to be treated;
- k) Ability of microbial cells present in the purified water, to change their surface charge, depending on the concentration of the microorganisms and the strength of an electric field.

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# The curves of purification degree of the solution from the microbe cells, depending on the packing material and the intensity of the field



Cell concentration, billion/ml

Blue curves -  $E = 2000$  V/m, brown -  $E = 1000$  V/m, green -  $E = 500$  V/m,  
▲ - ceramics T-10000, ◆ - quartz

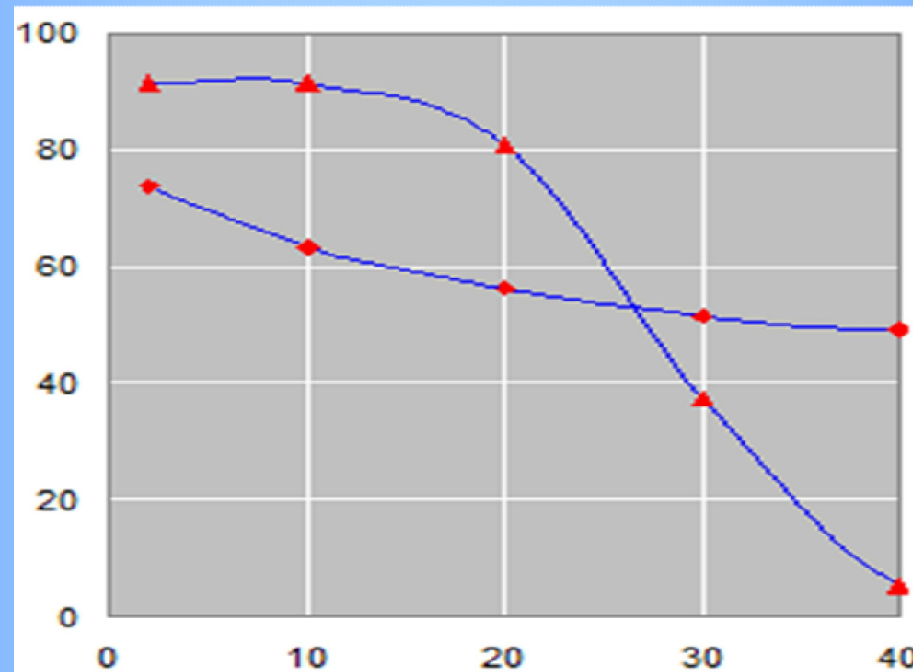
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## The curves of purification rate for suspension of bead size packing

Purification rate, %



Cell concentration, billion/ml

Ceramics T -10 000 E = 2000 V/m, ▲ - granules of 0,5 - 1,0 mm,  
◆ - granules of 1-2 mm.

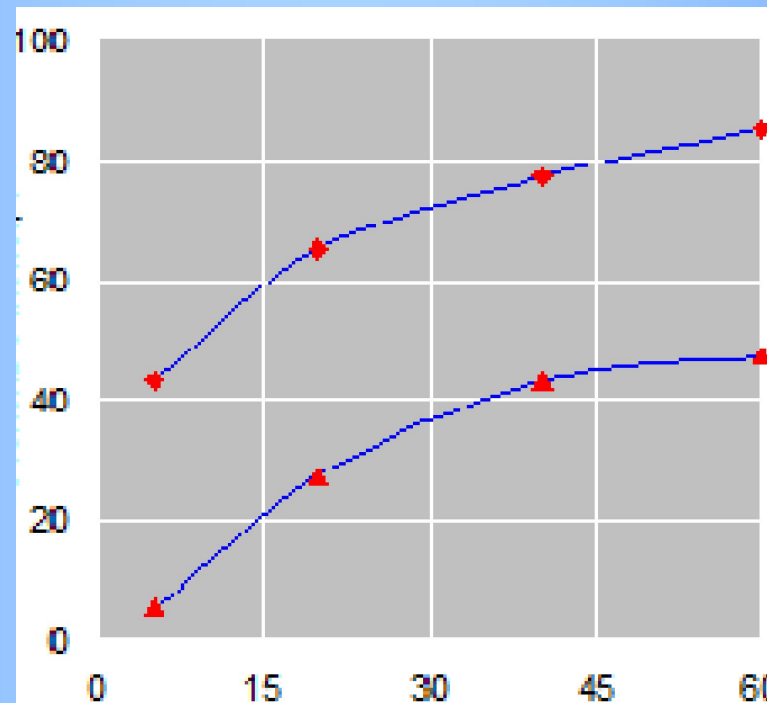
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## The curves of the purification rate of culture medium from E.coli cells according to the treatment time

Purification rate, %



Time elapsed, min

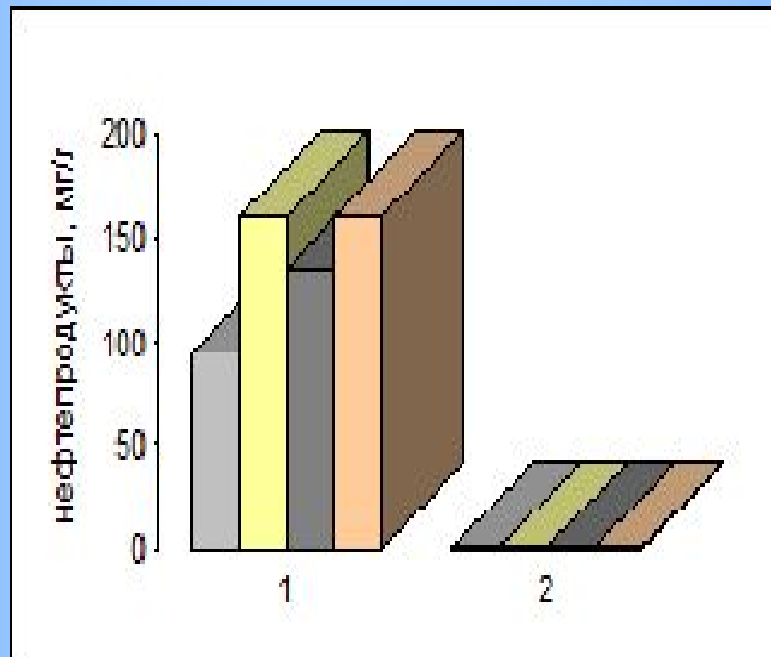
Packing – ceramics T -10 000, ▲ E= 1000 B/m, ◆ E=2000 B/m.

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**Water purification from oil products: 1 - the initial oil content,  
2 - after electro-column.**



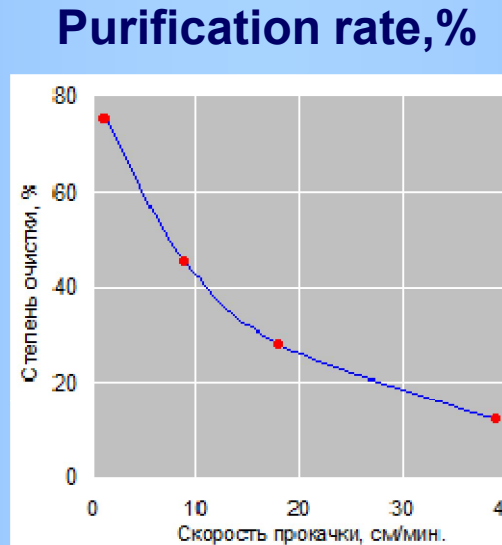
**Grey – black oil, yellow – diesel fuel; paler – salinity of water- 0,6 mg/l,  
darker – 1,5 g/l.**

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# The rate of purification of water from the E.coli cells depending on the rate of pumping



Packing - ceramics T-10 000, ▲ E= 1000 V/m, ◆ E=2000 V/m.

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# ELECTROCHEMICAL PROCESSES ON ELECTRODES OF WATER CONDITIONERS “CASCADE”

## EXAMPLES OF ACCOMPANYING OXIDIZING PROCESSES ON ANODES OF ELECTROCONDITIONERS

*Destruction of methylate:*  $\text{CH}_3\text{OH} + 2\text{H}_2\text{O} - 6\text{e} \rightarrow \text{CO}_3^{2-} + 8\text{H}^+$

*Destruction of carbamide:*  $(\text{NH}_2)_2\text{CO} + \text{H}_2\text{O} - 6\text{e} \rightarrow \text{N}_2\uparrow + \text{CO}_2\uparrow + 6\text{H}^+$

*Destruction of formaldehyde:*  $\text{HCHO} + 2\text{H}_2\text{O} - 4\text{e} \rightarrow \text{CO}_3^{2-} + 6\text{H}^+$

*Destruction of phenol:*

$\text{C}_6\text{H}_5\text{OH} + 16\text{OH}^- - 16\text{e} \rightarrow \text{HO}_2\text{CCH}=\text{CHCO}_2\text{H} (\text{ȳuc}) + 2\text{CO}_2\uparrow + 5\text{H}_2\text{O}$

*Conversion of cyanides into cyanates:*  $\text{CN}^- + 2\text{OH}^- - 2\text{e} \rightarrow \text{CNO}^- + \text{H}_2\text{O}$ ,

*with further destruction of cyanates into gases and water:*

$2\text{CNO}^- + 4\text{OH}^- - 6\text{e} \rightarrow 2\text{CO}_2\uparrow + \text{N}_2\uparrow + 2\text{H}_2\text{O}$ .

## EXAMPLES OF REDUCTION PROCESSES ON CATHODES OF ELECTROCONDITIONERS

*Derivation of insoluble hydroxides of heavy metals:*

$\text{Me}^{n+} + n\text{OH}^- \rightarrow \text{Me}(\text{OH})_n$

*Direct catalytic reduction of metals:*  $\text{Me}^{n++} + \text{e} \rightarrow \text{Me}^\circ$ ,

(for instance,  $\text{Hg}^{2+} + 2\text{e} \rightarrow 2\text{Hg}$ ;  $\text{Pb}^{2+} + 2\text{e} \rightarrow \text{Pb}$ )

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# Scientific background of water electrocondition

Scientific basement based on the account of a complex of the electrochemical and physical processes occurring in working chambers of electroconditioners: coagulation in the electric field, convertible sorption, filtration, electrolysis, electroflotation, electrooxidation and reduction of substances (including electrocatalytic heterogeneous and liquid-phases processes).

The questions of electrocontrolled sorption of the substances belong to the major ones in the theory of water electrocondition developed with participation of author of this technology

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# Three basic situations depending on value redox-potential are distinguished for natural waters:

## Oxidative

is characterized by values of ORP  $> + (100 - 150)$  mV, by presence of free radicals in water, as well as number of elements in the highest form of their valence ( $\text{Fe}^{3+}$ ,  $\text{Mo}^{6+}$ ,  $\text{As}^{5-}$ ,  $\text{V}^{5+}$ ,  $\text{U}^{6+}$ ,  $\text{Sr}^{4+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Pb}^{2+}$ ). The situation is occurred the most frequently in surface water

## Intermediate oxidative-reductive

is determined by value of ORP from 0 up to  $+ 100$  mV, unstable geochemical mode and variable concentration of hydrogen sulphide and oxygen. In these conditions both weak oxidation and weak restoration of a lot of metals

## Reductive

is characterized by values ORP  $< 0$ . It is typical for underground waters, where there are metals of low degrees of valence ( $\text{Fe}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Mo}^{4+}$ ,  $\text{V}^{4+}$ ,  $\text{U}^{4+}$ ), and also hydrogen sulphide.

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# THE MAIN CONCLUSIONS CONCERNING ORP FROM THE THEORETICAL ANALYSIS FOR PRACTICAL APPLICATION

---

- ORP of internal medium of the human persons has negative values (app. from -100 up to -200 mV).
- ORP of potable (tap) water practically always has positive values (more often from +100 up to +400 mV).
- Processing of water by electroconditioners "CASCADE" allows to reduce ORP to biologically favourable values.
- Use of the water after processing in electroconditioners "CASCADE" for drinking and water procedures is expedient to slow down processes of oxidizing destruction and premature senescence of an organism.

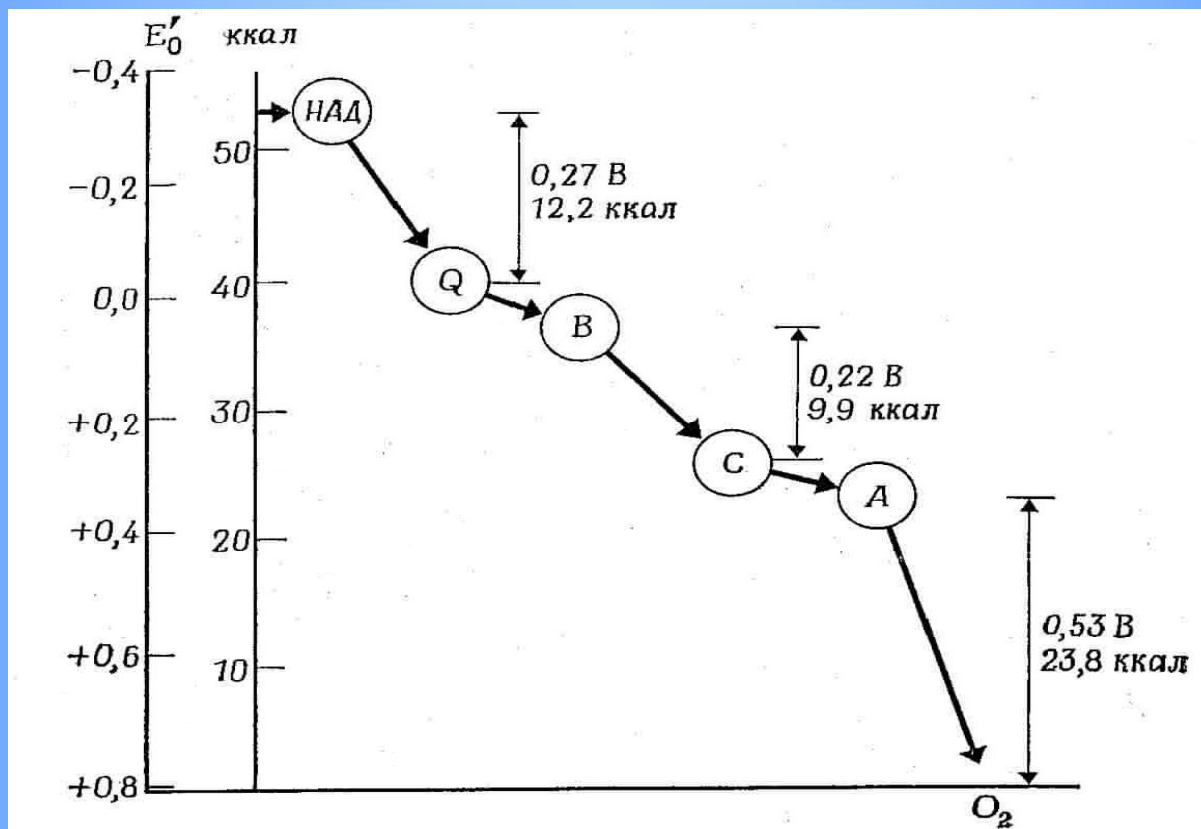
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## Decreasing of the free energy at movement of electron couple along inspiratory chain to oxygen



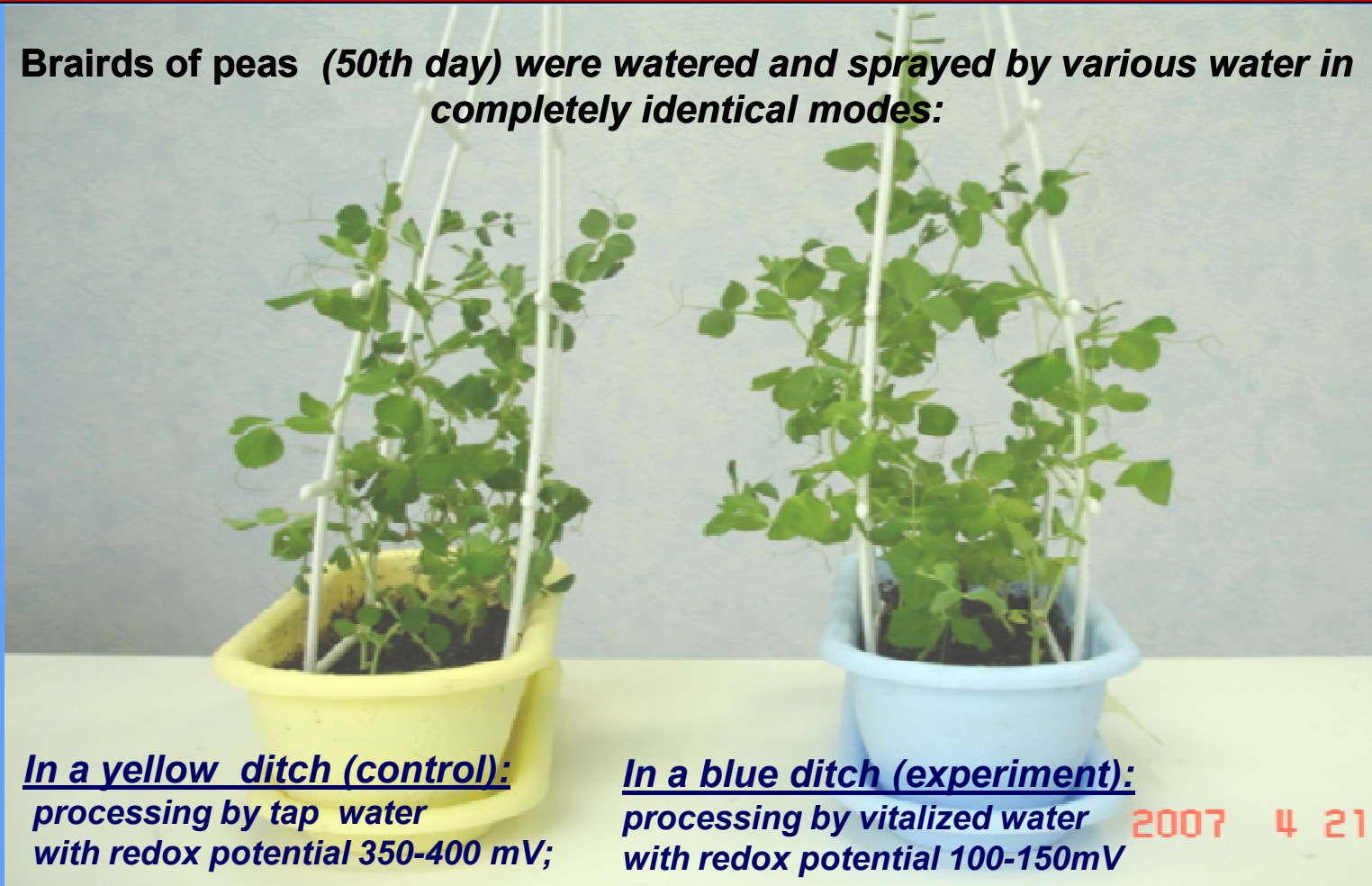
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# Illustration №1 of life-giving power of vitalized water

**Brairds of peas (50th day) were watered and sprayed by various water in completely identical modes:**



**In a yellow ditch (control):**  
processing by tap water  
with redox potential 350-400 mV;

**In a blue ditch (experiment):**  
processing by vitalized water  
with redox potential 100-150mV

2007 4 21

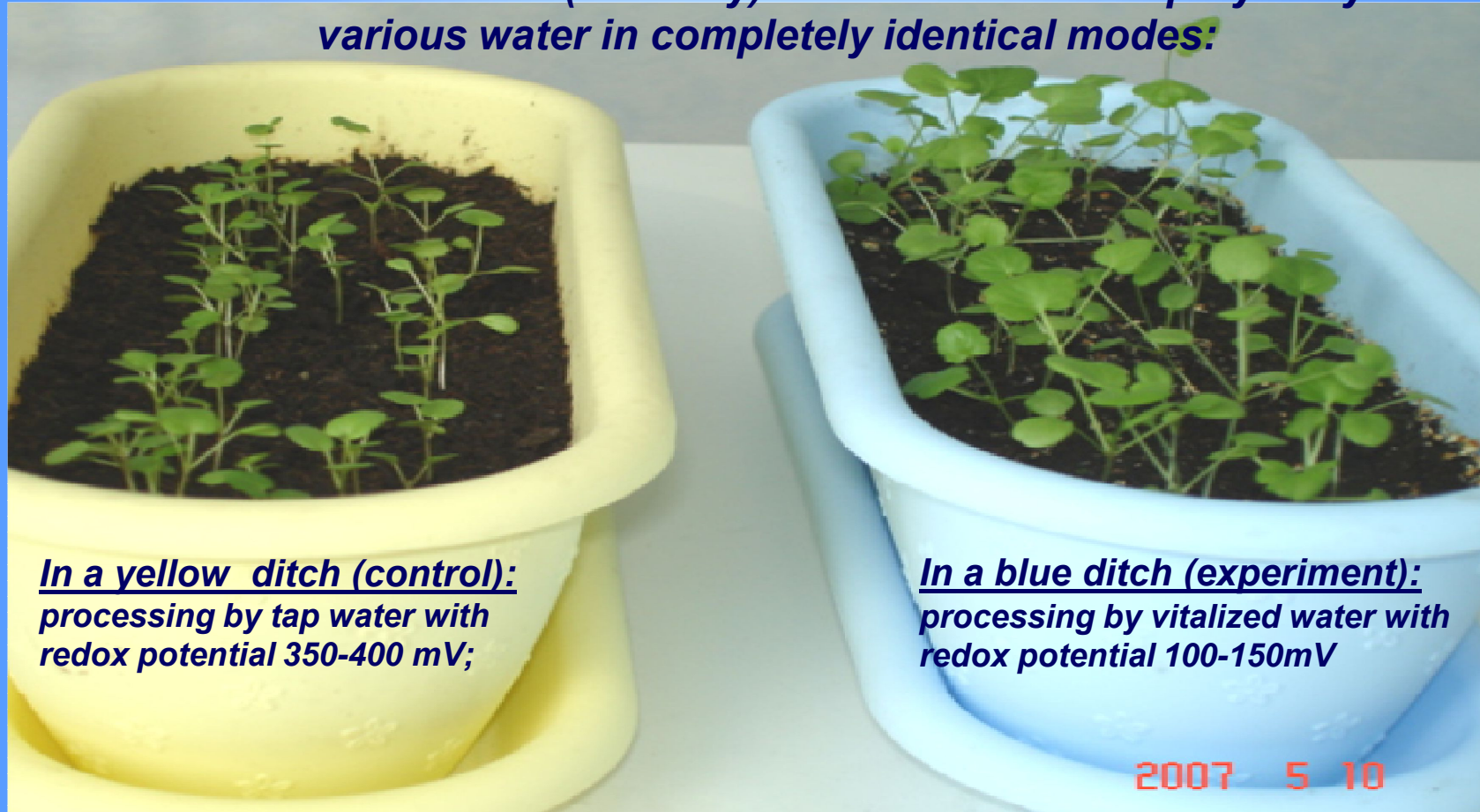
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# Illustration №2 of life-giving power of vitalized water

*Brairds of viola red (56th day) were watered and sprayed by various water in completely identical modes:*



*In a yellow ditch (control):*  
*processing by tap water with  
redox potential 350-400 mV;*

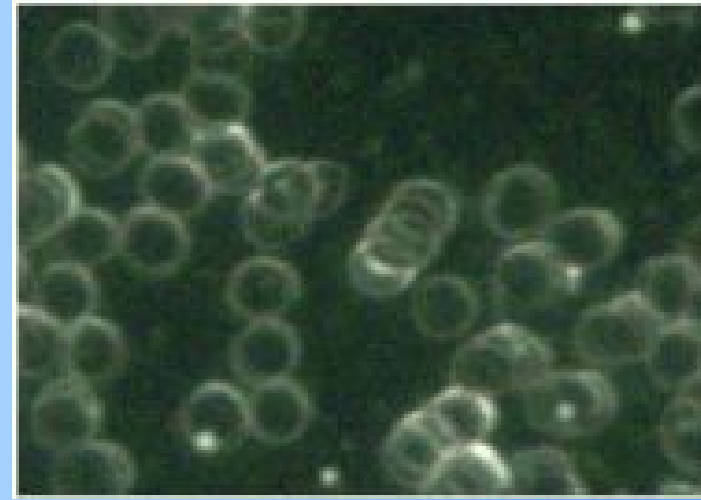
*In a blue ditch (experiment):*  
*processing by vitalized water with  
redox potential 100-150mV*

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# What else can vitalized water do?



Live blood analysis with dark field microscopy offers the unique ability to view the blood in real time. Trained professionals are able to note the presence of conditions in the blood that contribute to sickness and disease.

One of the most common conditions found during live blood analysis is stickiness (Rouleau) of the red blood cells – **left photo**. This creates sluggishness in both the circulatory and lymph systems and inhibits both nutrient and oxygen uptake, as well as the elimination of cellular wastes.

Live blood analysis illustrates the rapid reduction in clumping of the red blood cells, (representing the capacity for greater oxygen uptake and more efficient nutrient utilization) following the consumption of vitalized water – **right photo**.

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# What else can vitalized water do?



Photos made by Kirlian camera show that the energy radiating from the fingertip of a healthy individual before and after drinking one glass of vitalized water.

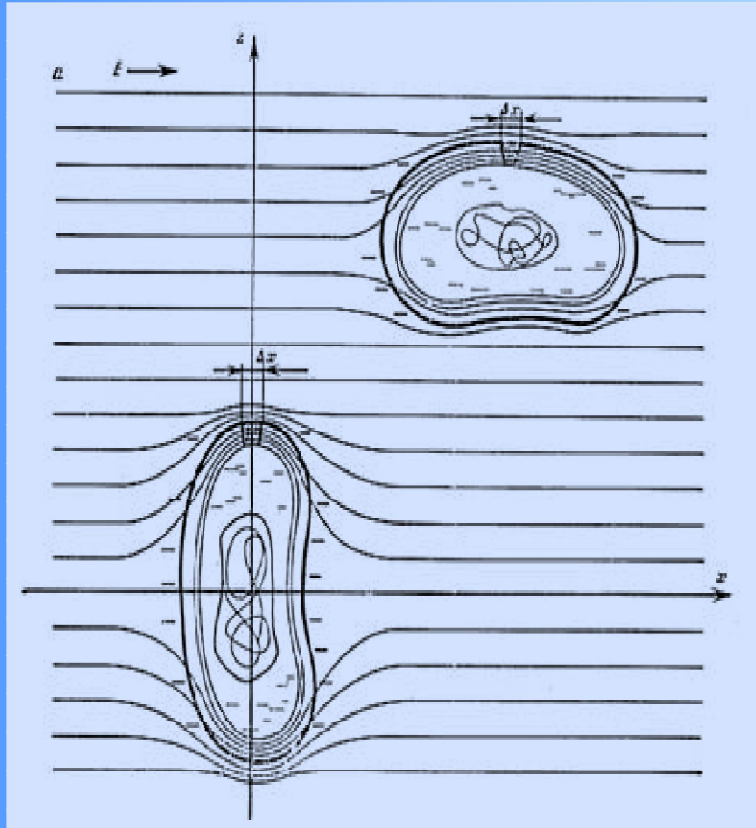
*Kirlian Photography is a process that uses high frequencies and electron streams to take pictures of the invisible radiating energy fields that surrounds all living things.*

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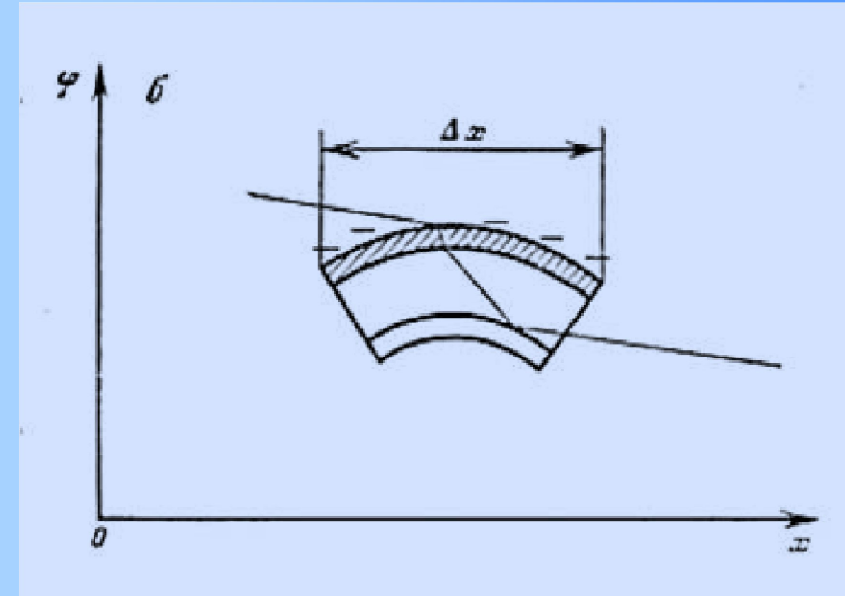




# Simplified model of a gram-negative microorganism' cell in homogeneous electric field



*lines of current in a culture liquid*



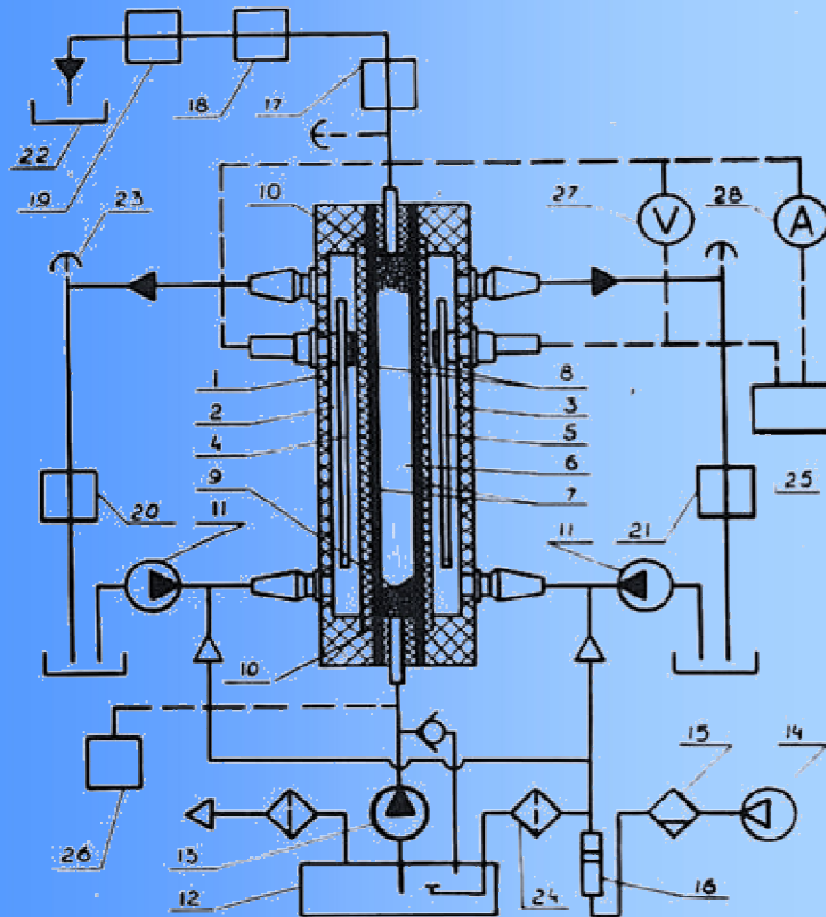
*reduction of potential  
in the cell membrane area*

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# The scheme of the main experimental setup



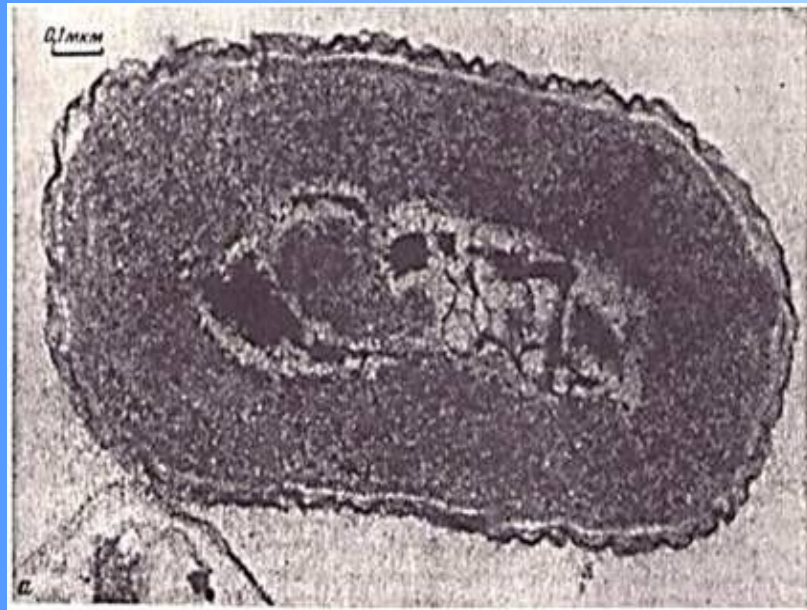
1-case, 2.3-electrode chamber, 4.5-electrodes, 6-the working chamber, 7-semipermeable membrane, 8-porous pads, 9,10-sorbent pellets and filters (in the case of a flow-through culturing of microbial cells), 11-pump for pumping buffer solution through the electrode chambers, 12-nutrient medium tank, 13-pump for pumping the culture medium through the working chamber, 14-compressor for culture medium aeration, 17,18-optical detectors, 19,20,21- conductometric detectors, etc., 22, - a vessel for the medium collection

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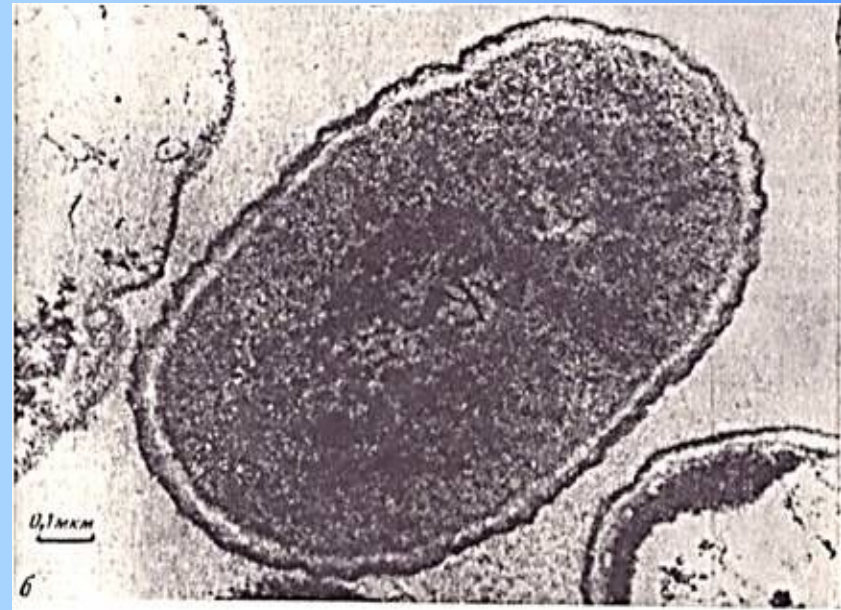




# **Electron micrographs of ultra thin slices of E.coli M-17 cells (x 84 000)**



*before the action  
of the electric field*



*after the action  
of the electric field*

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**Experiments for following ascertainment:  
"Can we talk about something like an action  
mechanisms of electrical and thermal treatment  
factors (thermal shock proteins)"?**

**Table 1**

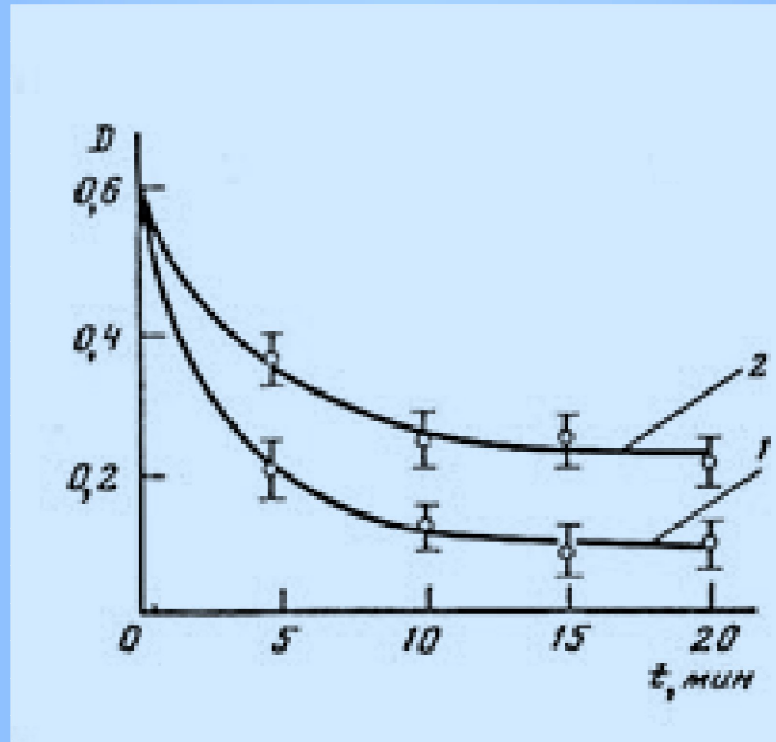
The type of effect	Survival rate of cells(%) obtained after	
	thermal shock	dehydration(drying in a thin layer, 40°)
Electrotreatment	3,3±0,3	3,6±0,4
Resuspending in EF-factor containing supernatant	2,4±0,2	4,5±0,6
Resuspending in supernatant of native culture subjected to thermal shock (50°)	1,2±0,1	1,3±0,1
Resuspending in supernatant of native culture heated to 60°	1,4±0,1	2,0±0,2
Resuspending in supernatant of native culture heated to 80°	1,6±0,2	2,5±0,3

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# Curves of E. Coli - M17 cells lysis



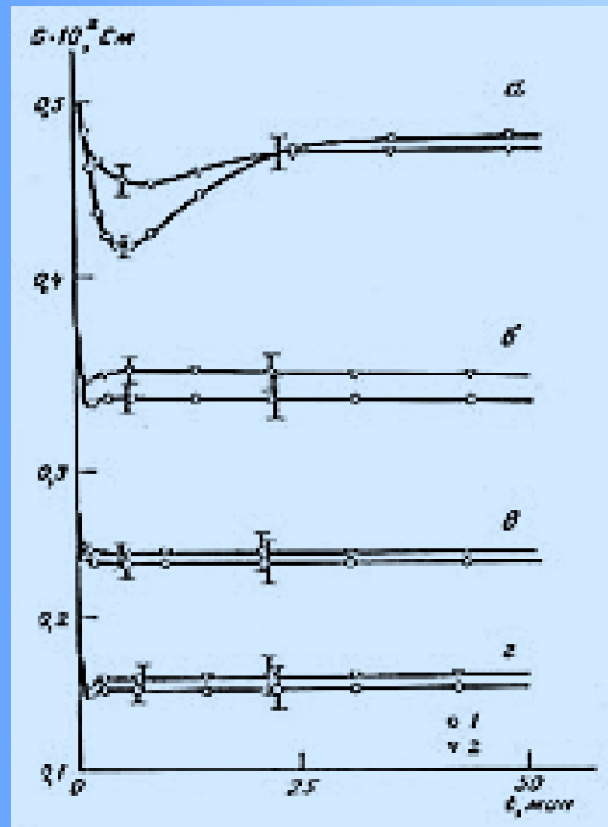
*Effect of DDS on cells before (1) and after (2) electric field treatment*

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# Conductograms for survival of hyperosmotic shock (1M solution of L-arabinose) by microbial cells of different taxonomic groups before and after the electric treatment



*a - E.coli*

*б - S.marcescens*

*в - Micrococcus Lysodeikticus*

*г - Arthrobacter sp.*

- Experimental points before the electric treatment of cells
- ▽- Experimental points after the electric treatment of cells

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## **EXPERIMENTS WITH ELECTROCONDITION OF AQUEOUS MEDIUMS HAVE DEMONSTRATED:**

*as against filters of other types, electroconditioners will manage with physiologically important problems of water quality which are not being solved at usual technologies purification*

- will allow to correct composition of potable water bearing in mind the majority of the normalized chemical parameters, which may be checked objectively, and the characteristics which are usually being perceived subjectively and not measured by analytical instruments;
  - will provide stability of a complex of quality characteristics of water at a level of recommended sanitary norms under various seasonal conditions, sudden emergency deterioration of a condition of water sources or pipelines;
- will improve structural characteristics of water (due to the local electric influences), having provided higher availability of water molecules to use by cells of the most various biological tissues, i.e. the best biocompatibility of water with various organic structures; will decrease redox-potential of water and as a result its bioenergetic, metabolic and immune properties will be improved as well as condition of human internal, integument, mucous membranes, joints and hair. Development of normal microflora of a human body will be stimulated and negative consequences of a disbacteriosis will be reduced;
  - will raise the productivity of a number of biotechnological processes

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# Models of water electroconditioners



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# System of water-preparation on the basis of electroconditioners "Cascade"® for industrial objects in Saint-Petersburg



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# Ideological credo of electrically controlled sorption (water electrocondition)

**P**rocesses of cleaning should remove from water everything superfluous: harmful contamination, in particular, substances, harmful and alien to a human organism (xenobiotics) and keep all that is useful and not harmful. And there should not be replaceable working elements in devices.

**I**t is provided only short-term periodic wash of sludge, which is formed in work processes, but does not worsen of treating water quality but only straiten its flux

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# How does it possible to contact us

## Consortium *“ElectroEcoTechnologies”*

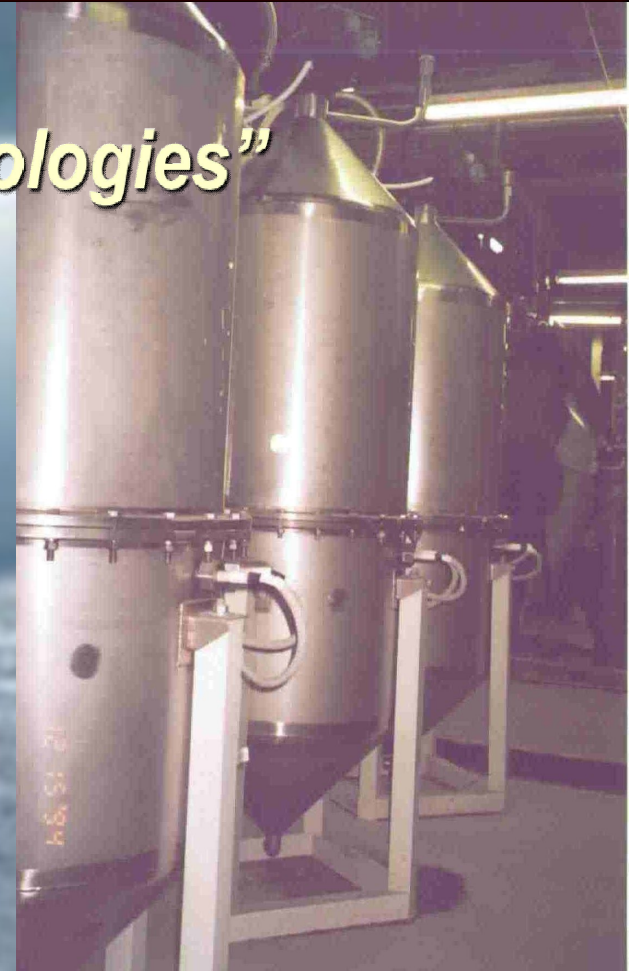
2a, Sredneohtinsky pr., off.2,

195027, Saint-Petersburg,

tel/fax: +7 (812) 224 33 92

<http://www.elecotec.com;>

E-mail: [info1@elecotec.com](mailto:info1@elecotec.com)



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Dr. Timur Atabaev.



- 
- 2012

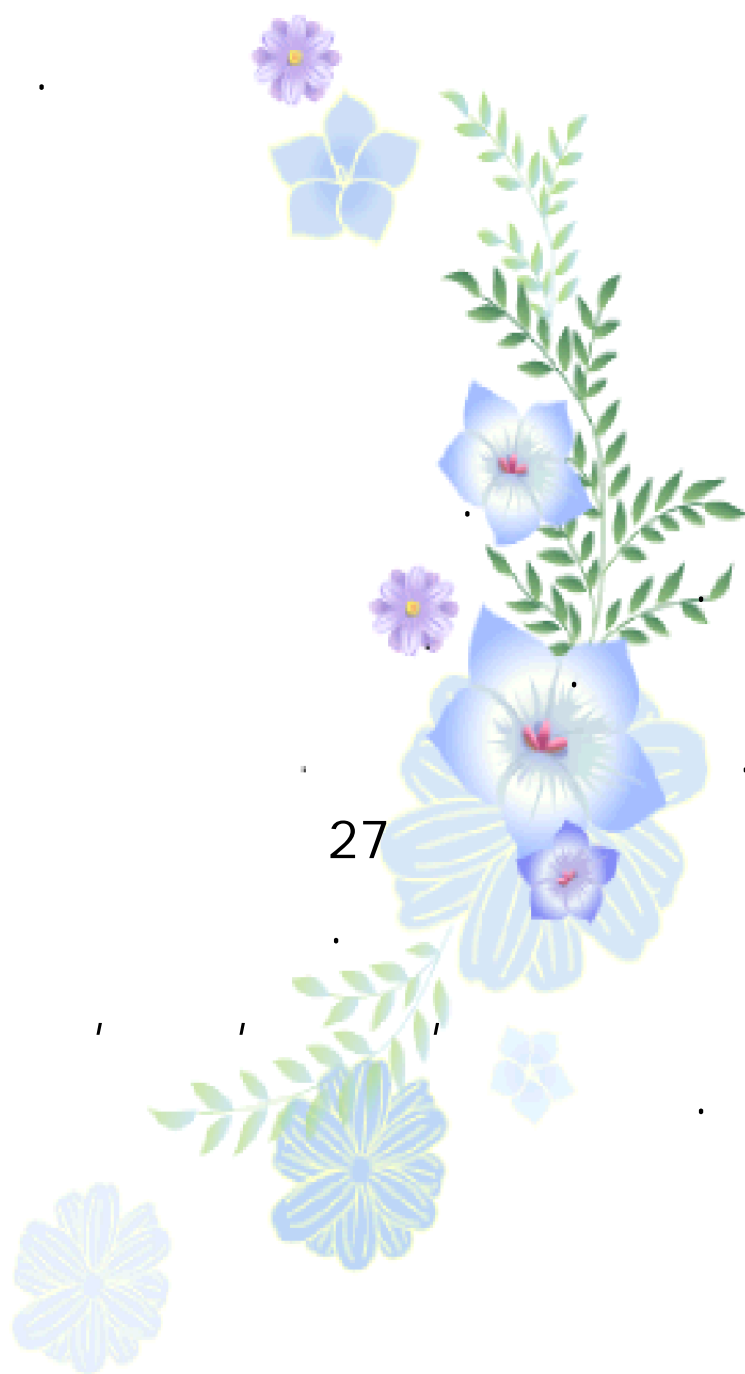
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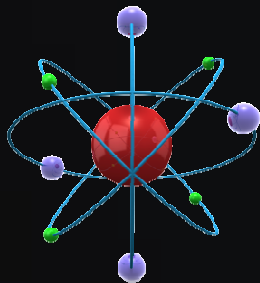
# **Multifunctional nanoparticles as a key factor for future nanomedicine and energy harvesting**

**National University of Uzbekistan, Department of Physics**

**Seoul National University, Department of Physics and Astronomy**

**Pusan National University, Department of Nanomaterials Engineering**

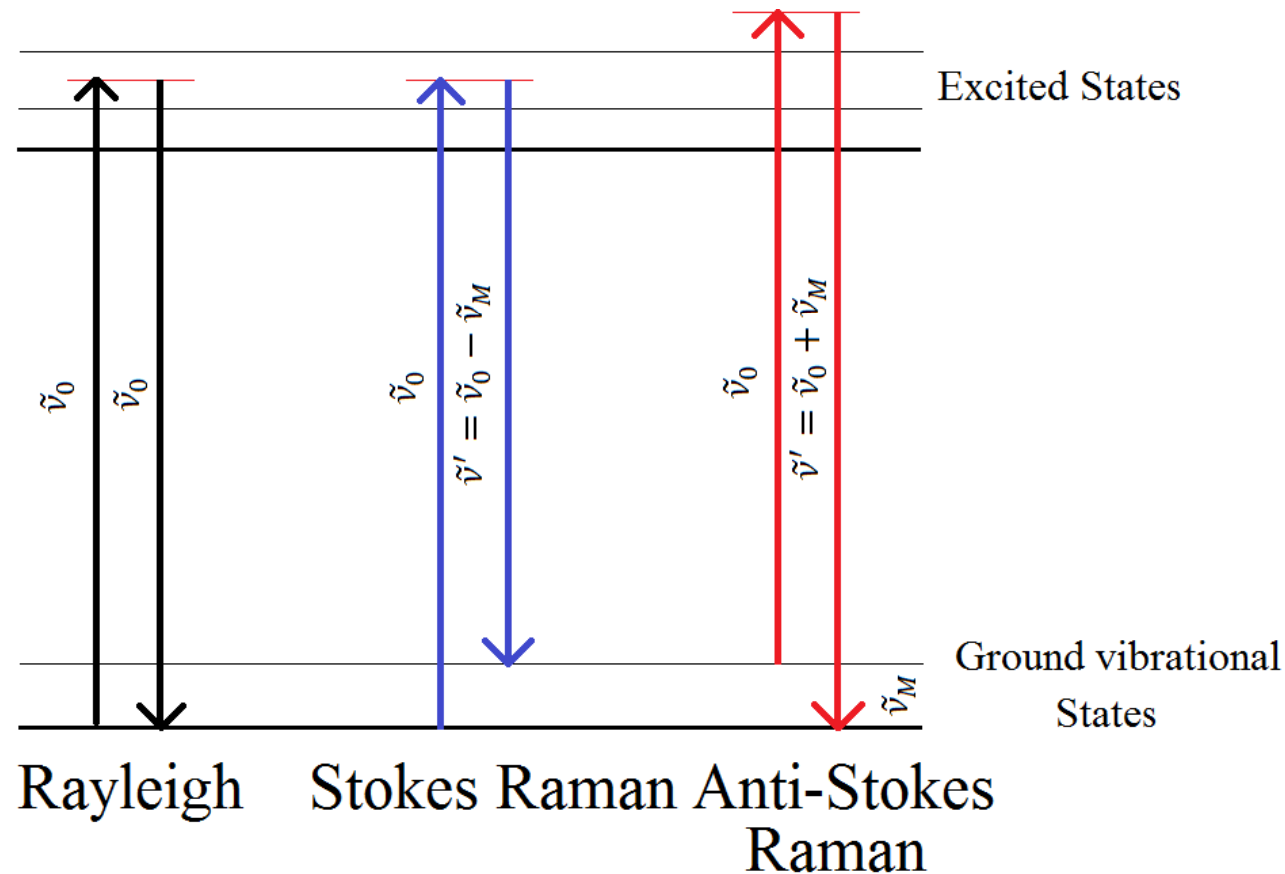
**Reporter: Dr. Timur Sh. Atabaev**





## Introduction

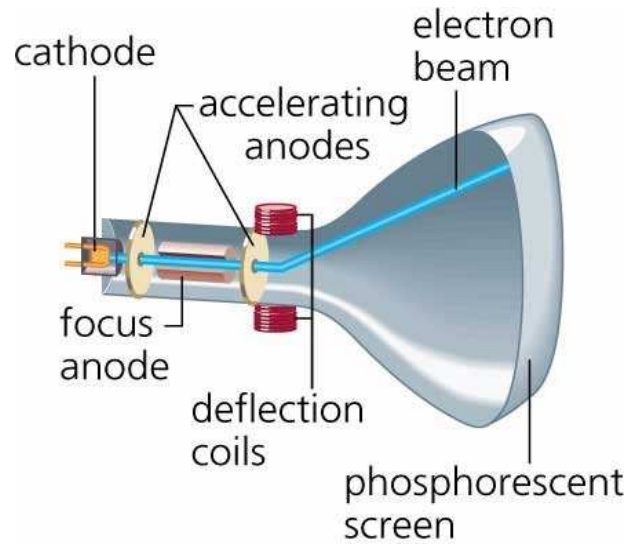
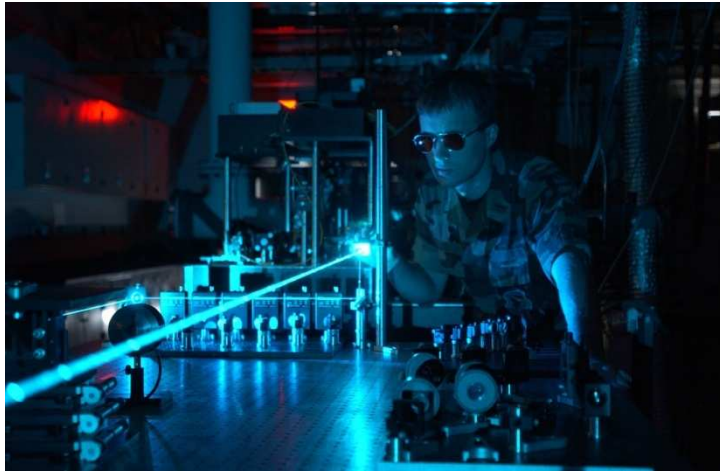
Optical materials (spectral converters) exhibit the phenomenon of luminescence (fluorescence, phosphorescence), i.e. they emit the light when exposed to radiation.





# Introduction

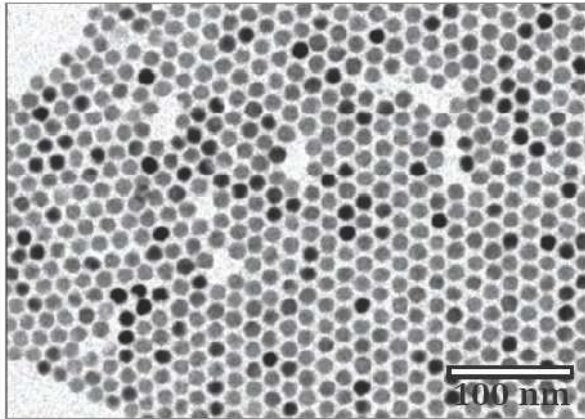
## Application areas of bulk optical materials



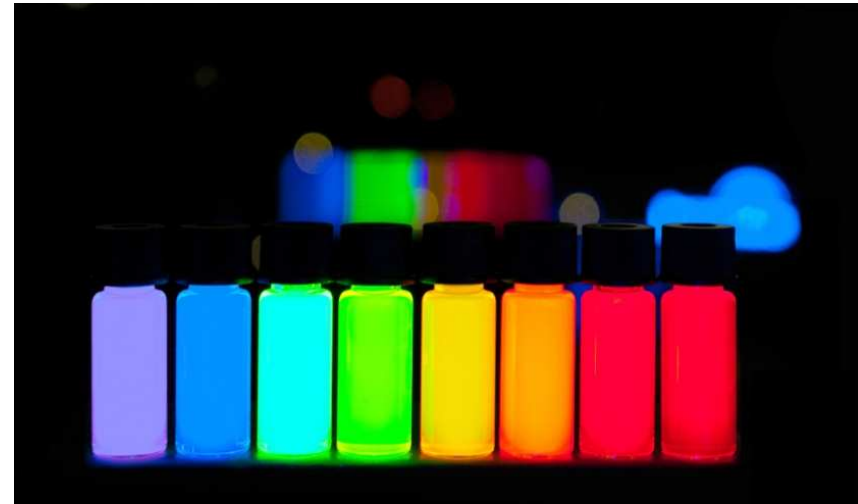
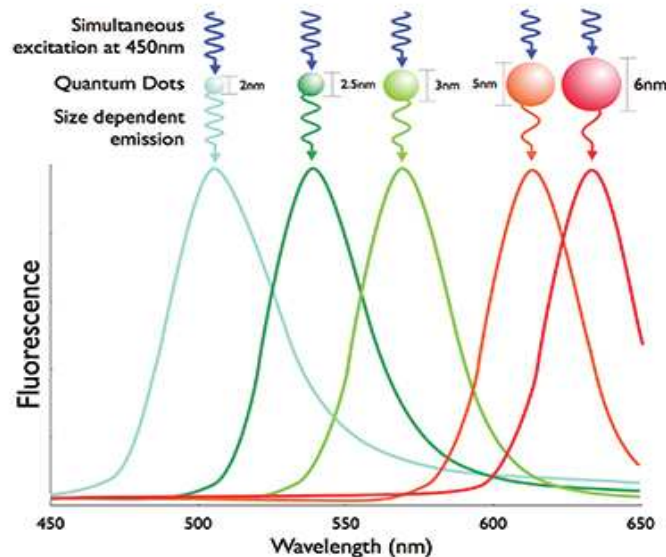


# Introduction

## Quantum Dots – Semiconductor Nanoparticles



Spectral Characteristics of Quantum Dots



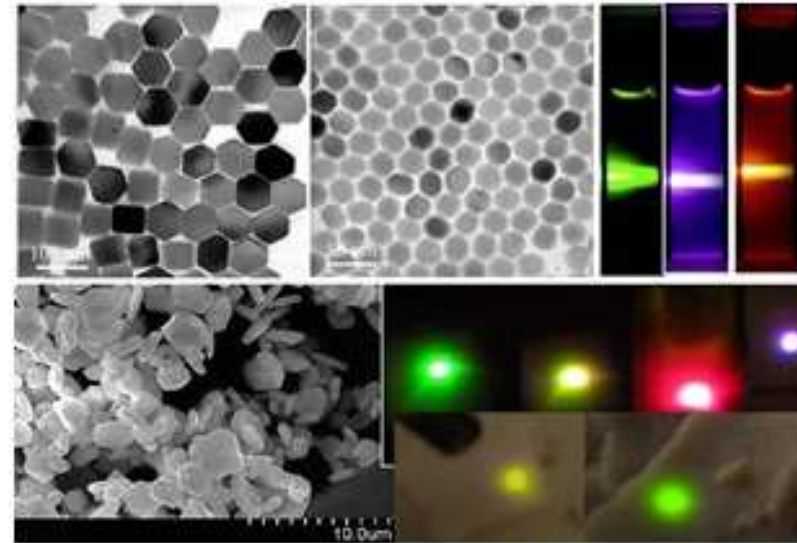
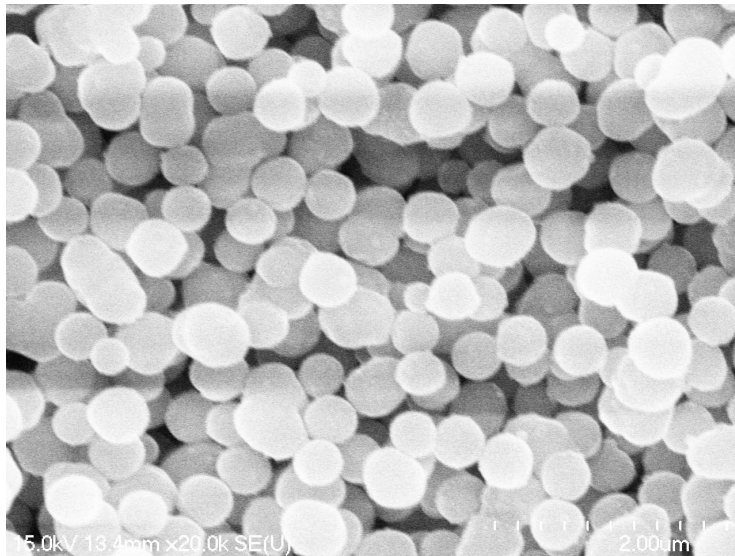
## Disadvantages of Quantum Dots

- Very high cost of fabrication
- Hard to control size distribution
- Chemical wastes
- Low output
- High degradation rate
- Limited application area
- Toxicity



# Introduction

## Phosphor Nanoparticles



### Advantages of Phosphor Nanoparticles compare to Quantum Dots

- Low cost of fabrication
- Easy to control size distribution
- Green product
- High output
- Extremely low degradation rate
- Broad application area
- Lower toxicity



# Introduction

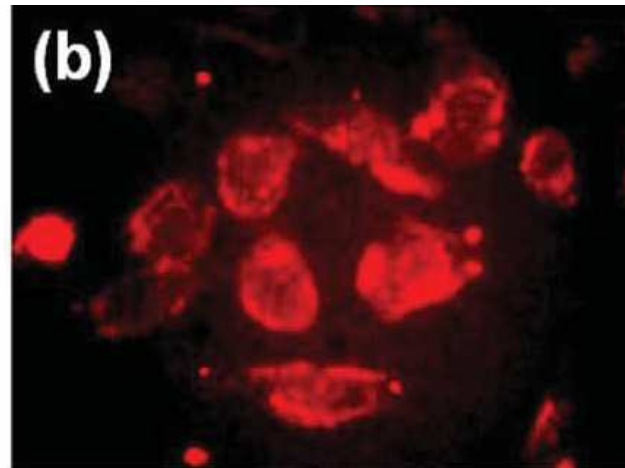
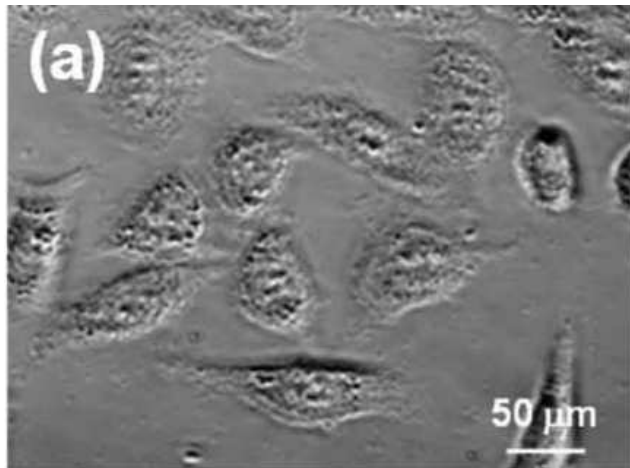
## New application areas of phosphor nanoparticles



Fingerprint detection



UV & IR emission detection

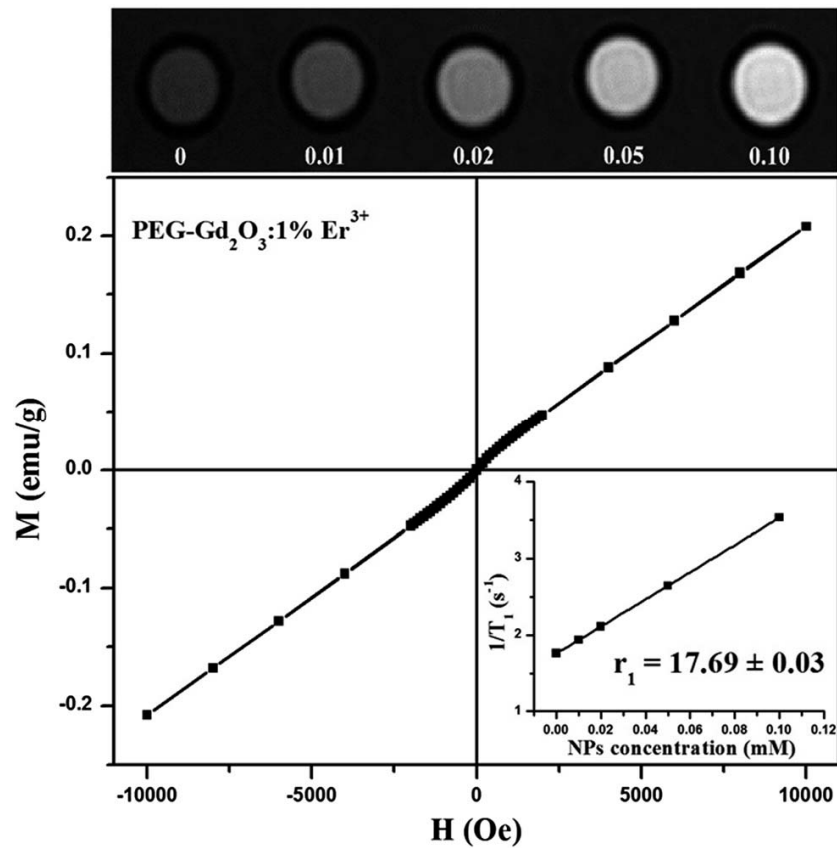


Fluorescent cell imaging

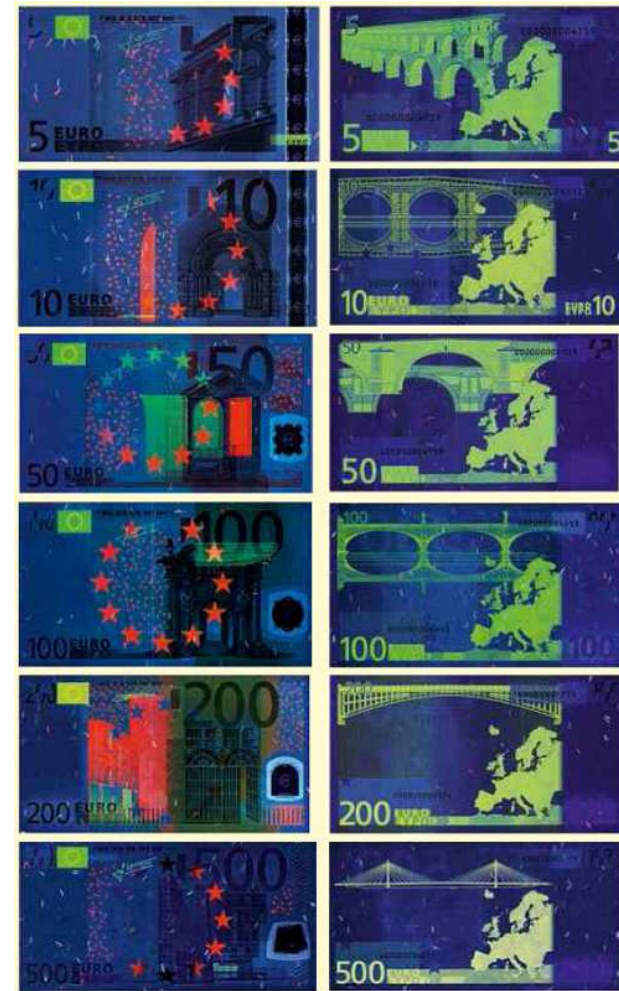


# Introduction

## New application areas of phosphor nanoparticles



MRI contrast agent

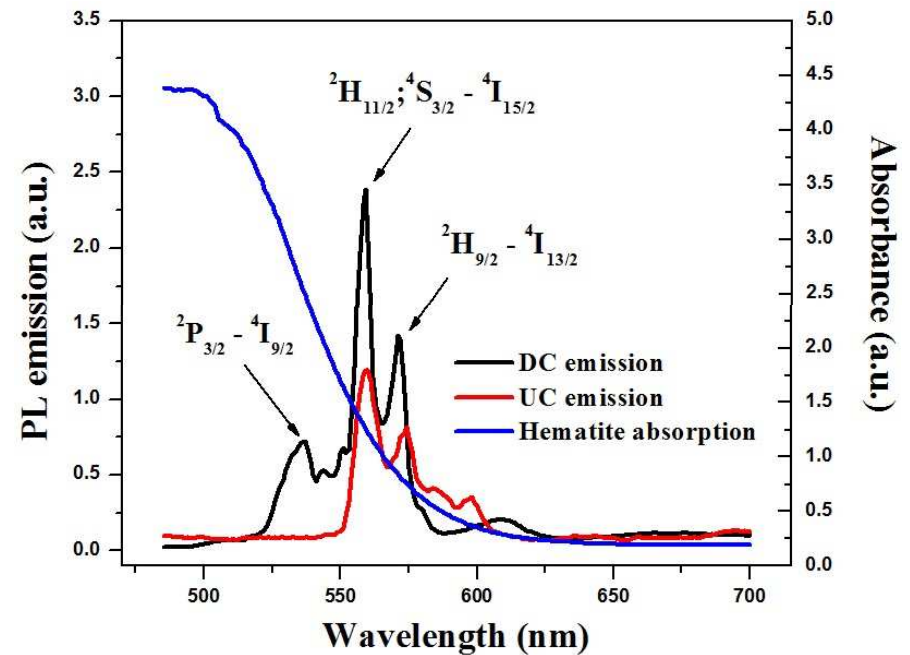
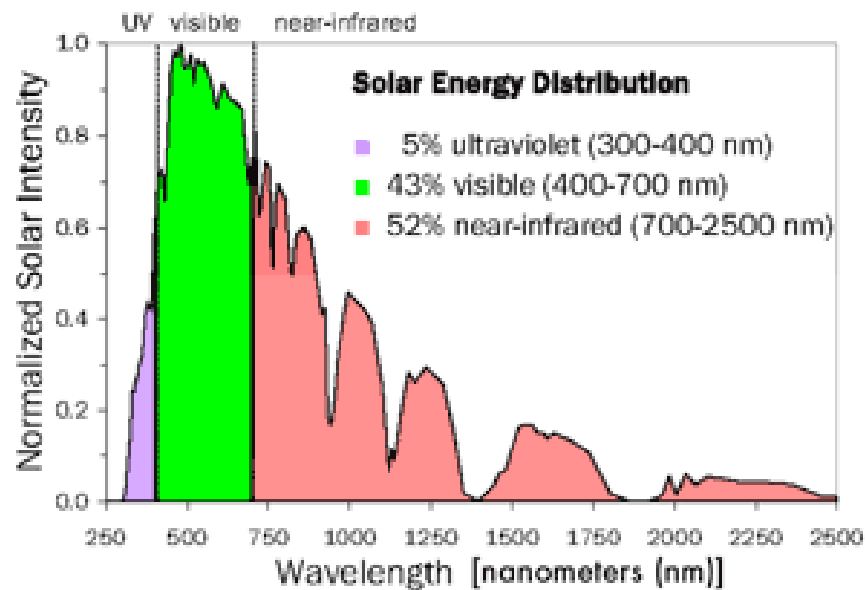


Security printing



# Introduction

## New application areas of phosphor nanoparticles

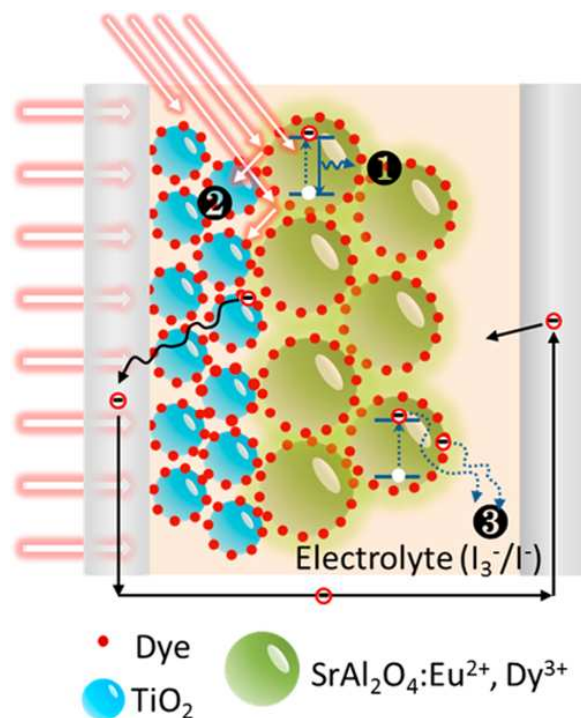


Solar cells efficiency enhancement

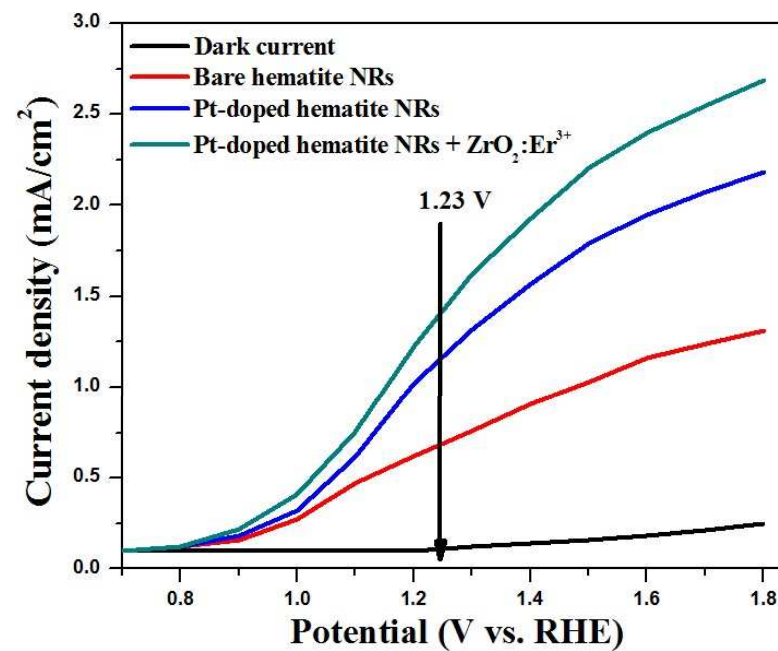


# Introduction

## New application areas of phosphor nanoparticles



Increased light harvesting by DSSC (27%)



Increased hydrogen production (16%)

Solar & Fuel cells efficiency enhancement



## List of literature

**T.S. Atabaev et al./ RSC Advances 4 (2014) 34343**

**T.S. Atabaev et al./ Advances in Optics (2014) 459065**

**T.S. Atabaev et al./ Journal of Physical Chemistry C 117 (2013) 17894**

**T.S. Atabaev et al./ Nanoscale Research Letters 7 (2012) 556**

**T.S. Atabaev et al./ RSC Advances 2 (2012) 9495**

**T.S. Atabaev et al./ Journal of Biomedical Materials Research A 100 (2012) 2287**

The screenshot displays the Sigma-Aldrich website interface. The top navigation bar includes the Sigma-Aldrich logo, a search bar, and links for '200,000+ PRODUCTS', '500+ SERVICES', 'Featured INDUSTRIES', 'Hello: Sign in. ACCOUNT', '24/7 SUPPORT', and '0 Items ORDER'. The breadcrumb trail reads: 'Korea (South) Home > Product Directory > Materials Science > Alternative Energy > Phosphor Materials'. The left sidebar lists 'Materials Science Products' with categories: 'New Products for Materials Science', 'Biomaterials', 'Bioelectronics', 'Specialty Polymers and Nanomaterials for Drug Delivery', 'Metal & Ceramic Science', 'Micro & Nanoelectronics', and 'Nanomaterials'. The main content area is titled 'Phosphor Materials' and contains two paragraphs of text.

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200,000+ PRODUCTS | 500+ SERVICES | Featured INDUSTRIES | Hello: Sign in. ACCOUNT | 24/7 SUPPORT | 0 Items ORDER

Korea (South) Home > Product Directory > Materials Science > Alternative Energy > Phosphor Materials

**ALDRICH** Materials Science  
Materials Science Products

New Products for Materials Science

- Biomaterials
- Bioelectronics
- Specialty Polymers and Nanomaterials for Drug Delivery
- Metal & Ceramic Science
- Micro & Nanoelectronics
- Nanomaterials

### Phosphor Materials

Phosphors are materials that exhibit the phenomenon of luminescence, i.e. they emit light when exposed to radiation such as ultraviolet light or an electron beam. Phosphor materials also called luminescent materials are used in a variety of display applications, such as electroluminescent, photoluminescent, plasma and field emission displays, LCDs, cathode ray tubes (CRTs), X-ray detectors, LEDs and many more.<sup>1-2</sup>

Inorganic phosphors usually consist of a host material that could be an oxide, nitride, oxynitride, silicate, sulfide, selenide, halide or oxyhalide, doped with small amounts of activator ions like rare-earth and/or transition metal ions.<sup>3-5</sup> The activator ions act as emission or luminescence centers and possess energy levels that can be populated by direct excitation or indirectly by energy transfer.

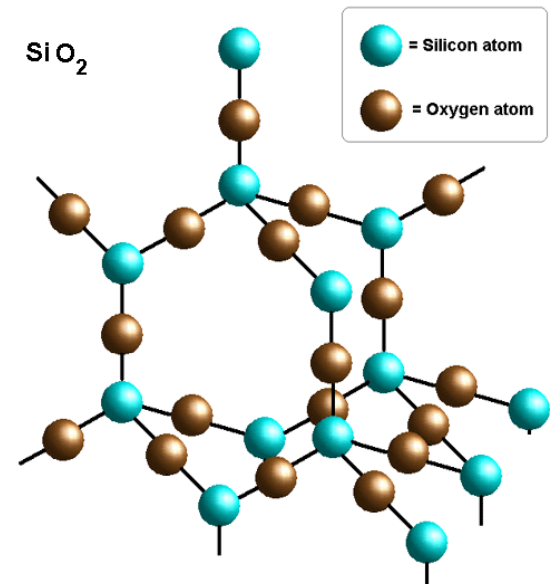
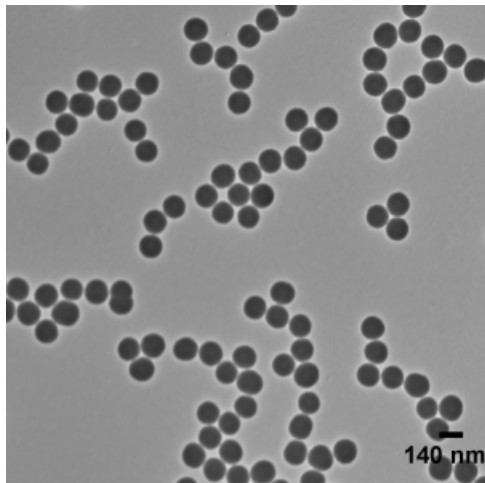


# Introduction

Silica (Silicon dioxide) is a potential biocompatible material for biomedical applications, because it is a cheap, chemically inert material whose surface can be easily modified.

Silica is manufactured in several forms including quartz, crystal, **colloidal silica**, silica gel, aerogel, etc.

Colloidal silica is suspension of fine amorphous and typically spherical particles in a liquid phase.



**Stöber process (1968)**

**Solvent, time, temperature, etc.**

**W. Stöber et al. J Colloid Interface Sci 26 (1968) 62-69**



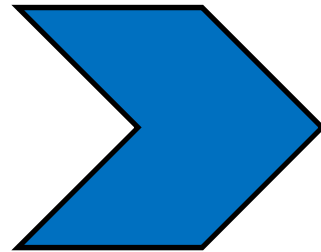
# Introduction

---

Nowadays, organic dyes and quantum dots (QD) have been widely utilized for detection of tumor cells using the principle of fluorescence.

Drawback:

- high cost
- broad spectral features
- decomposition
- photo bleaching
- toxicity



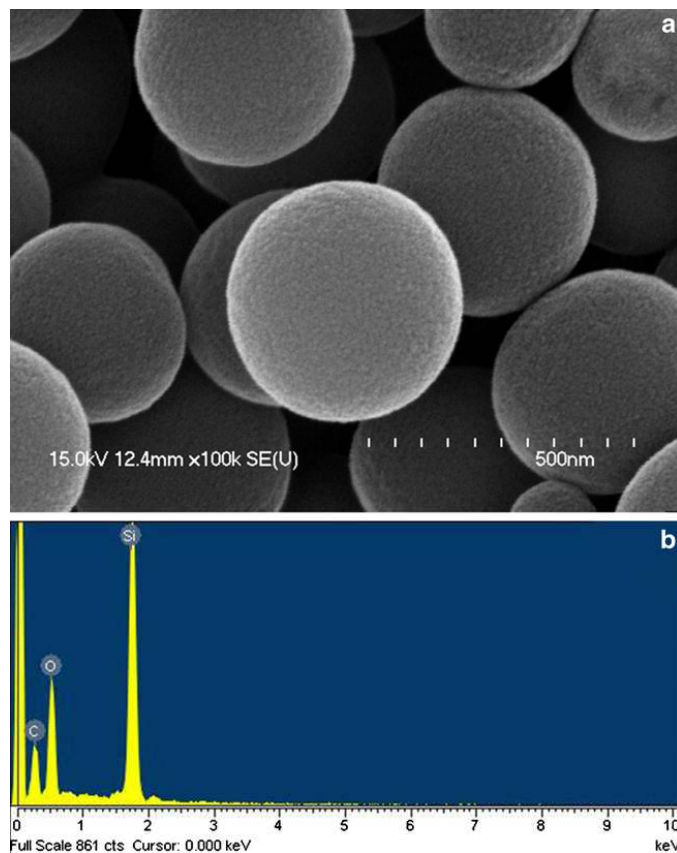
- **low cost**
- **biocompatible**
- **stable**
- **controllable**

## **Dye-embedded silica nanoparticles**

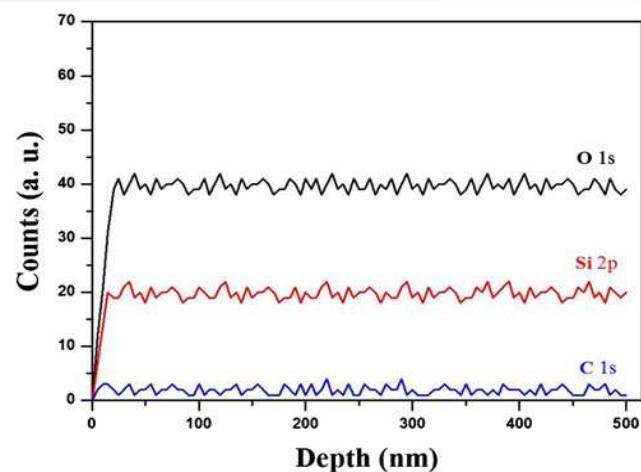
- Easy to fabricate
- Controllable size range
- Controllable luminescent properties
- Stable
- Biocompatible



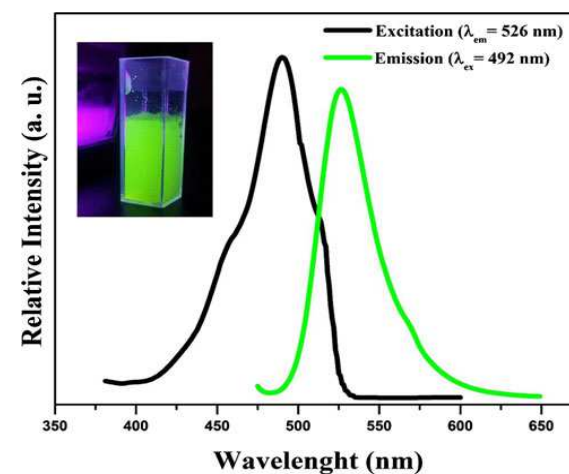
## Experimental part



FESEM image (a) and EDX spectra (b) of synthesized fluorescein-embedded silica particles



XPS depth profile analysis of dye-embedded silica particles

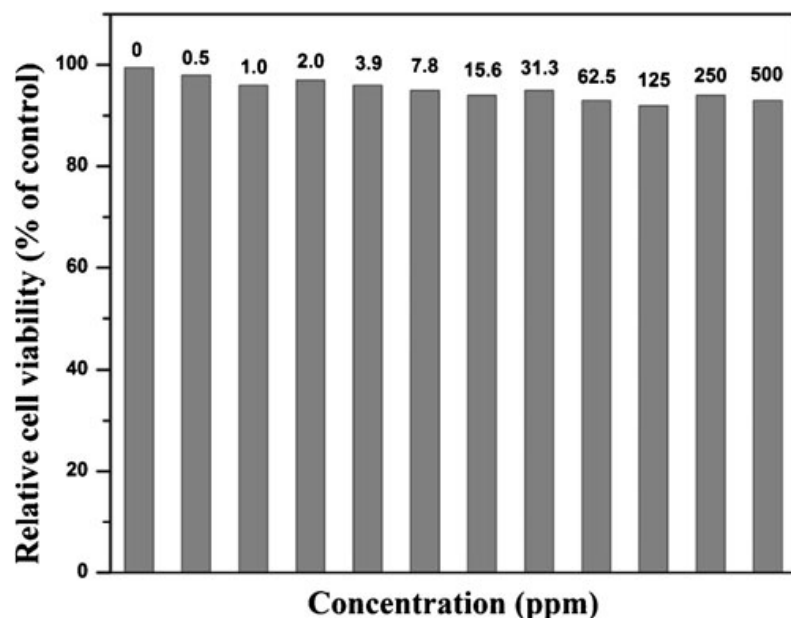


PL excitation and emission spectra of fluorescein-embedded silica particles

T.S. Atabaev et al./ *BioNanoScience* 3 (2013) 132-136

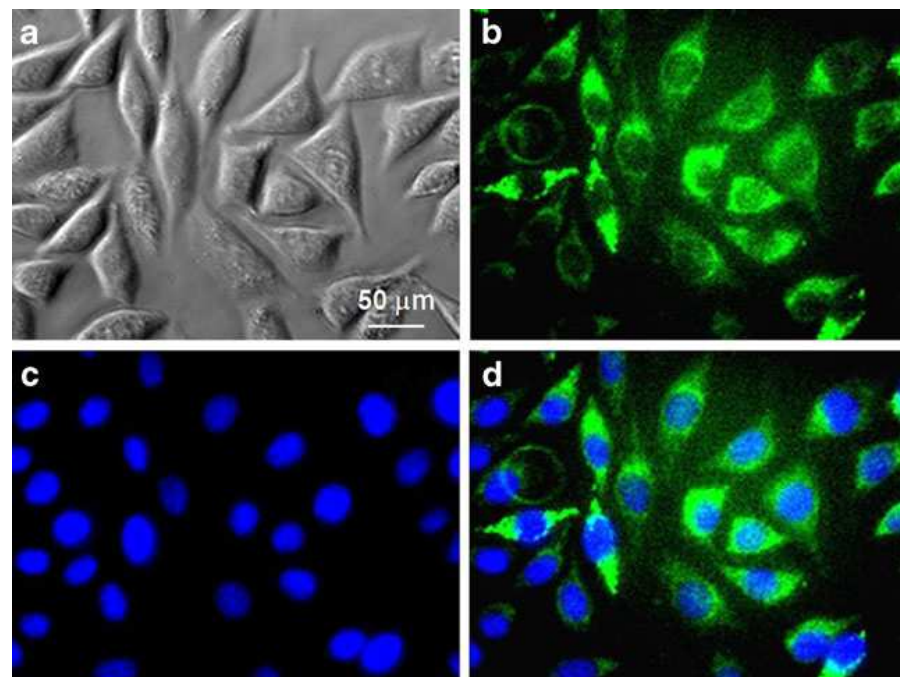


## Experimental part



Cytotoxicity profiles of fluorescein-embedded silica particles. Relative cell viability of L-929 cells exposed for 24 h to increasing concentrations (0~500 ppm) of particles was evaluated using the WST-8 assay.

T.S. Atabaev et al./ *BioNanoScience* 3 (2013) 132-136



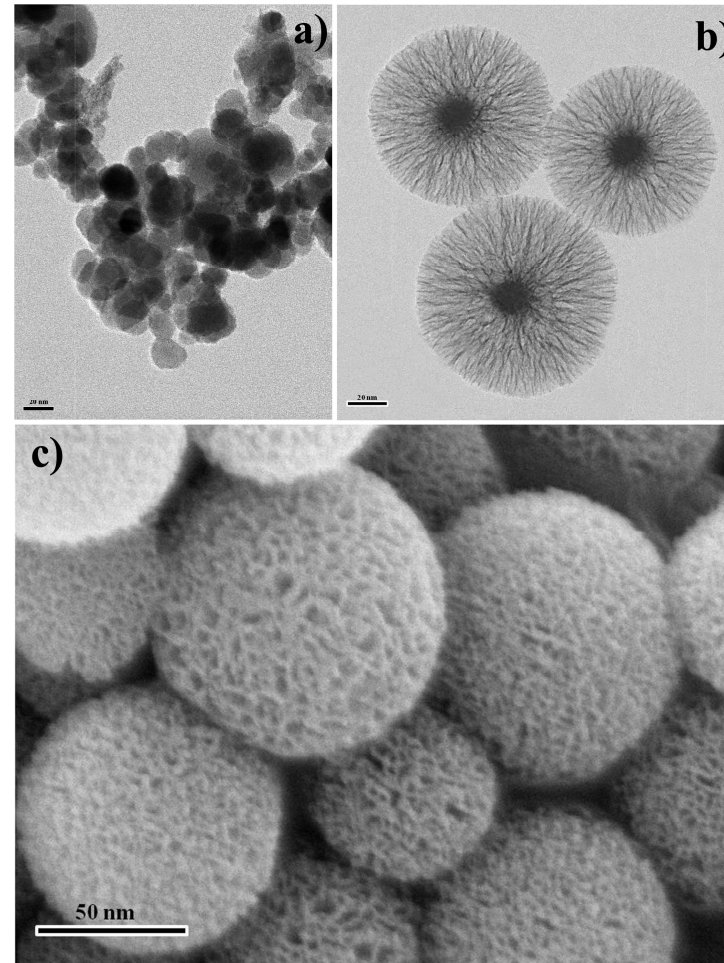
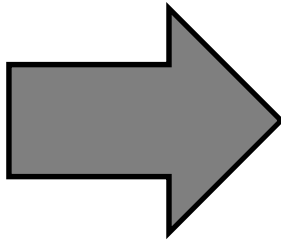
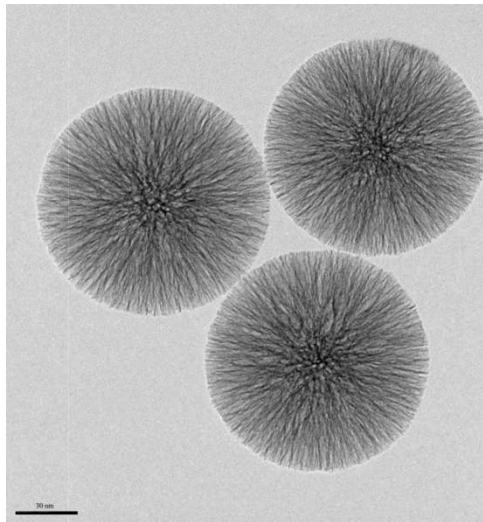
Fluorescence micrographs of L-929 cells treated with 50 ppm of dyeembedded SiO<sub>2</sub> particles for 1 h, followed by cell nuclei counterstaining with 10 μmol/L DAPI. (a) Phase contrast image of the cells co-labeled with the particles and DAPI. (b), ©Fluorescence images of the cells collected at  $\lambda_{exc}=450$  nm (green from the composites) and  $\lambda_{exc}=350$  nm (blue, from DAPI), respectively. (d) Merged image of (b) and (c). All photographs shown in this figure are representative of six independent experiments with similar results



## Experimental part

### Multifunctionality

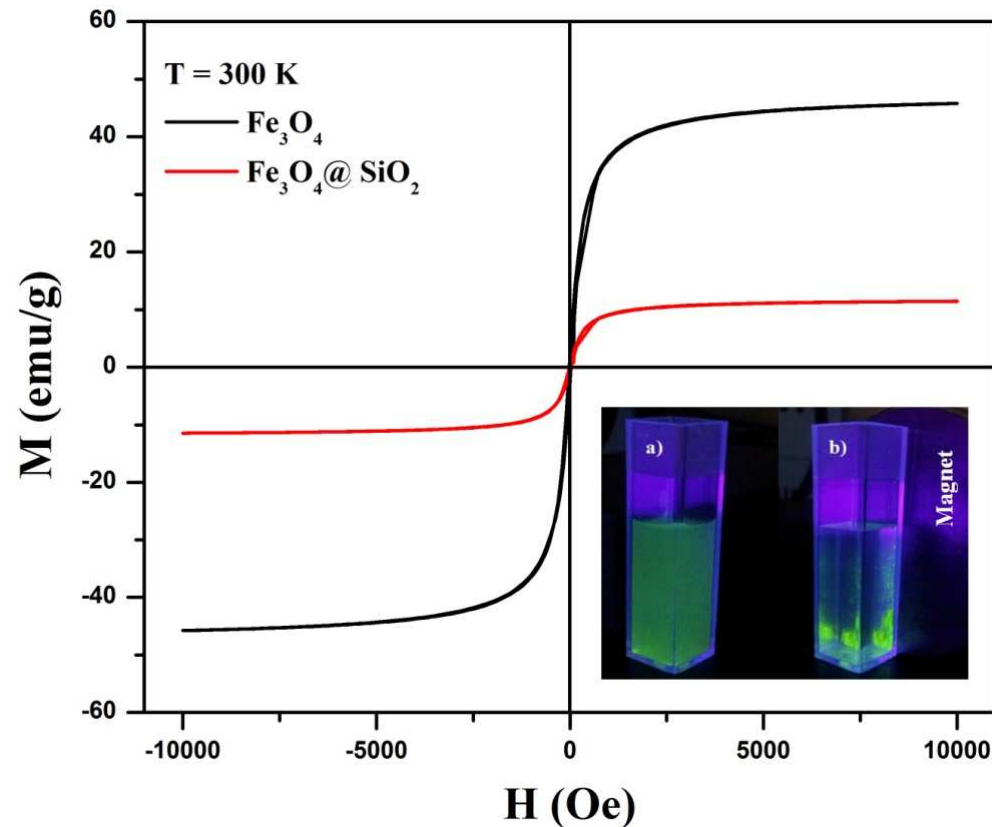
- Magnetic properties
- Optical properties
- Mesoporous structure



T.S. Atabaev et al. / *Nanotechnology* 24 (2013) 345603



## Experimental part



Magnetic hysteresis loop at 300 K of synthesized bare  $\text{Fe}_3\text{O}_4$  NPs and  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  composites. Inset the digital images of (a)  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  composites dispersed in water under excitation of commercially available 365 nm UV lamp, (b)  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  composites attracted by a magnet under excitation of UV lamp.

**T.S. Atabaev et al. / *Nanotechnology* 24 (2013) 345603**



## Conclusion & Acknowledgement

---

- Fabrication methods of phosphor and silica nanoparticles are presented
- Approach presented in this study can be extended to other optical systems
- More study and experiments will be needed to improve the biocompatibility of the samples

I would also like to express my sincere acknowledgements

- ✓ Financial support from Seoul National University R&D research grant (No. 3348 - 20110053)
- ✓ Prof. Hwang YH and Prof. Kim HK for PL measurements
- ✓ Prof. Han DW for biorelated experiments (cytotoxicity tests, cellular uptake measurements)





**Thank you!**  
**Any questions are welcome!**



Dr. Vasily Lenyashin.



- 1972 ~1999

- 20

- 1999 ~2012

- 25

- 2012 TRIZ-

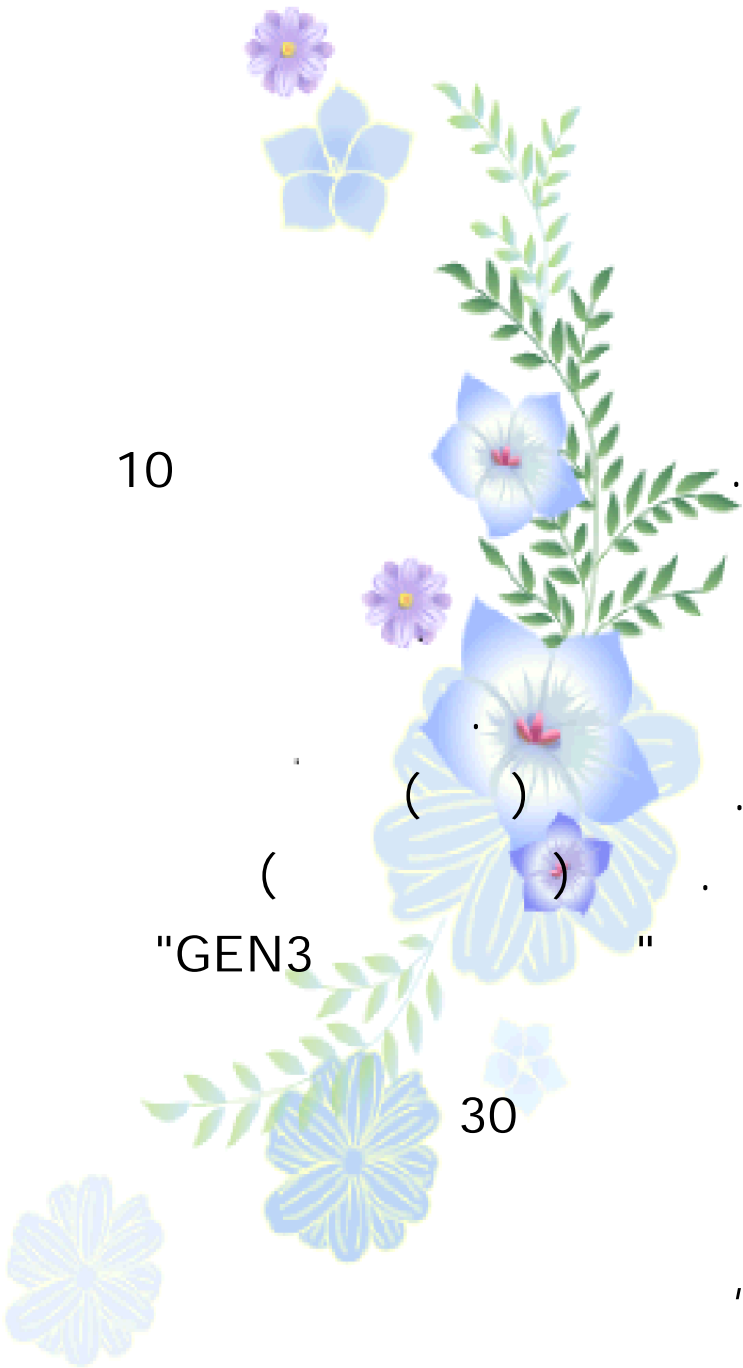
-

-

10

"GEN3

30







# TRIZ

**Using TRIZ at the stage of  
transition from laboratory  
technology to mass production**





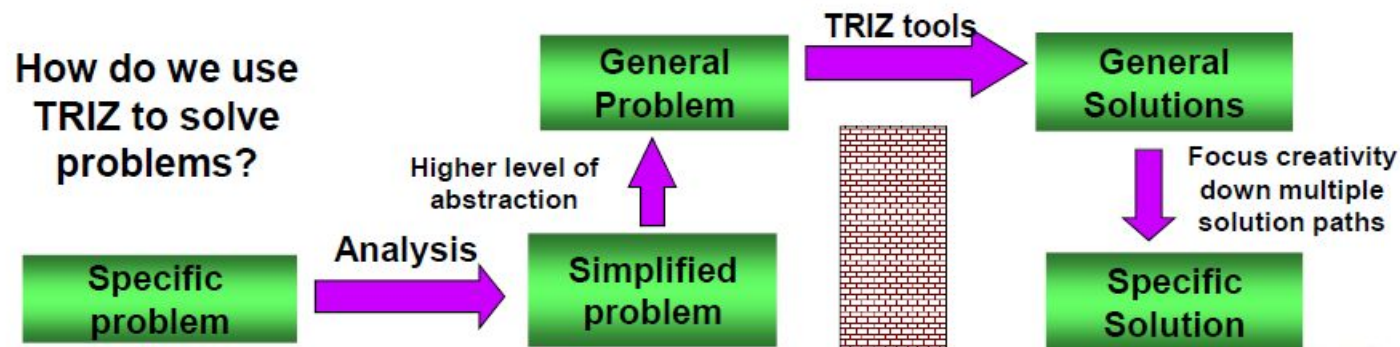
# What is TRIZ?

**ТЕОРИЯ РЕШЕНИЯ ИЗОБРЕТАТЕЛЬСКИХ ЗАДАЧ**  
(Teoria Reshenia Izobretatelskikh Zadach)

Theory of Inventive Problem Solving (TIPS)

Pronounced: **treez**

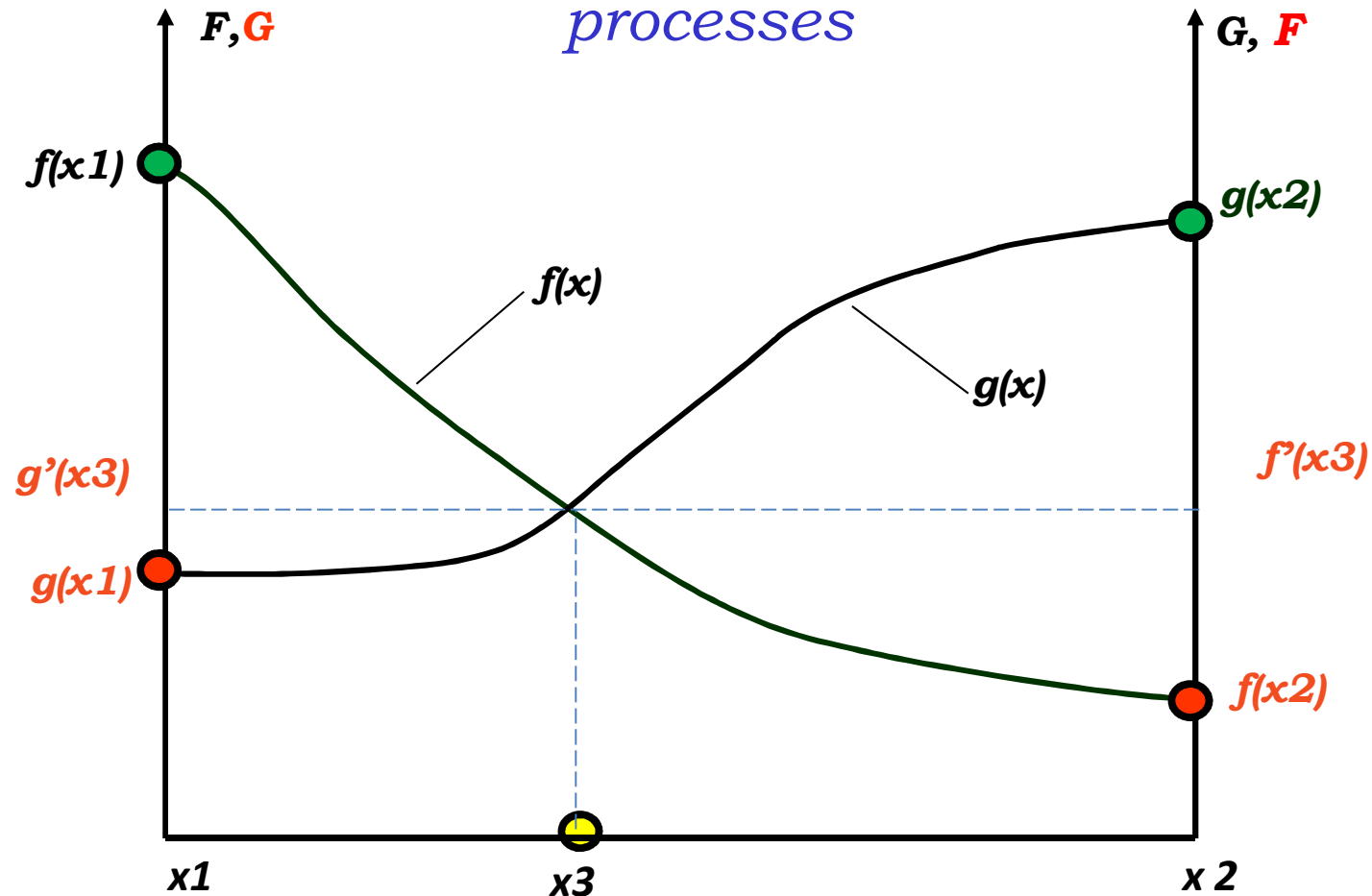
Solutions suggested on how  
similar problems resolved in  
other industries, sciences  
& technologies





# Mathematical introduction of TRIZ process

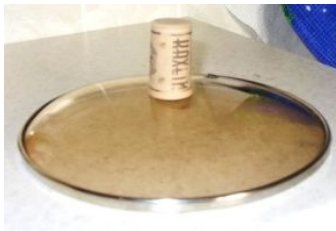
*Graphical introductions of optimization and TRIZ processes*



*If anyone tries to find point -  $x_3 \in [x_1, x_2]$  – then it isn't TRIZ way!!!*

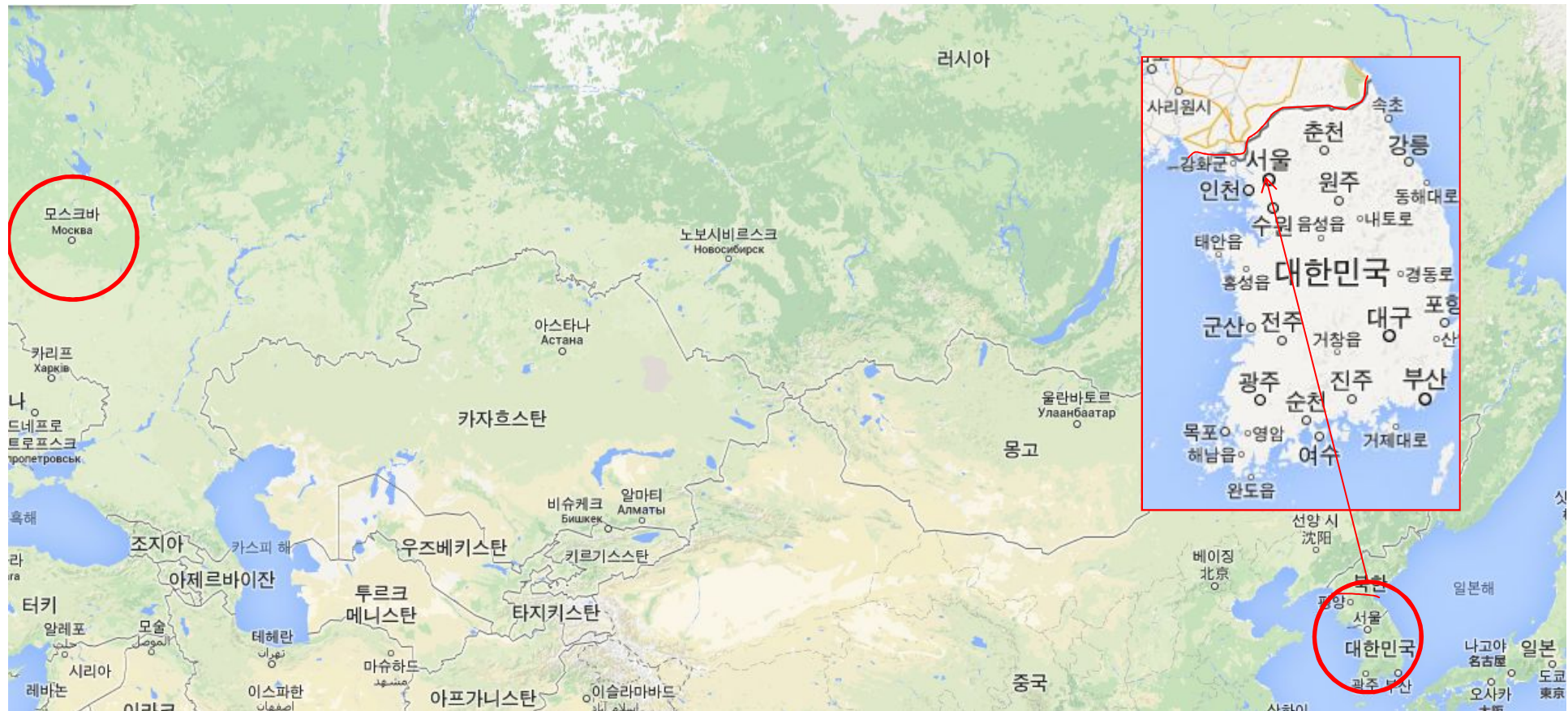


# Why TRIZ “was born” in Russia



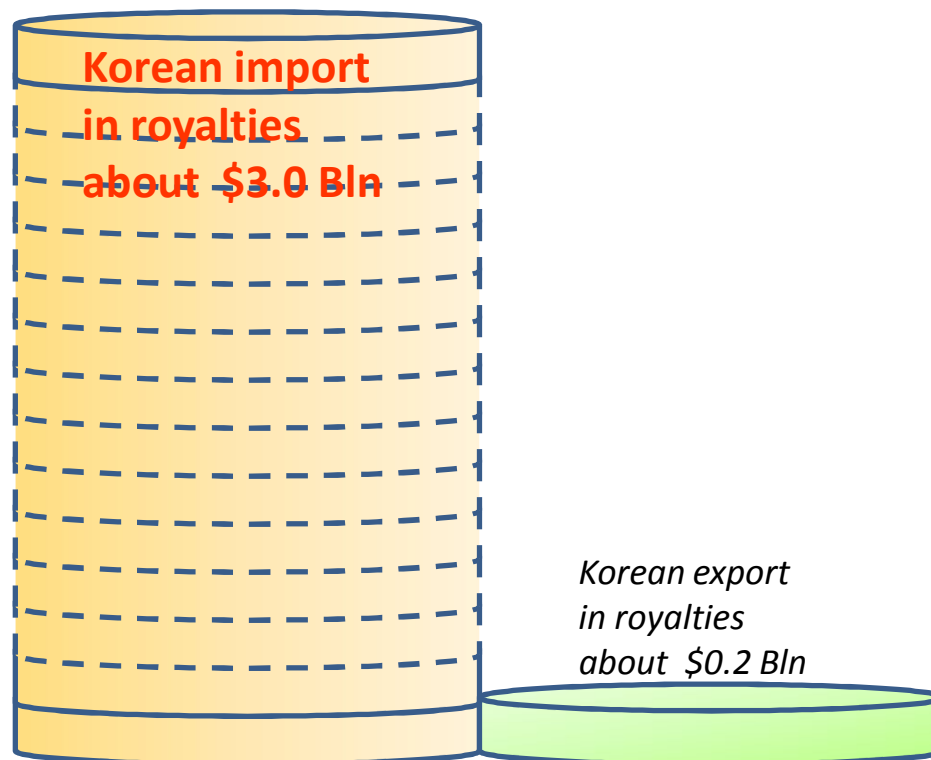


# TRIZ in SOUTH KOREA





# Why TRIZ is so needed in Korea?



“Korean businesses earned record-high royalties from technology exports last year, according to the Korea Industrial Technology Association (KITA) Monday. KITA said its survey of royalty revenues for last year showed that Korean firms earned a total of US\$193 million, a 36.8% jump over US\$141 million in 1998. Last year's amount was the highest ever since such statistics first started being kept in 1978. The technologies that brought in the largest amount - to the tune of US\$70 million - were **Samsung SDI's** Braun tube manufacturing technology for color TV sets and manufacturing technology for electronic scanning guns. The main markets for these technologies were China and Malaysia. By region, royalties from China amounted to US\$94.6 million, royalties from Southeast Asia came to US\$40.3 million and royalties from the U.S. totaled US\$17.2 million”



# How to find a needle in haymow?



How to find a needle in haymow?

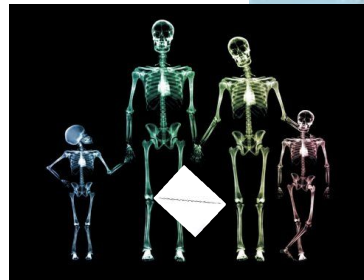
In Russian – “to find a needle in haymow” means absolutely hopeless busy or loss of time.



# How to find a needle in haymow?



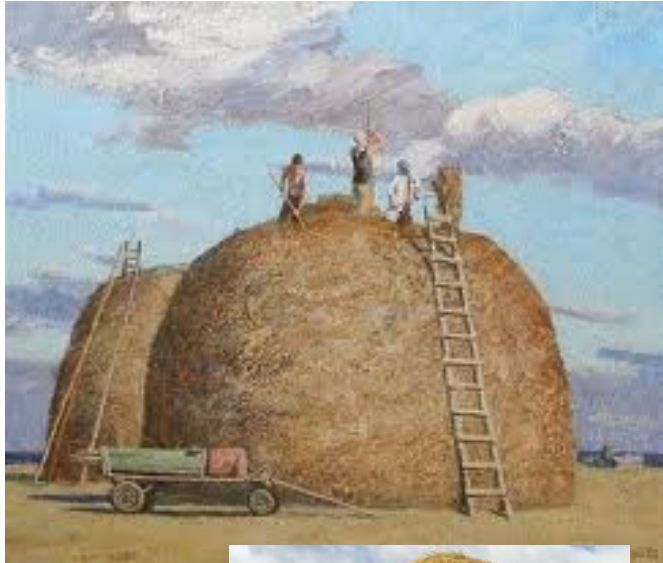
Magnet!!!



X-ray!!!



# How to find a needle in haymow?





# How to find a needle in haymow?



EDISON



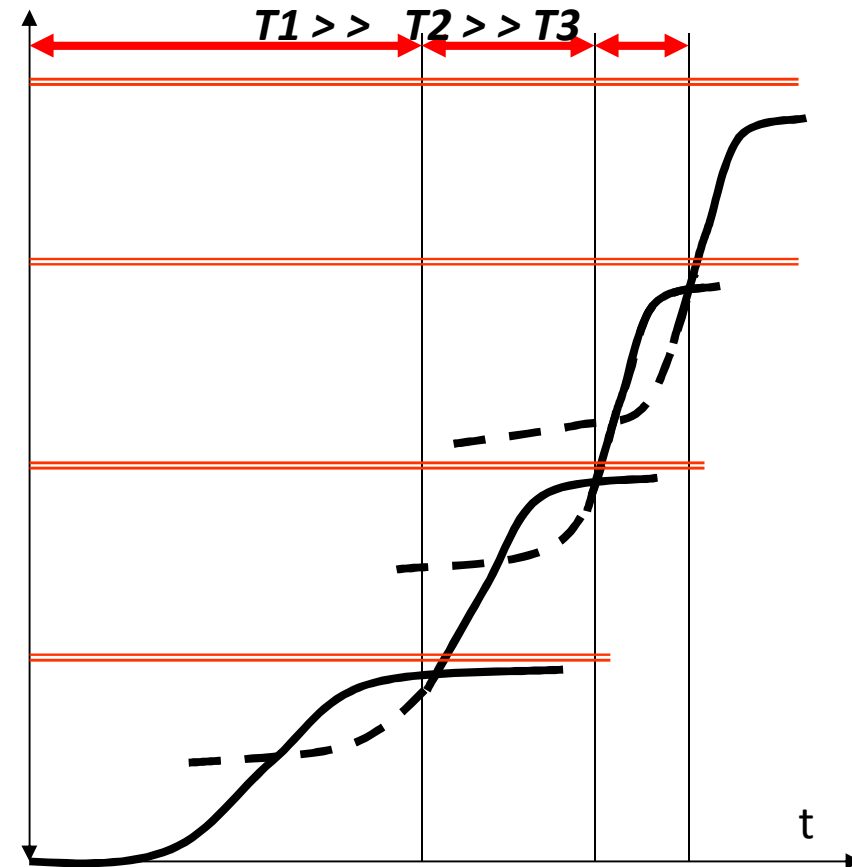
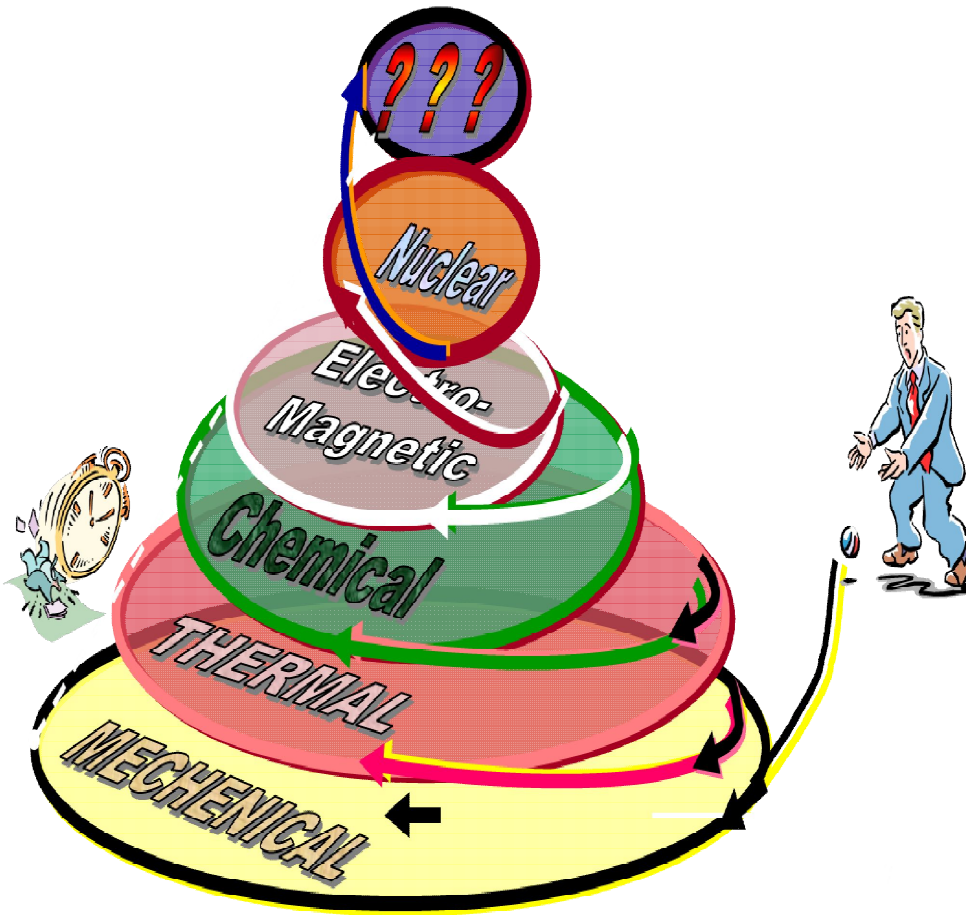
Tomas Edison  
(1847-1931)

***Don't loss a time – do it!!!  
Straw by straw...***





# Why TRIZ is so useful now?

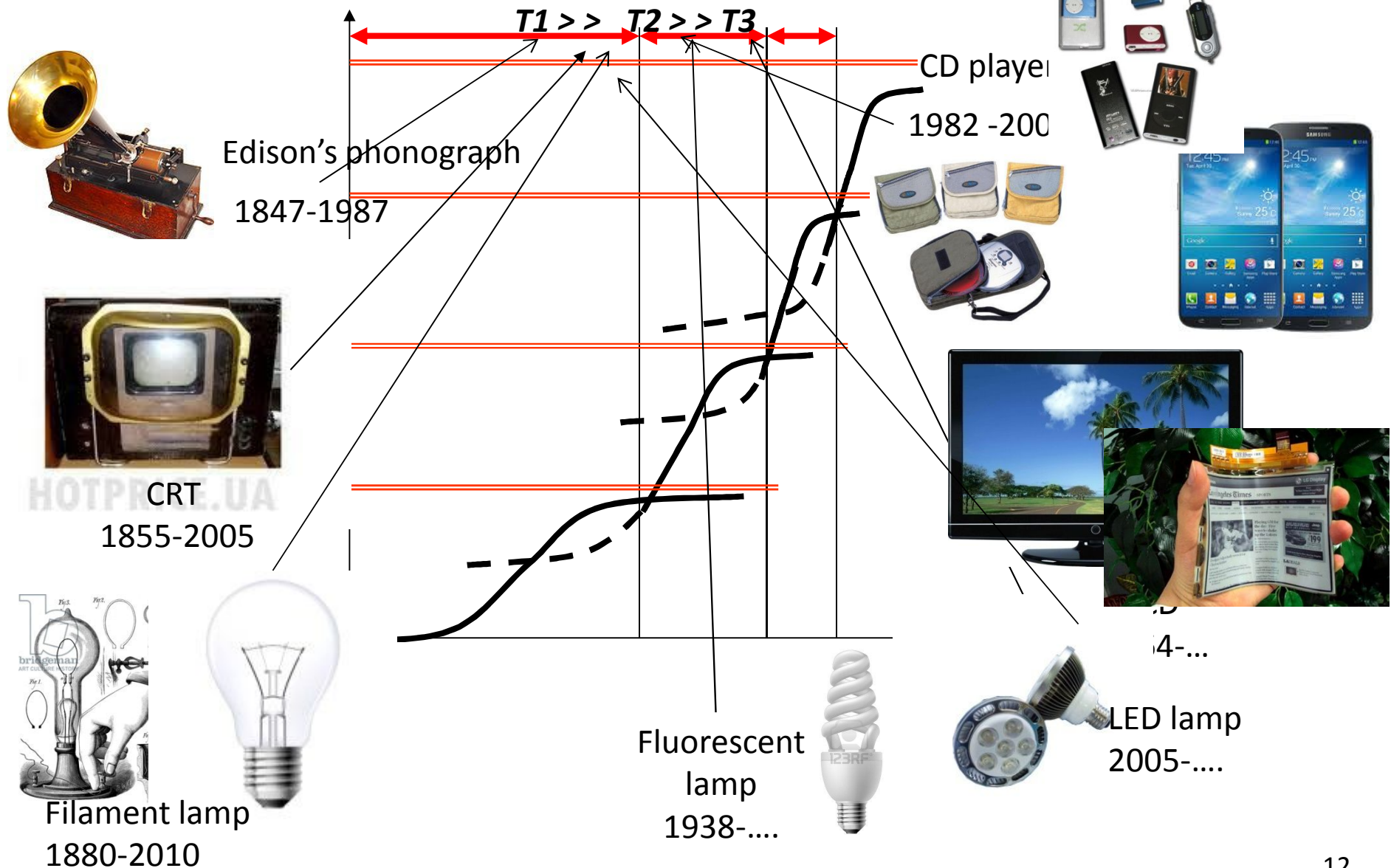


*Each new-generation system has shorter "life-time". So we are very restricted in time for doing improvements*



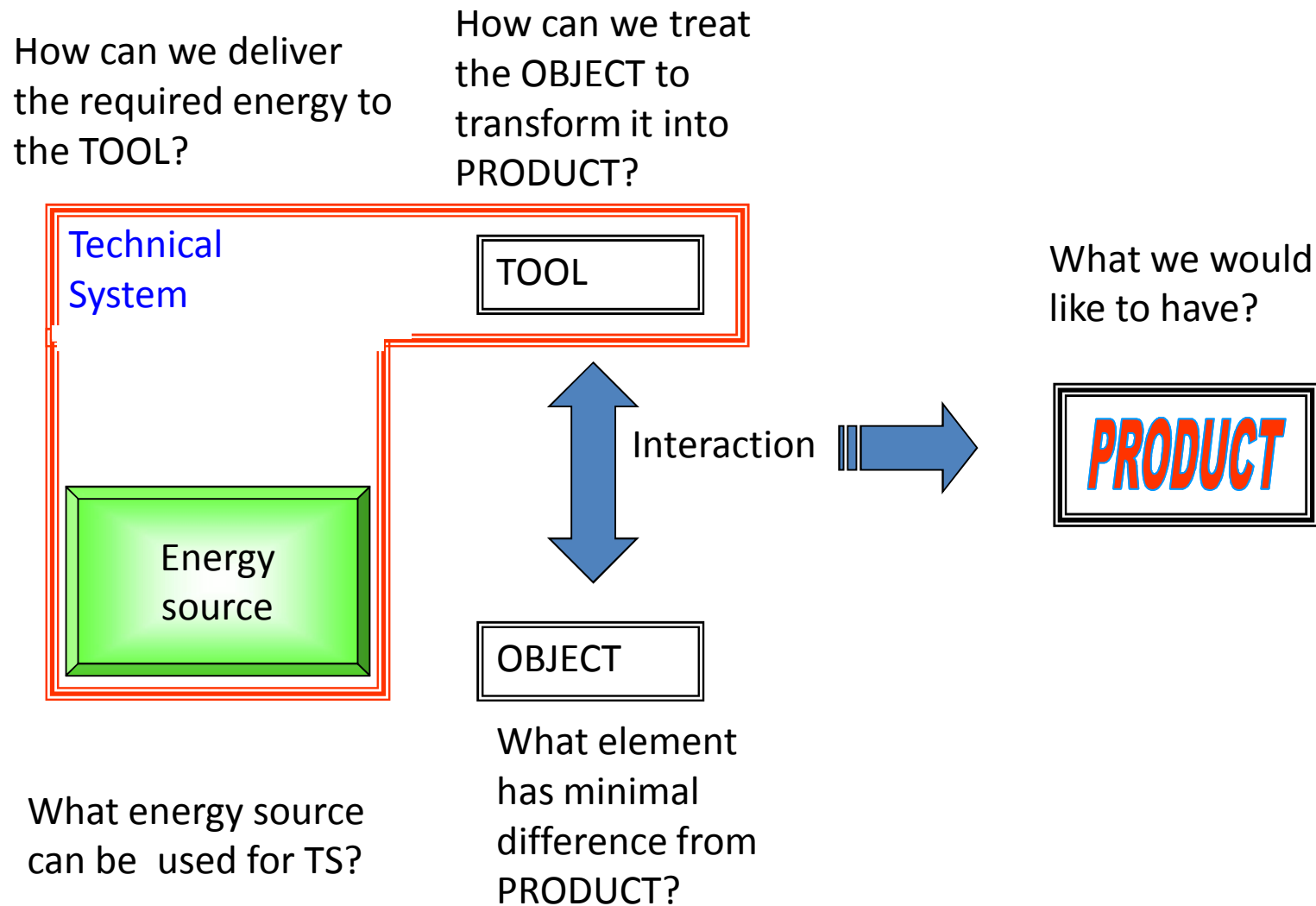
# Why TRIZ is so useful now?

GEN3 PARTNERS KOREA



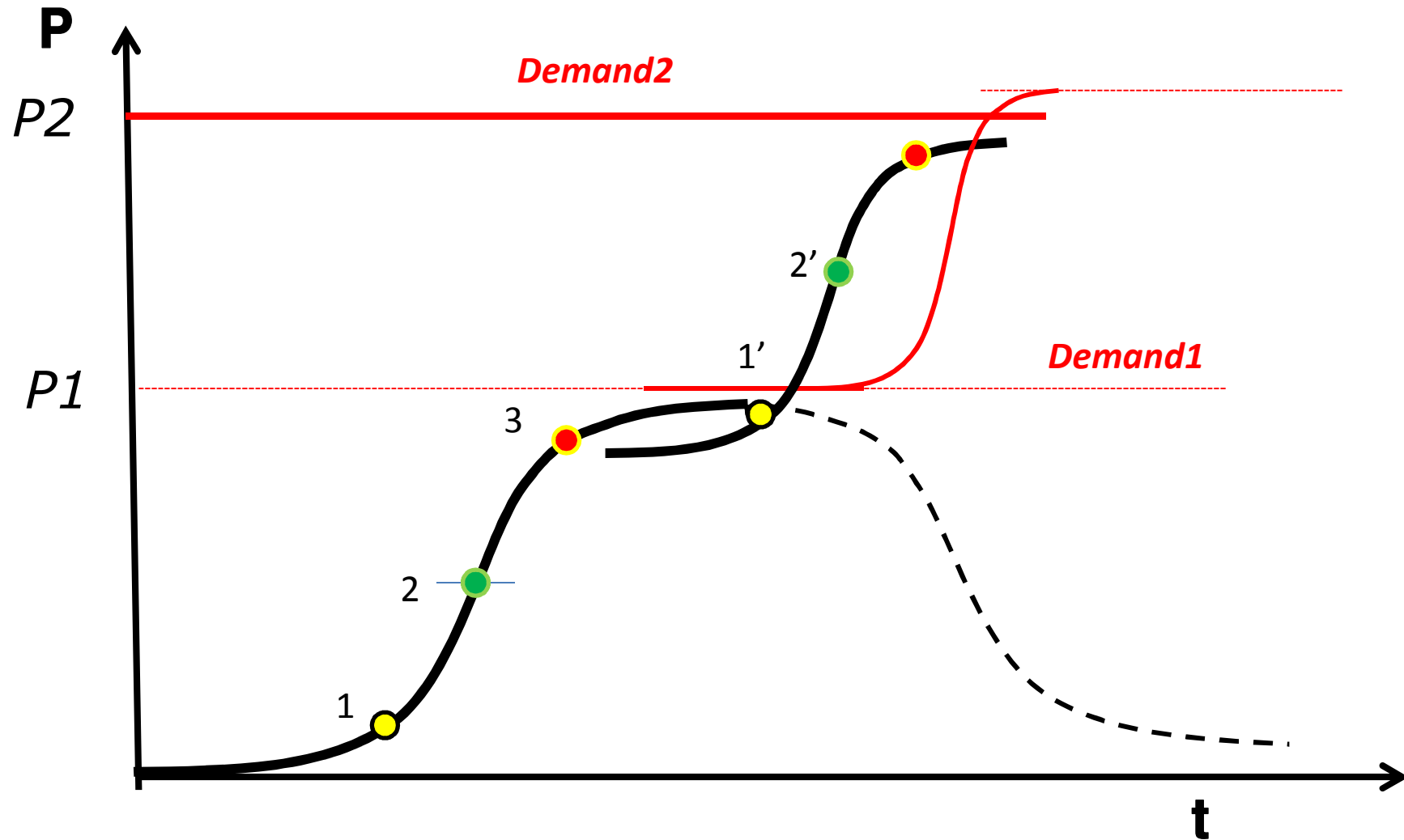


# Motivation of Technical System creation



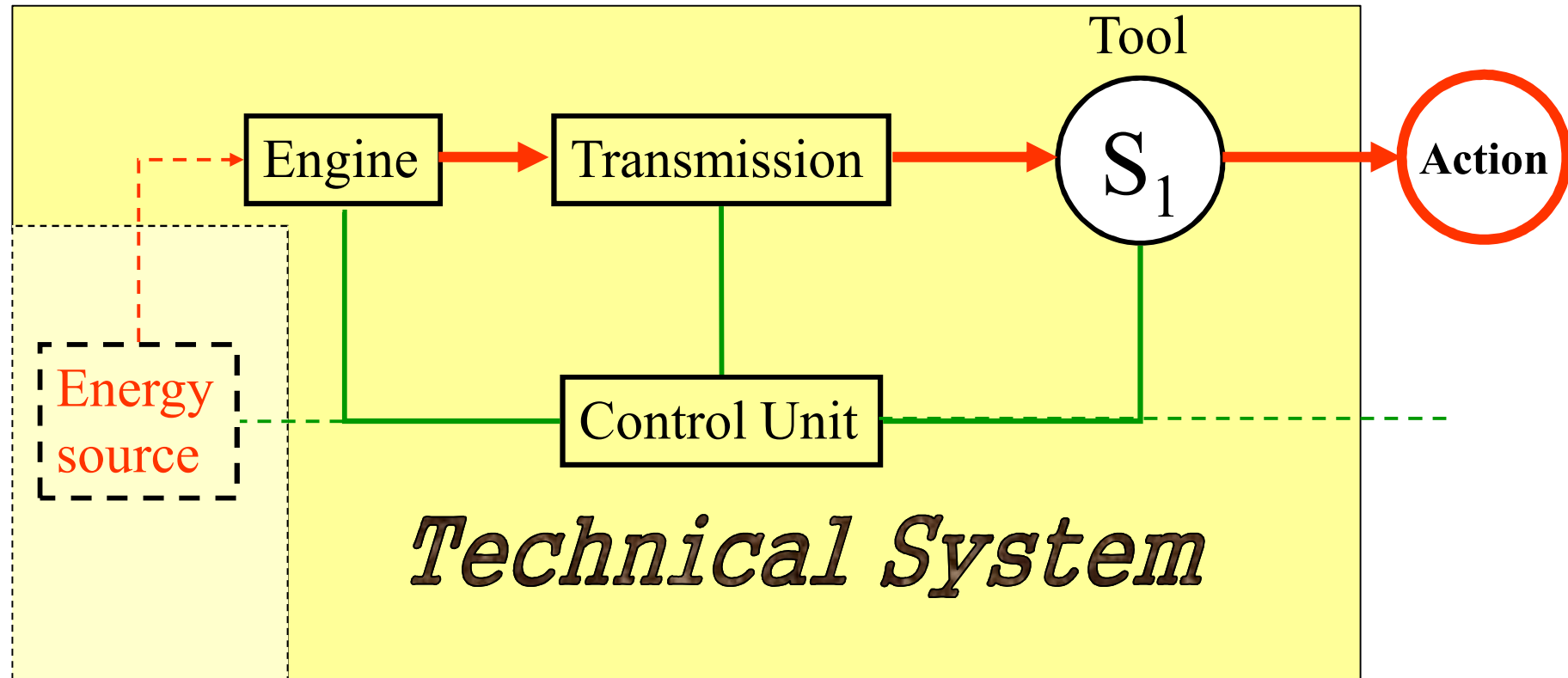


# Motivation for new Product/Technology appearance





# Model of a Technical System



1. Law of **T**echnical **S**ystem **C**ompleteness
2. Law of throughout **E**nergy **C**onductivity
3. Law of **R**hythm **C**oordination



# New Product/Principle of operation

## Digital piano



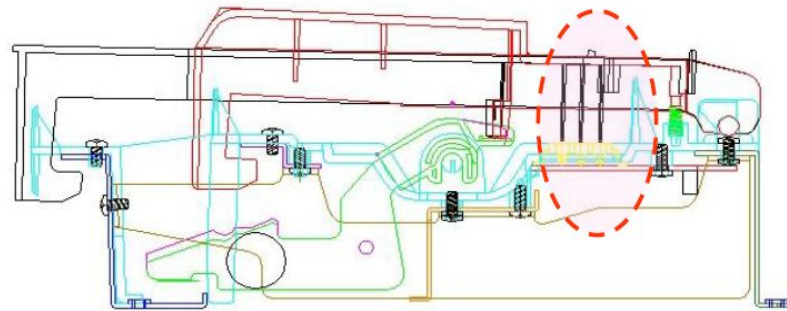
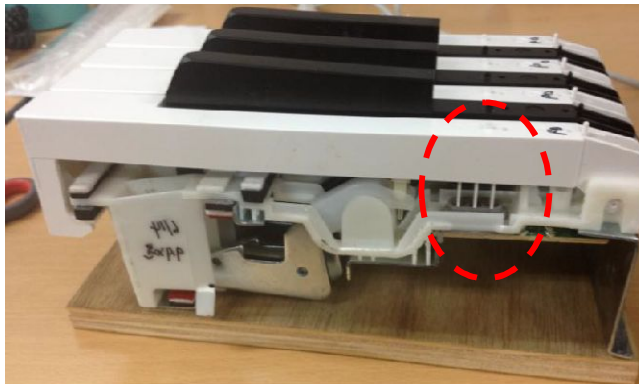
## Example: Digital Piano



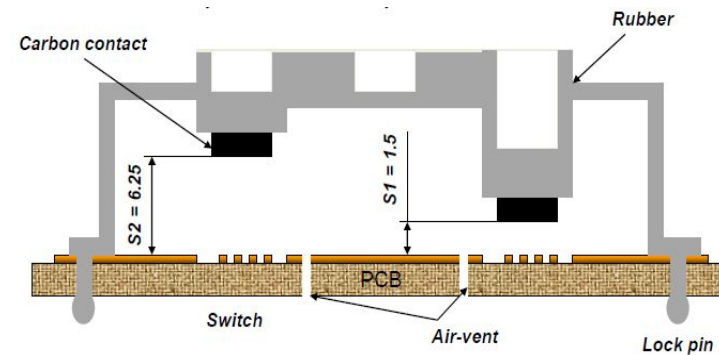


## Example: Digital Piano

- Power of pushing the piano key and sound level does not match accurately.



- Three bars push the rubber and it touches the PCB and the electricity flows
- The time difference between 1<sup>st</sup> contact and 2<sup>nd</sup> contact decides the sound level.

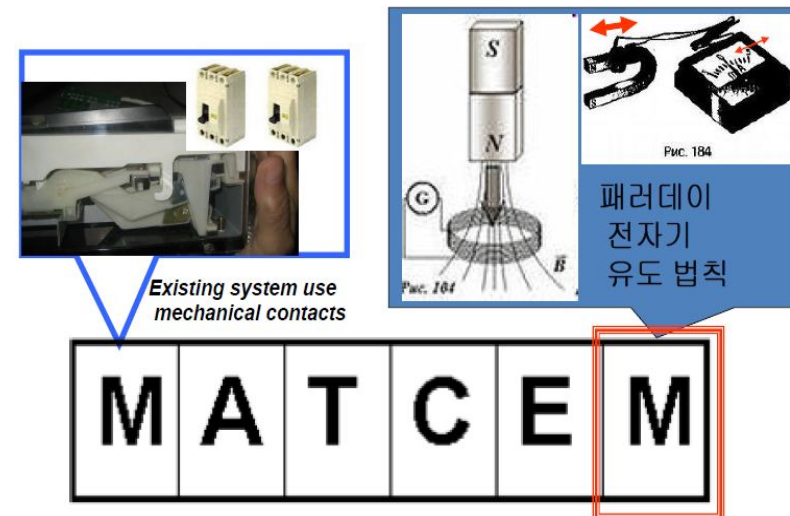




- FOS: Speed Camera



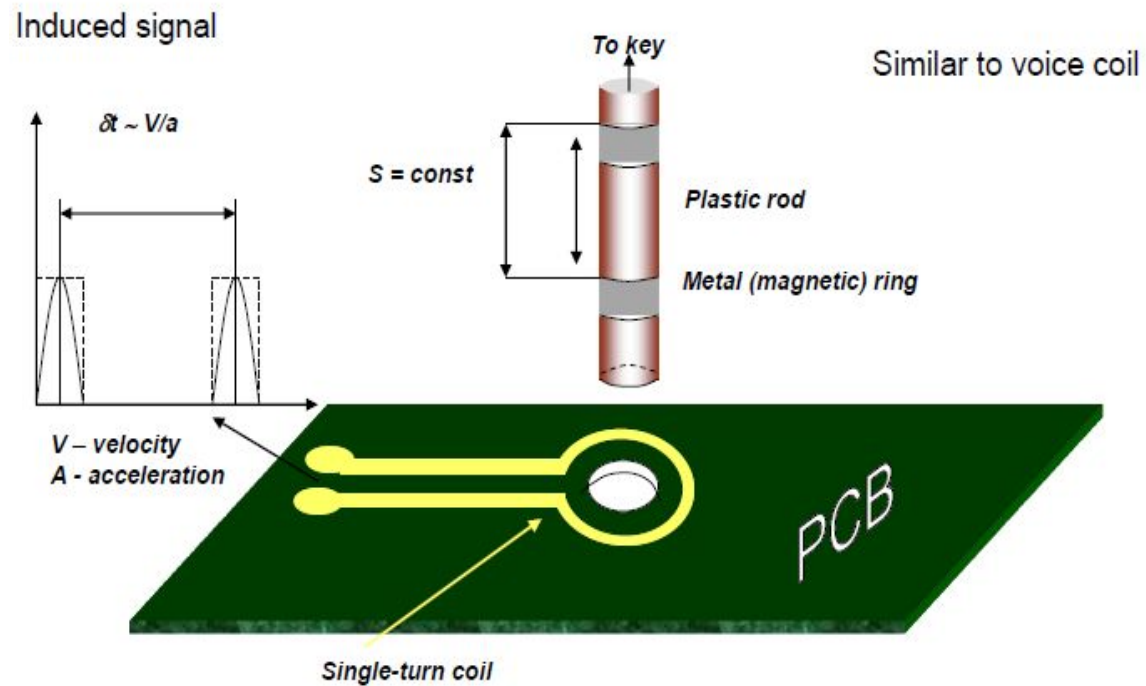
## Trend of Engineering System Evolution



Mechanical, Acoustic, Thermal, Chemical,  
Electrical, Magnet



- Proposed Solution



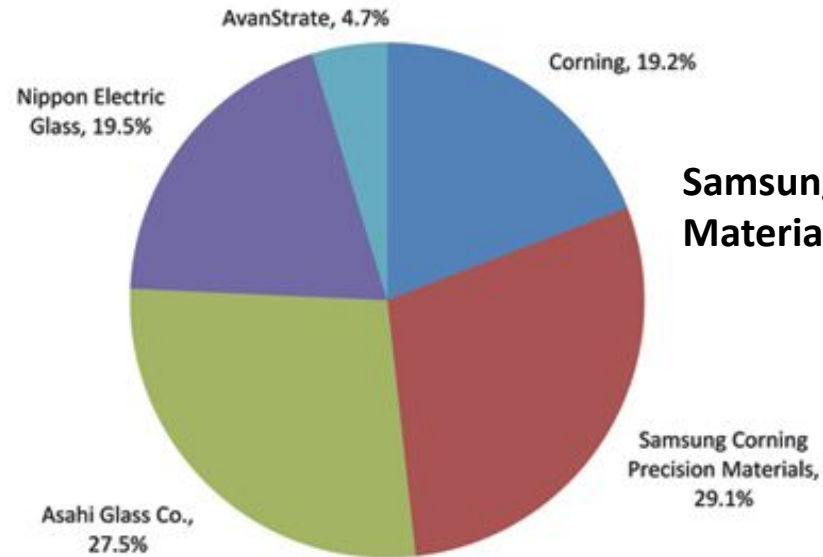
- Not affected by any change in rubber, dust, PCB etc.
- The number of parts are reduced.



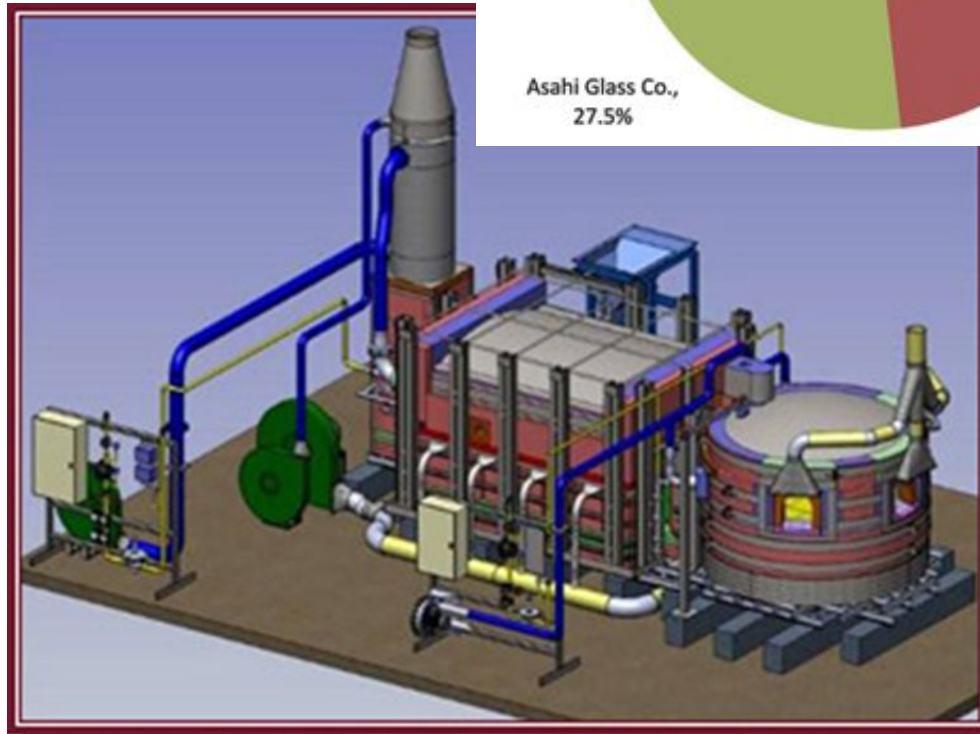
# WASTE UTILIZATION

GEN3 PARTNERS  
KOREA

## Glass production manufactory

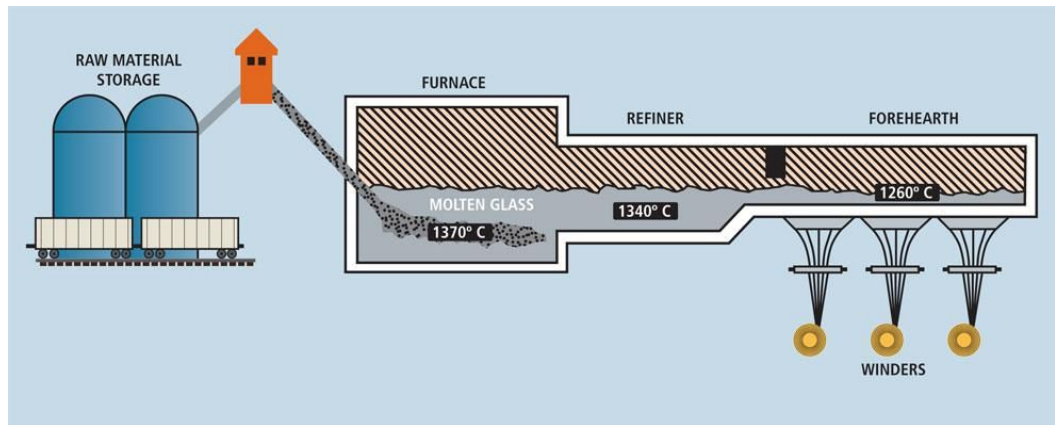


**Samsung Corning Precision Materials Co., Ltd.**





## Boric anhydride



Powder  $B_2O_3$





South Korea: 32% of world  
sea-crafts production



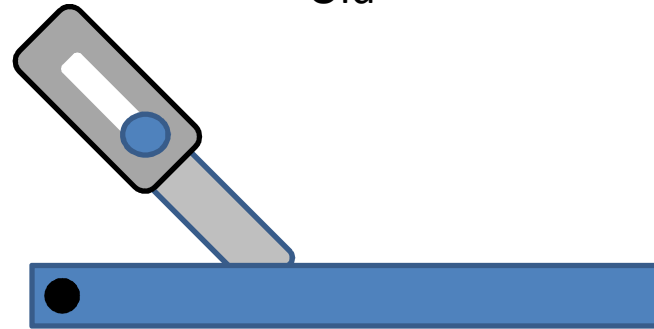


# COST REDUCTION



Refrigerators  
bar-shelf

Old



New

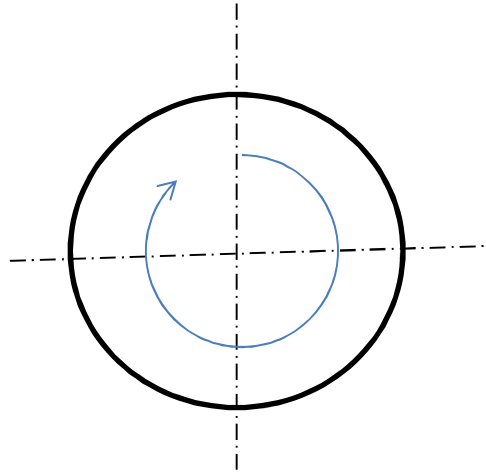




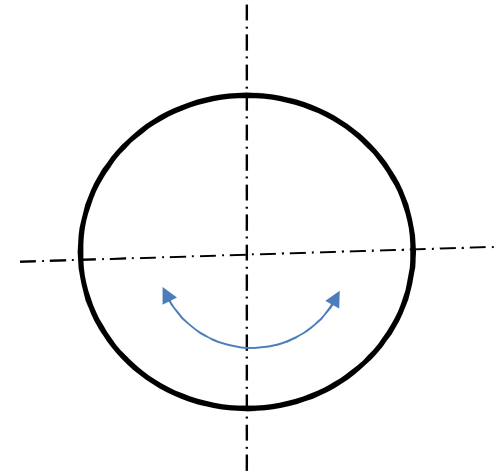
# Avoiding of competitor's patent



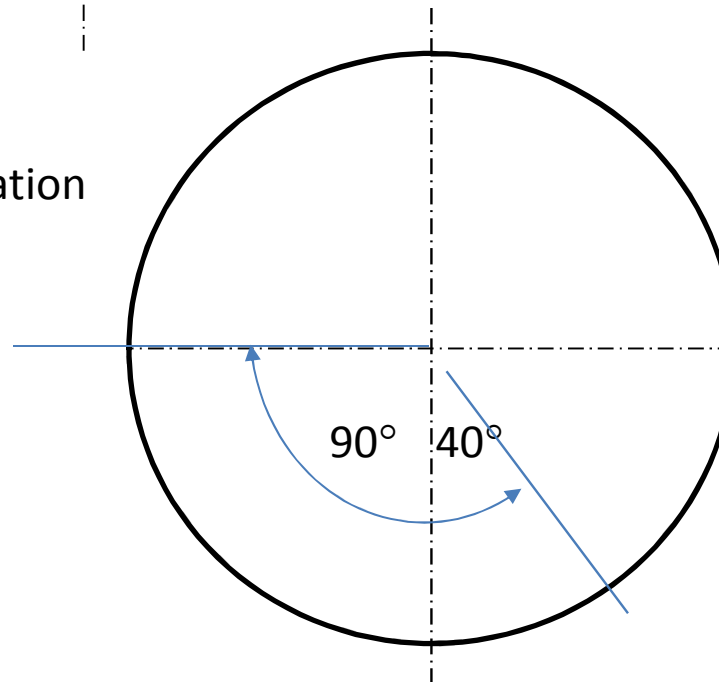
Dram rotation-  
Patent of competitor



Dram shuttle service-  
Patent of competitor



Dram shuttle service+ rotation  
Samsung Patent





감사합니다

THANK YOU

СПАСИБО

ЗА ВНИМАНИЕ

바실리 레니아신

Vasily Lenyashin [leniachine1@mail.ru](mailto:leniachine1@mail.ru)

Василий Леняшин -82-10-9080-7110



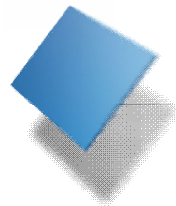
Theme 2.



# 중진공 신규사업 Technology Commercialization

SBC  중소기업진흥공단





# Overview

## 1 사업명

R&D 성공과제 사업화·기술이전 지원

## 2 사업내용

R&D 성공기술 → 기술사업화진단을 통해 사업화기획, 제품화지원  
→ 사업화성공을 향상

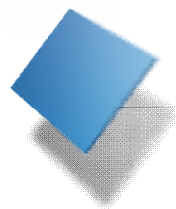
## 3 사업규모

2015년 신규사업, 사업비 예산 19.23억

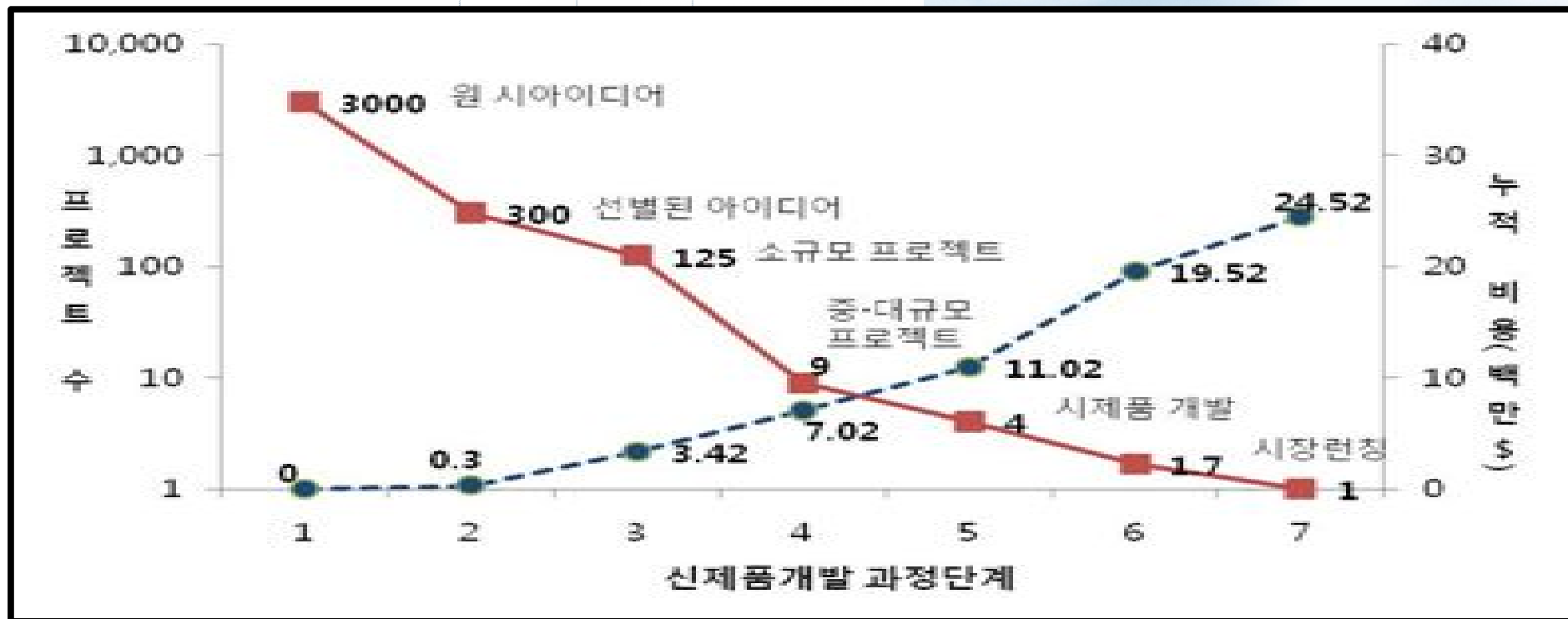
## 4 지원대상

R&D성공판정 기술, 기업부설연구소 보유 기업 개발한 특허등록 보유기업





# Background



→ 중소기업의 기술사업화 추진이 매우 어려움 (자금, 인력, 시간)

\* R&D 기술개발 성공률 92%, 사업화 성공률 42%

(선진국 사업화성공률 : 미국 69%, 영국 70%, 일본 54%)



# Goal & Strategy

비전

중소기업의 기술(꿈)을  
성공의 사업화(꽃)로

목표

2018년까지 「기술사업화 성공기업」 100개 육성

추진  
과제

Money<sup>1</sup> → Technology → Money<sup>2</sup>  
Always, Money<sup>2</sup> > Money<sup>1</sup>, ROI > 0

Input  
Money



Output  
Technology



Outcome  
Money

추진  
전략

Who?  
기술사업화진단

1. 기술완성도
2. 시장성
3. 사업화역량

How?  
사업화기획

1. 마케팅 시스템
2. 사업화추진 로드맵
3. 연계지원 방안

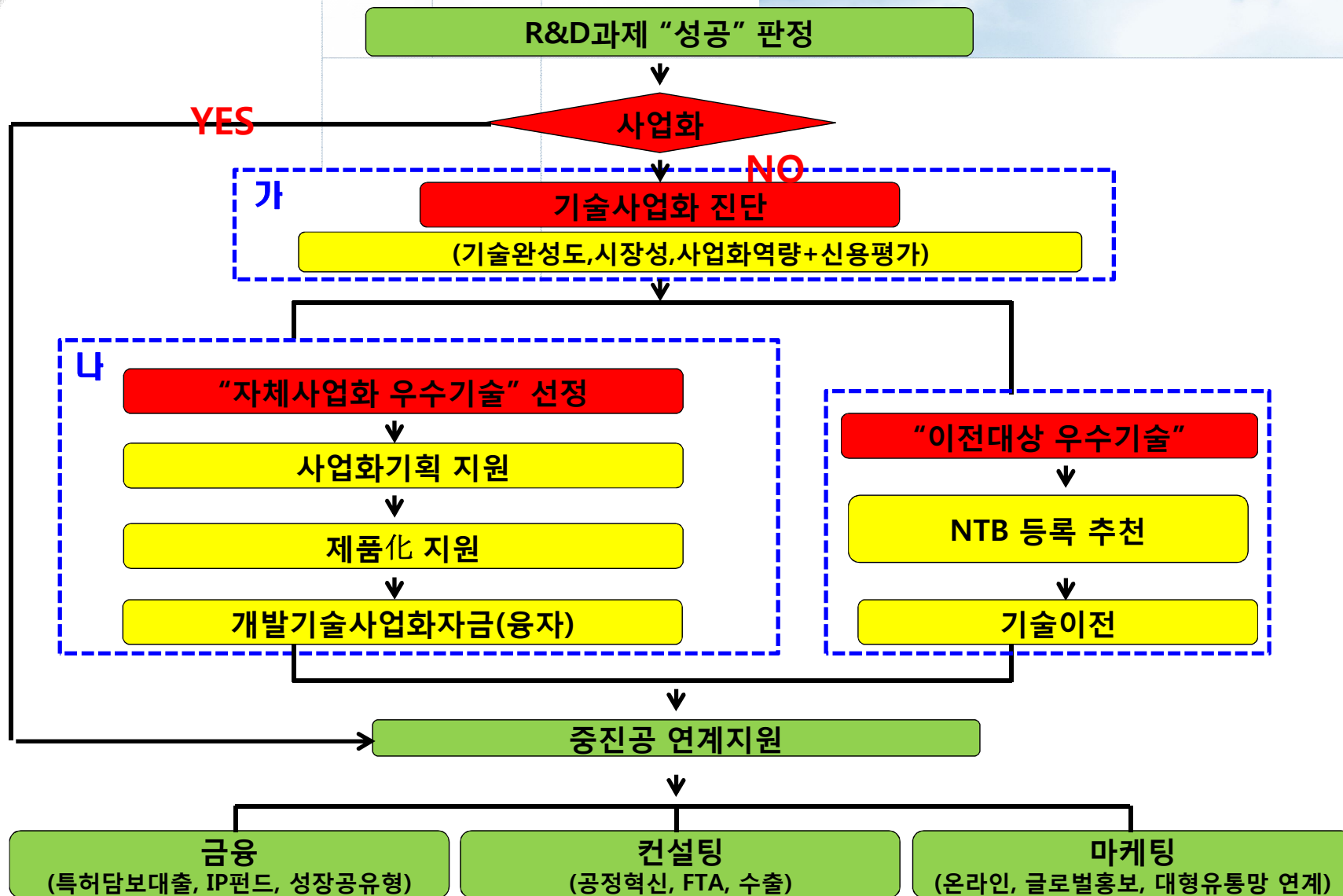
What?  
사업화지원

1. 제품화
2. 상품화
3. 양산화





# Structure & Process



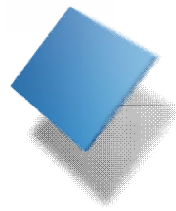




# Details

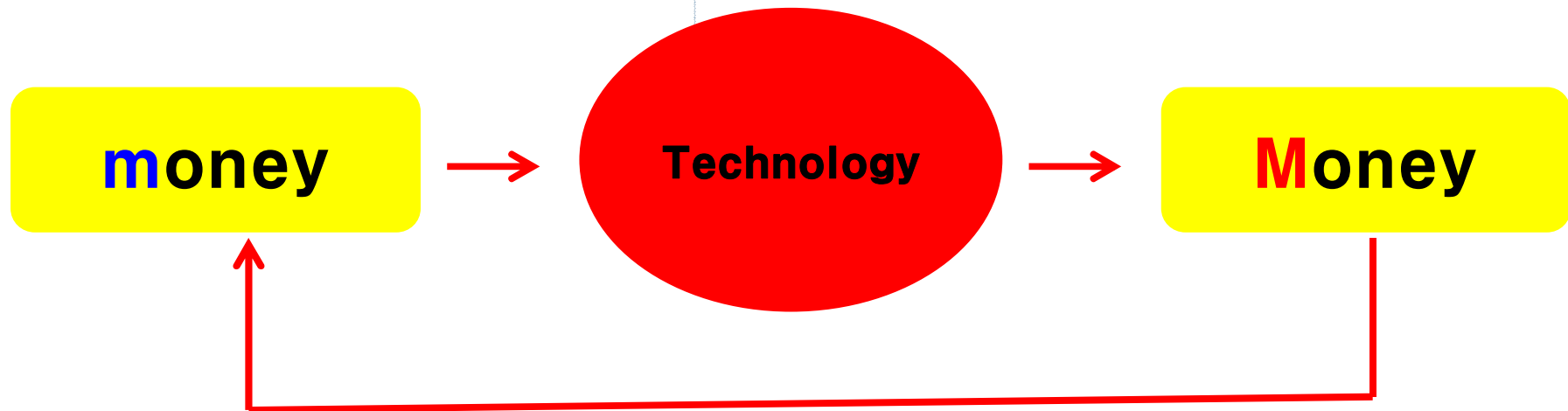
구 분	사 용 용 도
제품화	<ul style="list-style-type: none"> <li>▪(평가) 시제품의 성능평가, 품질평가, 신뢰성평가</li> <li>▪(인증) 시제품의 인증 (국내, 해외), 공인인증기관 성적서 발급</li> <li>▪(컨설팅) 공정개선, 양산적용, 품질개선에 필요한 기술컨설팅</li> <li>▪(제작) 시제품 디자인개발, 출시제품(고객요구제품)</li> </ul>
상품화	<ul style="list-style-type: none"> <li>▪(홍보자료제작) 상품디자인, CI/BI개발, 영문 디렉토리</li> <li>▪(홍보) 홈페이지, 모바일, 검색엔진 등 지원, 온라인 쇼핑몰 판매대행</li> <li>▪(교육) 마케팅코칭(유통망진출, 디자인향상), 글로벌마케팅 교육</li> <li>▪(글로벌) 해외 대형 유통망 연계지원, 글로벌 바이어 구매알선</li> </ul>
양산화	<ul style="list-style-type: none"> <li>▪(시설자금) 금형제작, 생산설비, 시험검사, 장비도입 등</li> <li>▪(운전자금) 원자재구입, 시장개척비, 인건비 등</li> </ul>





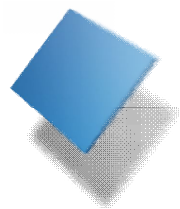
## Outcome

mTM 선순환 구조  
(Always, **m**oney < **M**oney)



기술사업화 선순환 생태계 구조  
→ “창조경제” 활성화



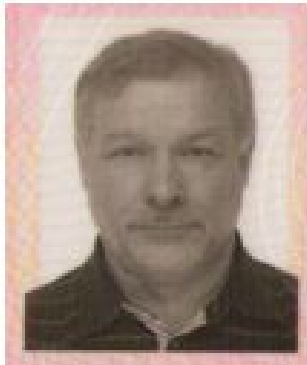


# Schedule

	2015 1月	2015 2月	2015 3月	2015 4月	2015 5月	2015 6月
사업홍보	● →					
사업광고		● →				
사업접수			● →			
진단 및 평가			● →			
사업화 지원					● →	



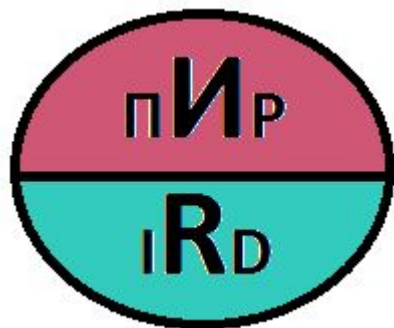
**Dr. Oleg Olshansky.**



(주)피아이알 대표이사.

- (주) 솔라테크널러지사 기술이사.
- 現 인포데이트사 공동창업자 겸 대표이사.
- EU 기술협력 파트너업체.
  - \* 기업협회 (SRO) Linteh CZ -- 태양광 설비 공급
  - \* 기업협회 (SRO) Kriner & SRO B64
  - \* 태양광 에너지 프로젝트 파트너 및 기업의 기술/공학 서비스 제공
  - \* Montech GMBH (독일) and PIR (RF) 측정기구 및 디자인 협업





# **“INDUSTRIAL RESEARCH and DEVELOPMENT” LLC**

Russia, Volgograd, Myasnikov str. 41

Tel: 8-(844)2-707040, 740652 fax: 8-(844)2-38-11-12

<http://pir34.ru/tom-3000/tom-3000> e-mail: [pir34@mail.ru](mailto:pir34@mail.ru)

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## **«TOM-3000»**

### **Ozone Testing in the Rubber Industry**

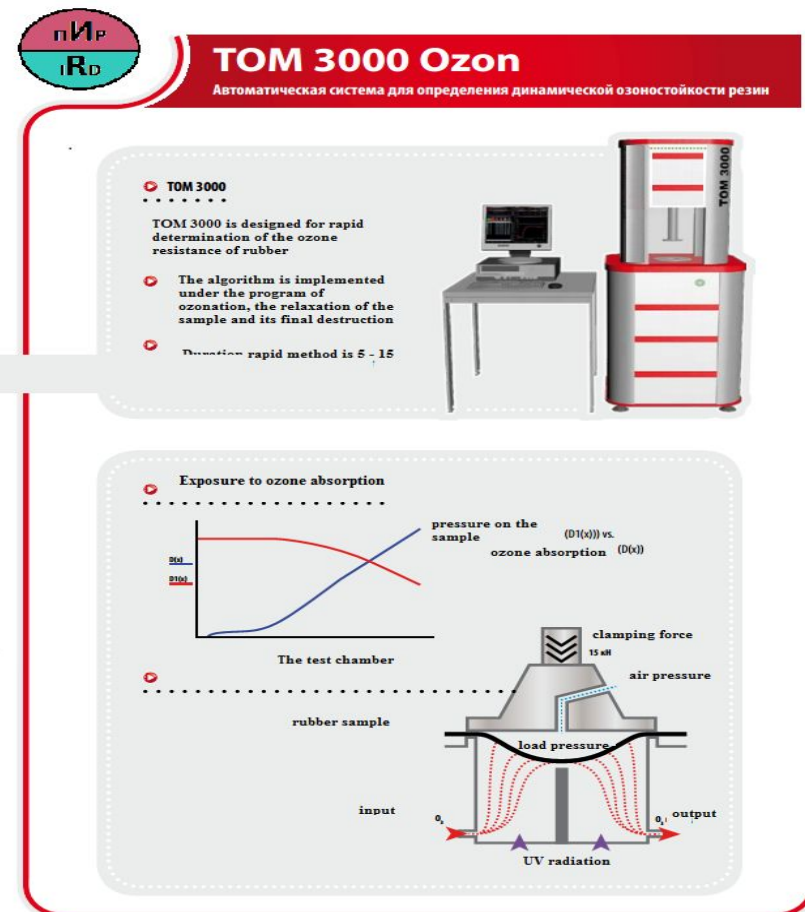
**Method and Equipment for express-estimation of ozone-resisting of reinforced and not reinforced vulcanizates in flatly strained state, under UV-irradiation and without it.**

**Equipment for determination of effectiveness of stabilizers and antiozonants for elastomeric compositions.**



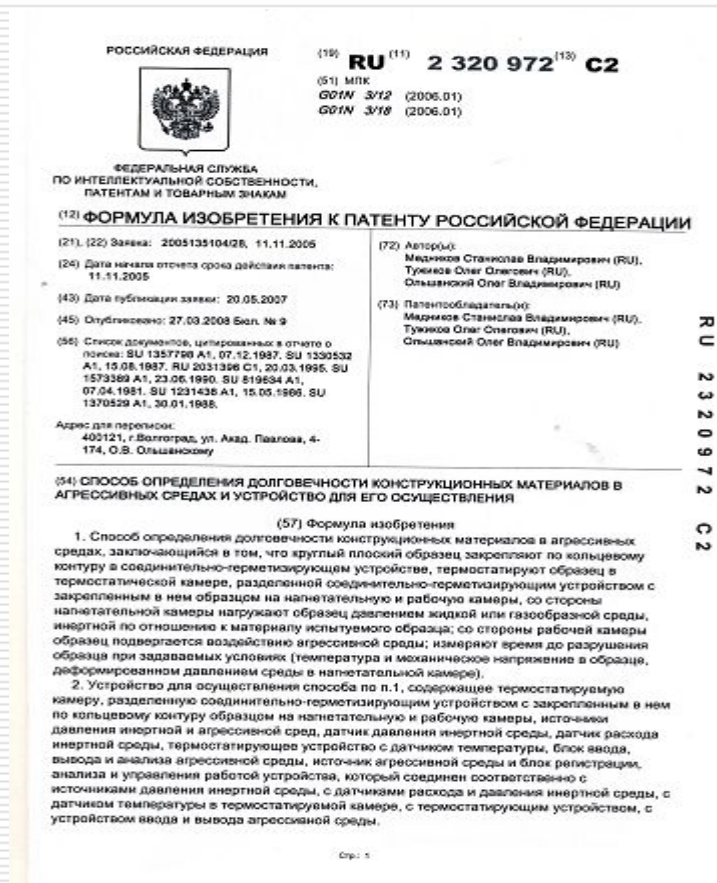
# Main advantages of «TOM-3000»

- ❑ Express-estimation of ozone-resisting of reinforced and not reinforced vulcanizates under different **biaxial** flatly strained state.
- ❑ Proximate analysis of ozone-resisting **under UV** irradiation and without it.
- ❑ Express determination of the standard description of material –Young's modulus;
- ❑ Tearing test under condition of flatly strained state;
- ❑ All listed kinds of tests under simultaneous action of different aggressive factors (electromagnetic and other penetrating irradiations; liquid, gaseous and dusty oxidants);
- ❑ Possibility of execution of all listed kinds of tests under different temperatures, both constant, and varying under a law adjusted beforehand;
- ❑ Scientifically justified mathematical instrument of processing of obtained results allows to determine range of additional indexes of ozone-resisting, including constants of speeds of processes, passing under ozone destruction of rubbers.





# Method and Equipment for express-estimation of ozone-resisting of reinforced and not reinforced vulcanizates in flatly strained state, under UV-irradiation and without it.





# Main technologic advantages of «TOM-3000»

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- ❑ Optimization possibility of rubber mixture by test results of samples on «TOM-3000», by input control of ingredients.
  - ❑ Research possibilities of samples of vulcanized, reinforced by cord;
  - ❑ Analysis of influence of capillary modifiers, that facilitate increase of operating characteristics, influence of preliminary effects on vulcanized;
  - ❑ Equipment is fully automatized;
  - ❑ It allows to keep tests results both in electronic and documental forms of test reports, that could be included to the history of making product process.
-



# General methodology of elastomers tests

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- ❑ **Disadvantage** – generally tests are making under **monoaxial strained state**, while during exploitation in elastomers generally **biaxial states** works
- ❑ **Equipment «TOM-3000» tests rubber samples under **biaxial** flat strained state**



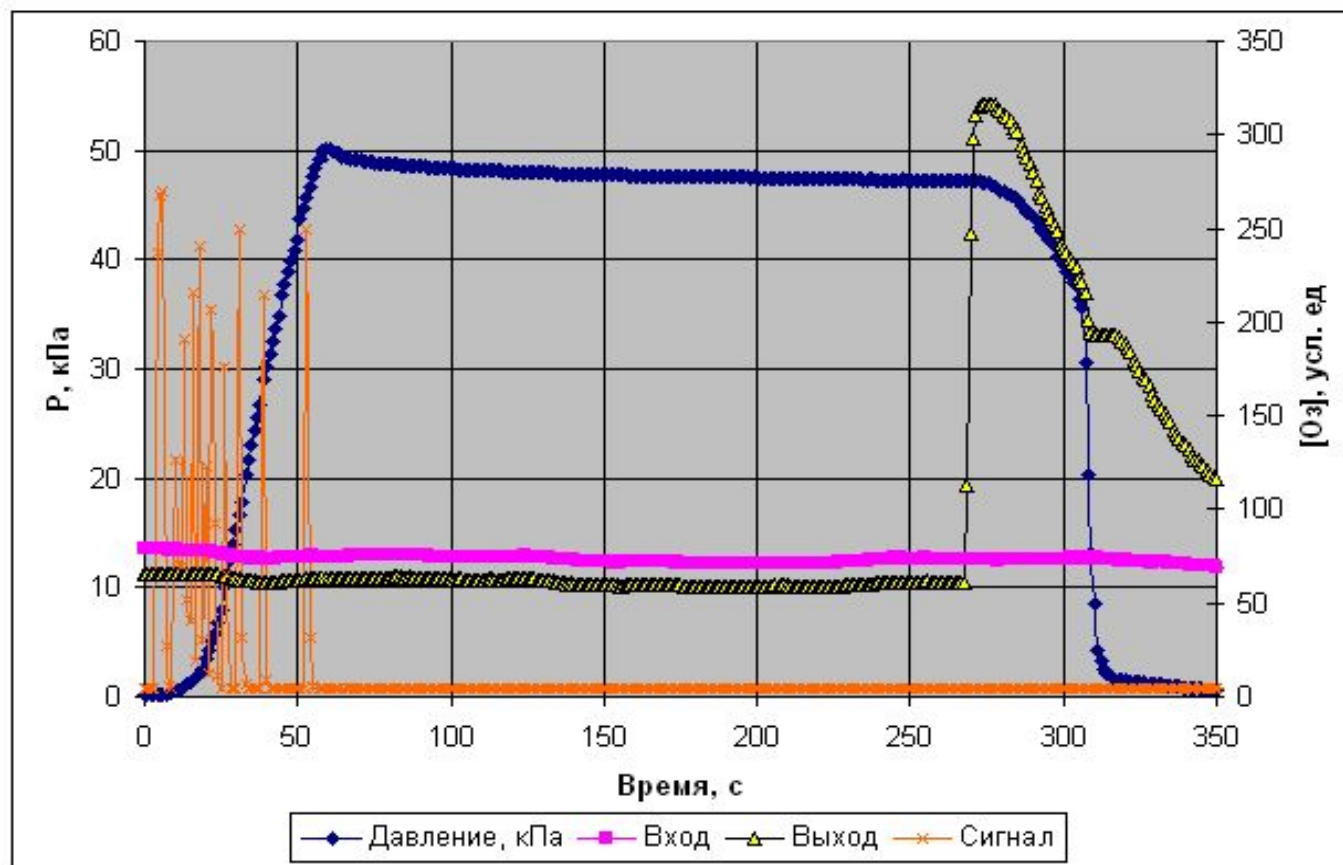


# Essence and disadvantages of test methods of ozone-resistance with GOST, ISO

- ❑ Time determination before formation of first break with existent **GOST and ISO** – is 100% subjective factor
- ❑ Time determination before first break of sample with existent **GOST and ISO** – does not allow to register vulcanizate's characteristic behavior during tests
- ❑ Hardware-controlled tools registering test results are absent on existent equipment for tests with active **GOST and ISO**.
- ❑ **Full process automation of test on the equipment «TOM-3000» and scientifically justified mathematical unit of processing received results allow to register test process and determine all necessary indexes of active GOST and ISO, and also to find row of additional characteristics of ozone-resistance of composite materials (including reinforced), such as processes speed constants, leading under ozone destruction of rubbers , composite destruction speed and others.**



# Equipment's result of research





# Using equipment's results you can find:

---

1. Young's modulus for composite material
2. Physical relaxation strain material time
3. Time before formation of first breaks in material
4. Absorbed ozone quantity before formation of first breaks (index for durability calculation)
5. Material durability under ozone action
6. Dependence of strain changing in sample on absorbed ozone quantity (dynamics of sample's destruction)
7. Absorbed ozone quantity during sample's destruction
8. Time before destruction
9. Time of destruction
10. Process speed constant
11. Sample's destruction speed
12. Critical index of material





# Not reinforced samples after tests

---



50

51

52

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# Reinforced samples after tests

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50



51



52

Условия озонирования:  $P_{\text{исп}} = 50 \text{ кПа}$ ,  $Q = 18 \text{ л/ч}$ ,  $[O_3] = 12 \text{ мг/л}$

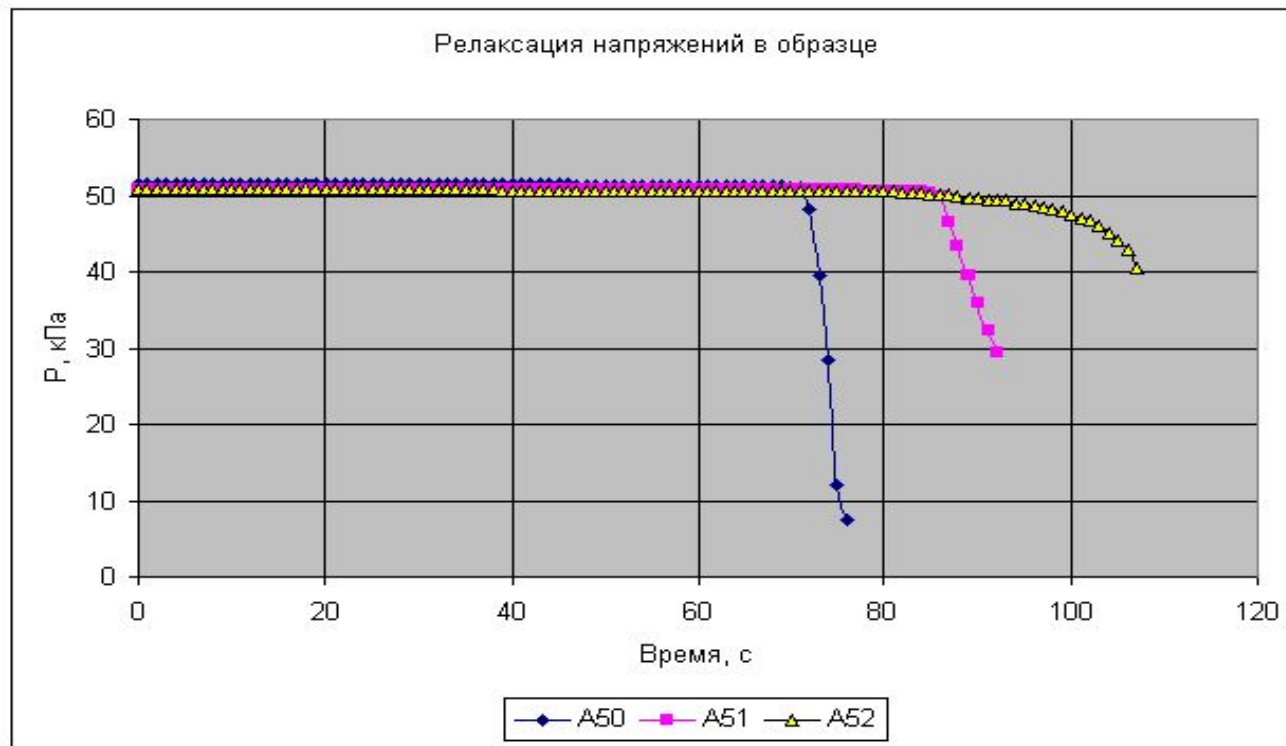
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Terms of ozonated:  $P = 50 \text{ KPa}$ ,  $Q = 18 \text{ L/h}$ ,  $O_3 = 12 \text{ mg/l}$ .



# Chemical relaxation of strains under ozone action

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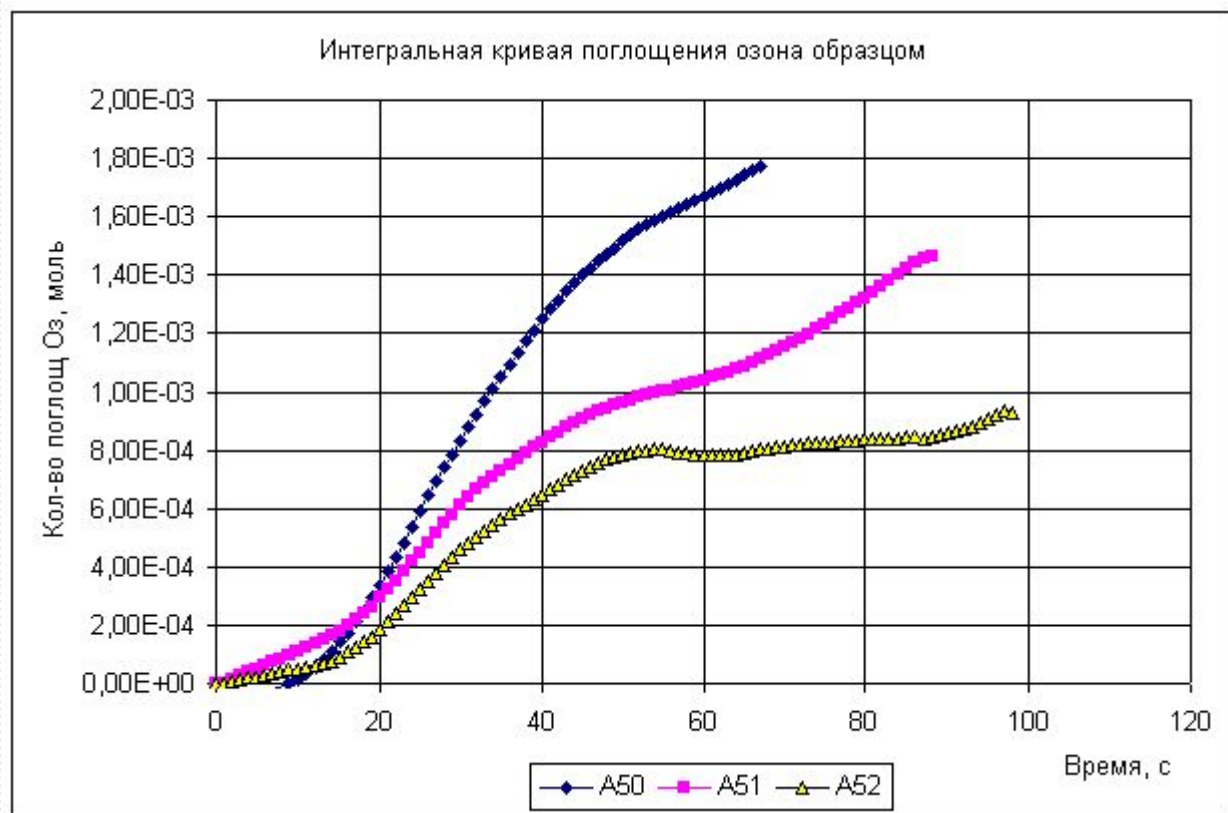
Stress relaxation in the sample

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# Absorbed ozone quantity

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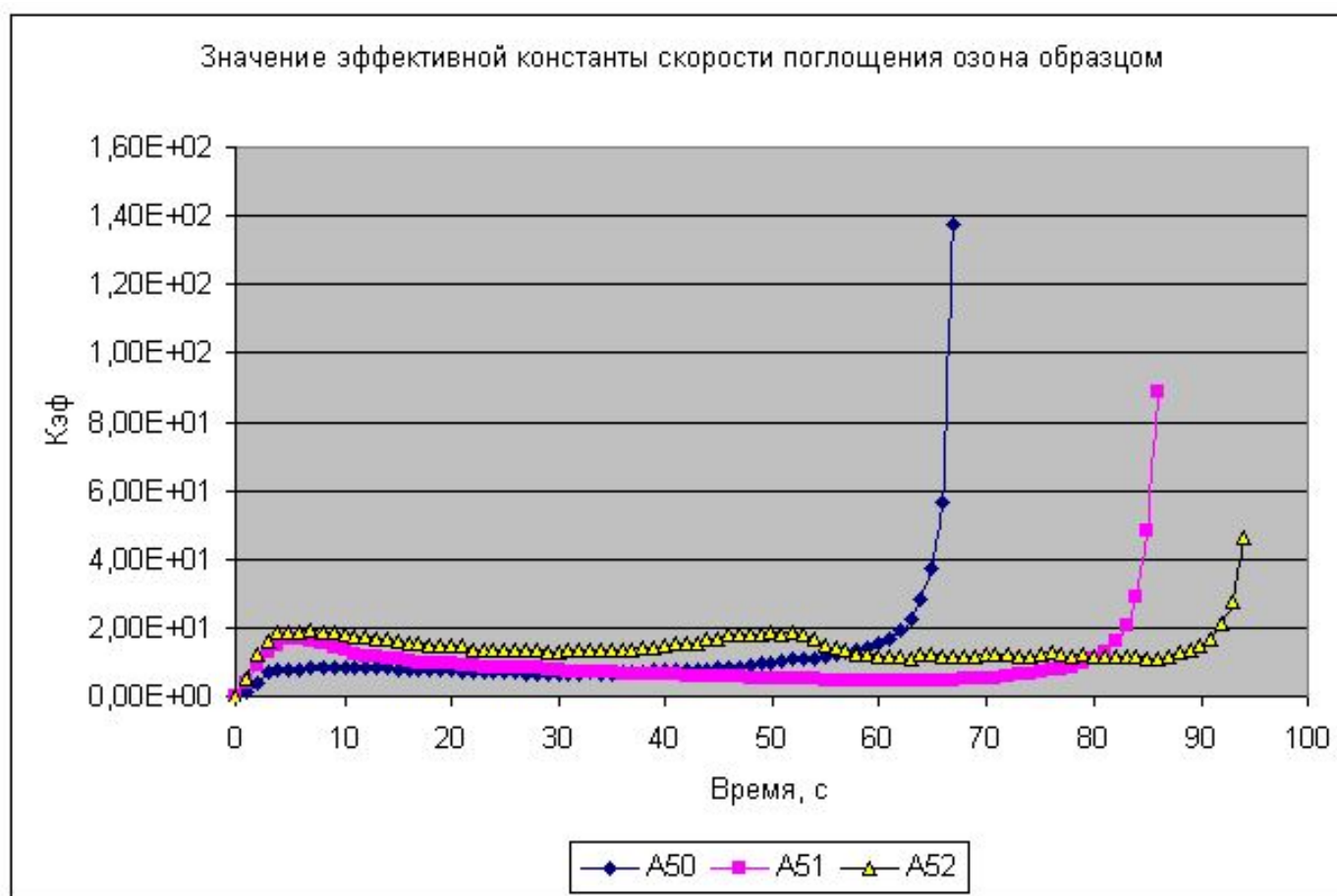


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Integral curve of the ozone absorption model

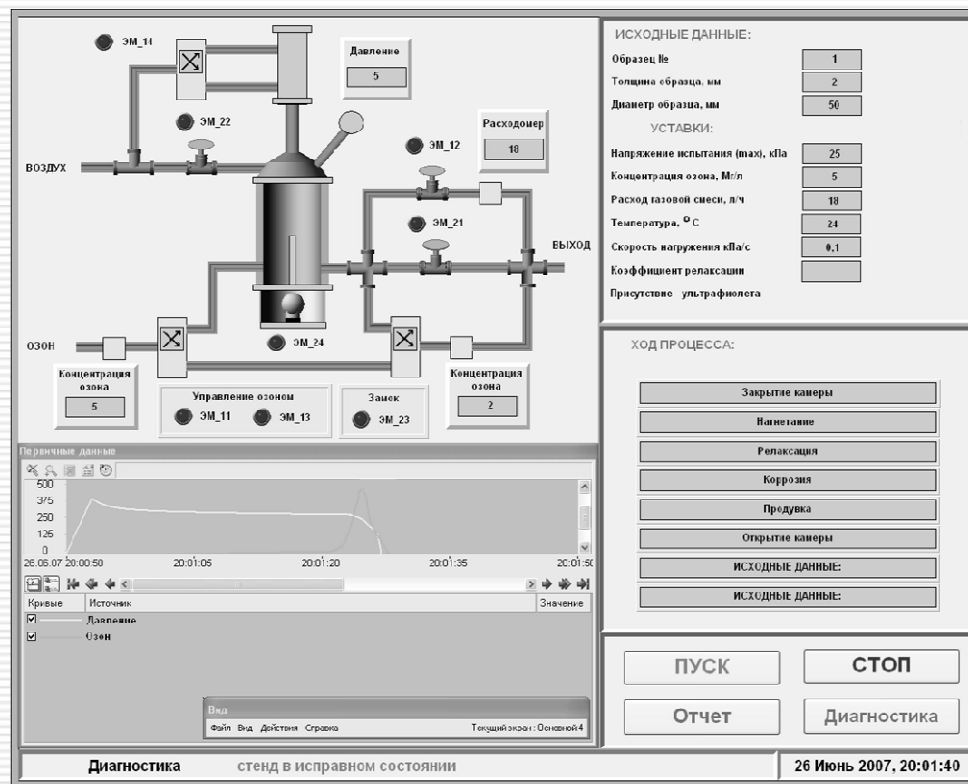


# Effective speed constants during tests





# Main view of equipment and main screen of special soft





# «Industrial researches and engineering» ltd. co

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Main company's directions of activity are:

- Engineering, designing and manufacturing of new research equipment for rubber composites tests, and also characteristics of ingredients for polymeric compounds;
  - Engineering additional technological equipment;
  - Researches of inside isolation tank equipment, working with aggressive agents.
-



# Our partners

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- ***Volgograd state technical university***  
departments:



- **Base and inorganic chemistry,**
- **Technology of high molecular and fibrous materials**
- **Chemical and technology of processing of elastomeric materials**

- ***"ContrAvt" Ltd., Nizhniy Novgorod***



- ***"Elemer" Ltd., Moscow***





# “INDUSTRIAL RESEARCH and DEVELOPMENT” LLC

---

- **Oleg O. Tuzhikov,**  
Mobile phone: +7-927-254-45-81  
d.ph., docent, VSTU  
General director

- **Stanislav V. Mednikov,**  
d.ph., docent, VSTU  
Technical director

- **Oleg V. Olshansky,**  
Mo,ile phone +79023644841  
main scientist  
Co-Director. Head Department of Commercialization R&D

□



**Address: Russia, Volgograd, Myasnikov str. 41**

**Tel: 8-(844)2-707040, fax: 8-(844)2-38-11-12**

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**http://pir34.ru e-mail: pir34@mail.ru**



Dr. Leonid Chechurin.



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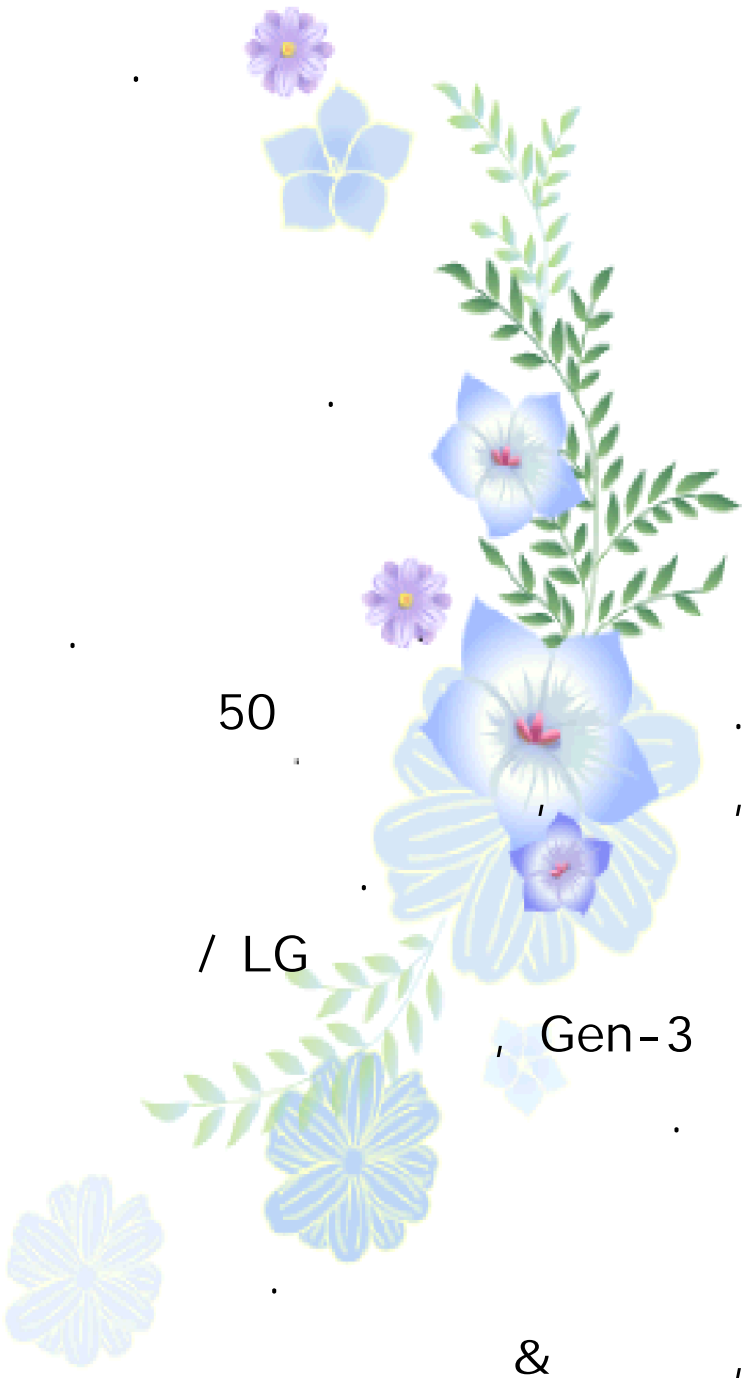
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CAD/CAM/CAE,  
(TRIZ ).





# Key Product Design Technologies: Big Data Search, TRIZ, Physics, CAD

Leonid S. Chechurin

St.Petersburg State Polytechnical University (Russia),  
Principal Researcher

Lappeenranta University of Technology (Finland), Professor

**KOREA-RUSSIA Industrial Hi-Tech Forum 2014**  
**Seoul. Nov 11, 2014**



# St.Petersburg State Polytechnical University

[www.spbstu.ru](http://www.spbstu.ru)



20.000 students

2000 professors, instructors and researchers

3 Nobel Prize Winners (physics), one is acting

Points of excellence

1. Engineering, esp. machine-building, construction
2. Computer Science (coding, algorithms)
3. Physics and Chemistry (Solid state, radio, material science)

# Lappeenranta University of Technology

[www.lut.fi](http://www.lut.fi)



7.000 students

1000 professors, instructors and researchers

One of 300 world best universities in THE ranking

Points of excellence

1. Business, Management
2. Energy, Environment
3. Product Design

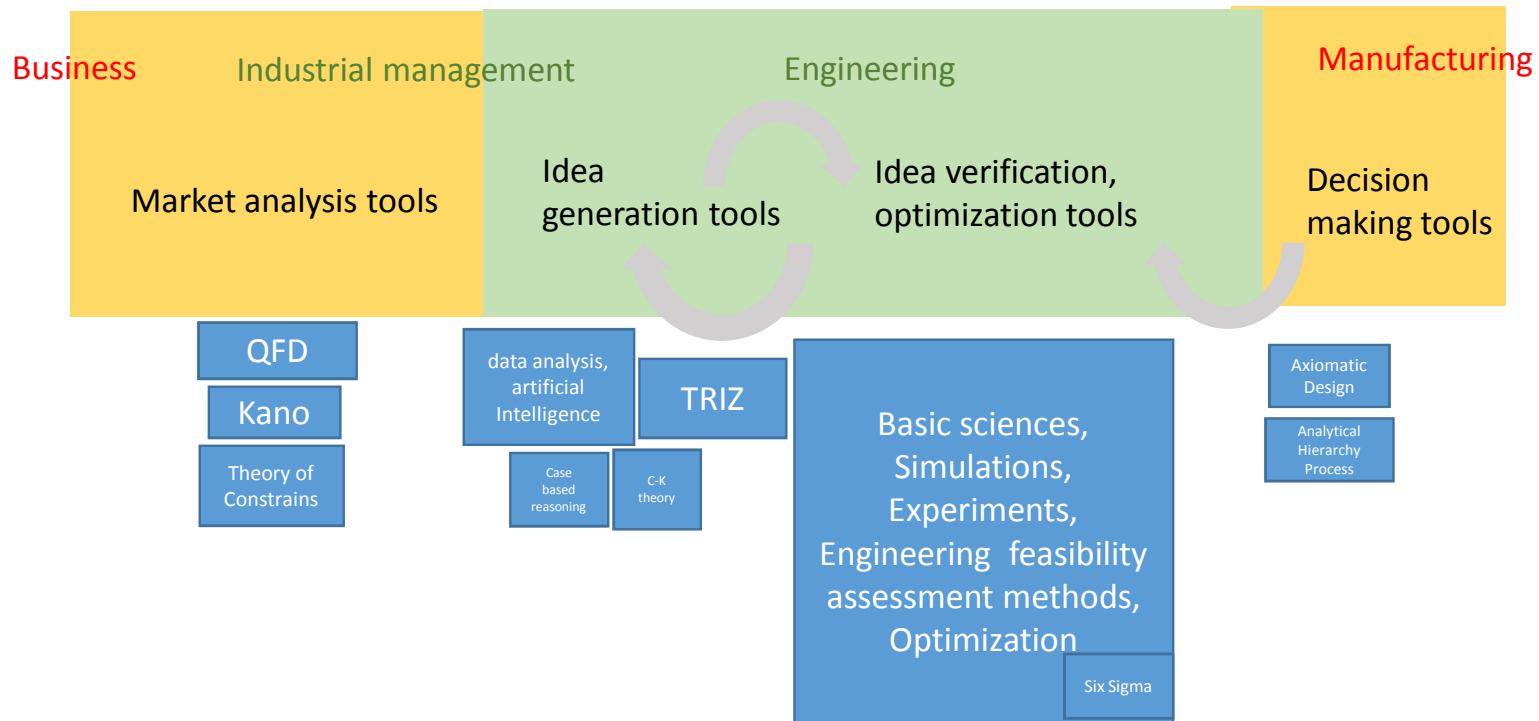


# Leonid.Chechurin@lut.fi

- 1993      *Graduated from Physics and Mechanics Dept. of SPbSPU*
- 1997, 2010      *PhD, Doctor of Science degrees in System Theory at SPbSPU*
- 1998-1999      *invited Professor at Kum-Oh National University of Technology, South Korea*
- 1999-2001      *TRIZ consultant at Samsung Monitor Company (Seoul, South Korea)*
- 2001 – 2012      *Head of Innovatics Theory Dept. of SPbSPU*
- 2005 – 2006      **Engineer** for Design Engineering Group at **LG Electronics** Production Engineering Research Institute (Osan, South Korea)
- 2007- 2011      **TRIZ consultant** at Algorithm (**Gen3 Partners, Inc.**) company (supplier for GE, Siemens, Wrigley, BAT, MC,...), part-time
- 2011 Sept-Nov      *Research Fellowship at Politecnico di Milano (Italy)*
- 2012 – 2014      **Principal Engineer for Samsung Electronics** (South Korea)
- 2014      *Principal Researcher for SPbSPU and Professor at Lappeenranta University of Technology*



# Product Design Roadmap



...and its popular Instruments



# Product Design Roadmap and Key bottlenecks

New  
product/  
technology  
request



1. How to search for information/ideas  
(better than by keywords)? – Big Data, Semantic Search (20%)
2. How to generate new ideas? – TRIZ, DFX, Axiomatic Design (10%)
3. How to prove that the new idea works? – Physics+CAD/CAM/CAE (70%)



# 1. Searching better Idea Search

## Questions of data gathering:

- Bring me all patents (papers, info...) on the subject of the problem
- Remove all the noise

## Simple questions of technology intelligence:

- Who (else) is working on the problem?
- What the competitors are doing?
- Who is the most active developer in the field?
- Who is cooperating with whom? What are project teams?

These and other questions can be answered by patent landscaping methodology

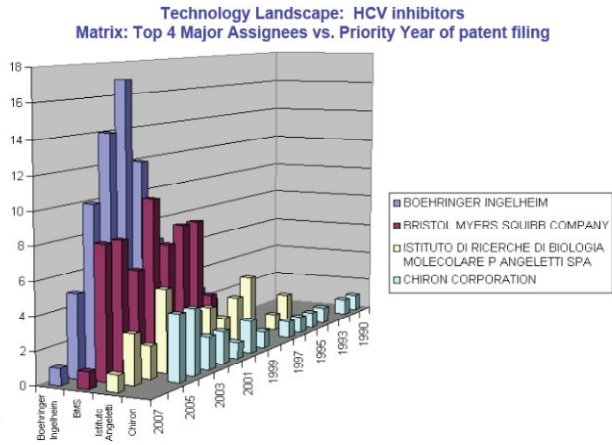
## Hard questions of technology intelligence:

- Extract the concepts out of the texts
- Cluster the information pool according to (concepts...)
- Find *similar* technology
- Generate *new idea*, hypothesis, axiom...

Some of these questions can be answered by semantic text analysis algorithms

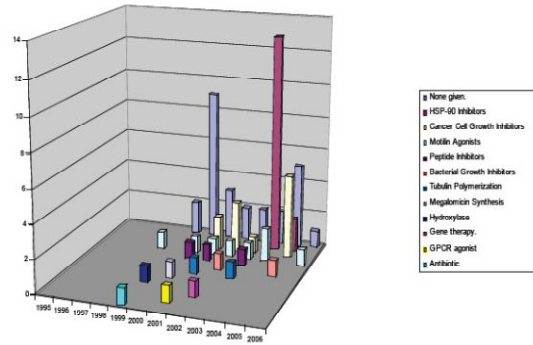


# Patent Landscaping: Example



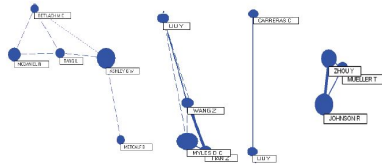
**What research has Kosan done recently and what may they have abandoned?**

### Mechanism of Action vs Priority Year

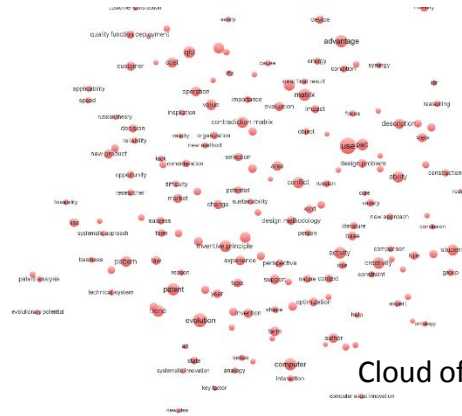


## Competitor Patents Landscape

### What are Kosan's research teams? Inventor Auto-Correlation Map

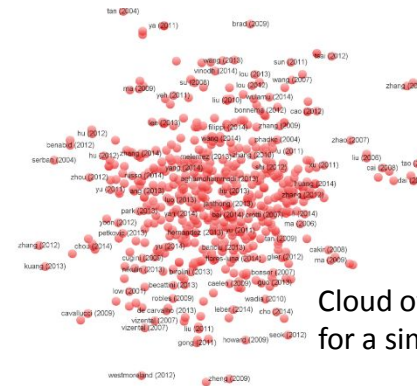


**What are the key concepts clusters for the problem? Patent (paper) clustering: TITLE-ABSTRACT key term extraction**



Cloud of words stay for a concept

## What patents are similar? Patent (paper) clustering: bibliography similarity test



Cloud of patents stay  
for a similar background



# Commercially available tools for automated patent/paper text processing [ref]

**Group 1** can work on the unstructured text:

- ClearForest
- Goldfire InnovatorTM
- Inxight
- OmniViz
- TEMIS

**Group 2** can work on structured text only:

- QuosaTM
- RefVizTM
- STNAnaVistTM
- VantagePoint
- Thomson Data Analyzer

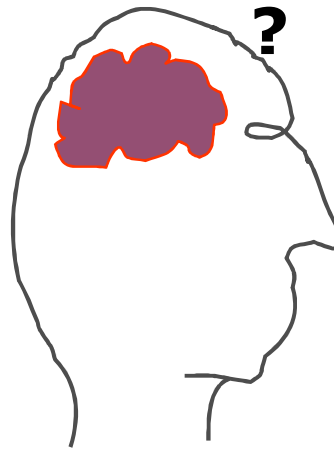
**Group 3** can work on patents only or partially structured text (“hybrid”) data:

- Aureka
- M-CAM DoorsTM
- Wisdomain
- PatAnalystTM

[ref] «Text mining and visualization tools – Impressions of emerging capabilities». YunYun Yang et al. *World Patent Information* 30 (2008) 280–293



# 1. Searching better Idea Search



Problem



**FIND:**

How to stabilize gondola swings?

**146842** Document(s) found:



# Nearest Future?

Yet a (my) **DREAM**: semantic idea search



**FIND:**

How to stabilize gondola swings?

5 idea(s) found:

Results :

By gyroscopic forces (4 patents, 5 papers)

By feedback control

passive feedback (5 patents, 3 papers)

by anti-resonance phenomena (chapter from a book)

by dynamic damping (3 patents 2 papers)

active feedback (20 patents, 40 papers)

By parametric stabilizing (1 paper, 2 patents)

*From IDEA SEARCH to IDEA GENERATION*



## 2. Tools for Conceptual Design (Ideation)

### **TRIZ**, the Theory for Inventive Problem Solving

Axiomatic Design

Design for Manufacturing and Assembly

Design for Robustness

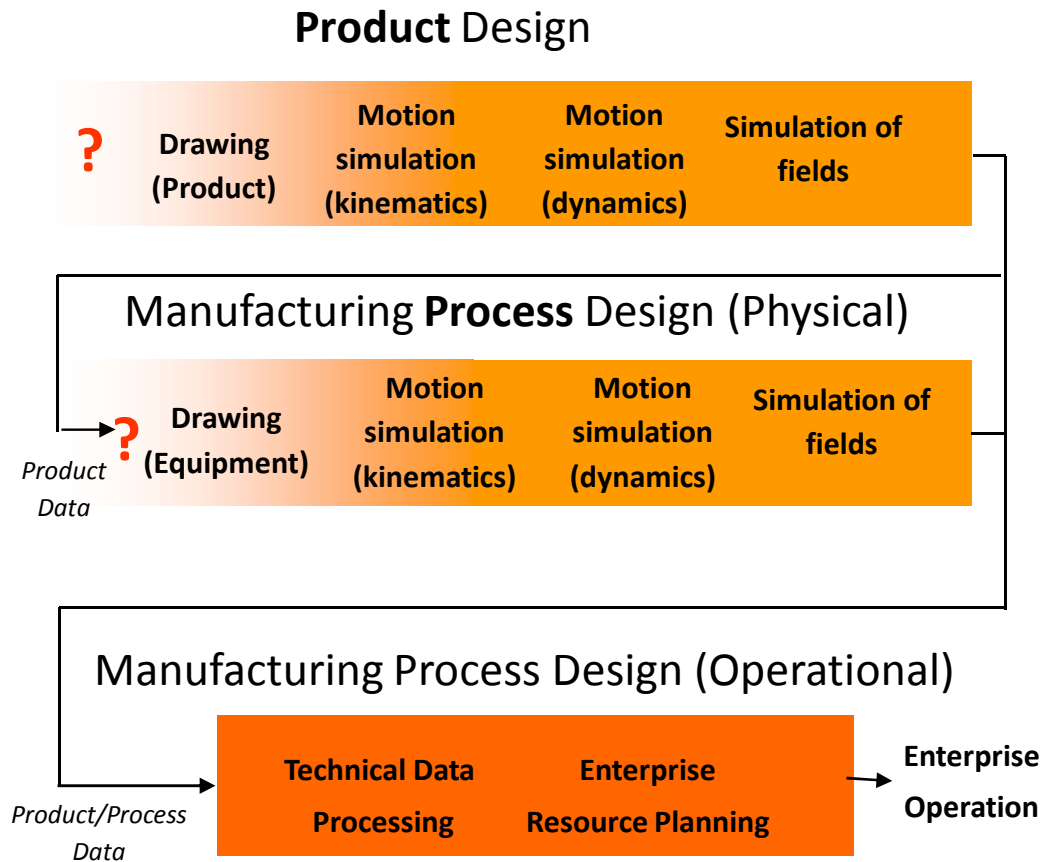
Design for Environment

Morphology based design, Topology optimization and Evolutionary Design Algorithms

Artificial intelligence methods based on data processing (literature-based discovery)



# 3. Physics and CAD/CAM/CAE



## Some of computer-aided technologies

Computer-aided architectural design (CAAD)

Computer-aided design and drafting (CADD)

Computer-aided industrial design (**CAD**)

Computer-aided engineering (**CAE**);

Computer-aided manufacturing capability (CAMC);

Computer-aided manufacturing (**CAM**);

Computer-aided material information (CAMI);

Computer-aided package selection (CAPS);

Computer-aided process planning (CAPP)

Computer-aided software engineering (CASE);

Component information system (CIS);

Coordinate measurement (CMM);

Electronic design automation (EDA);

Enterprise resource planning (**ERP**);

Manufacturing Process Management (MPM)

Manufacturing process planning (MPP);

Manufacturing resource planning (MRP);

Product data management (**PDM**)

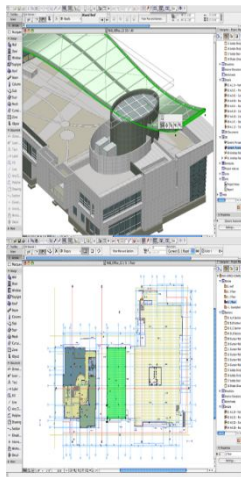
Product lifecycle management (PLM)

Reverse engineering (RE)

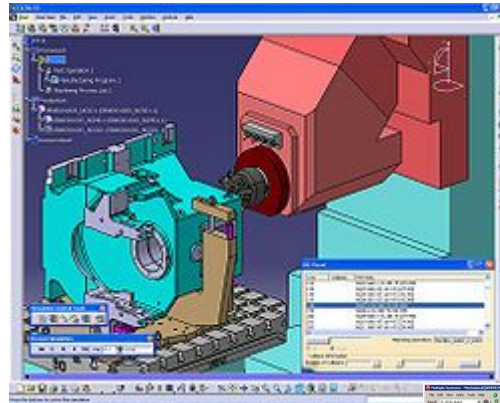


# Computer Aided Design for Architectural, Engineering and Construction

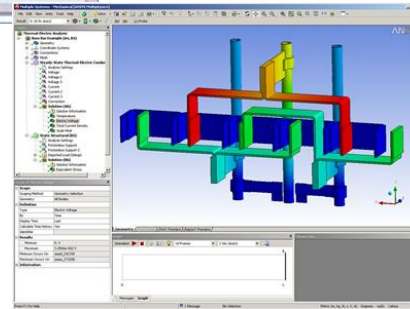
AutoCAD



SolidWorks



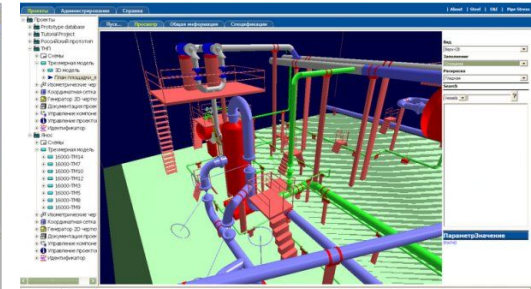
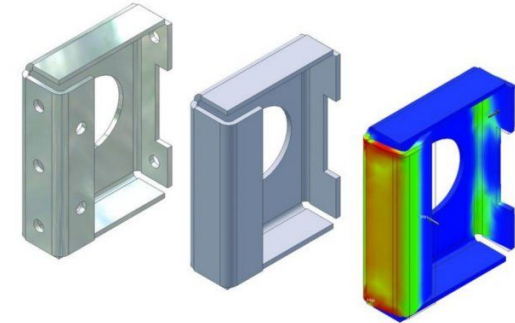
CATIA



ANSYS



Compass  
(integrated to SolidWorks)



Drawings, 3D models, Component databases, Component parameterization, Integration with manufacturing tools (CAM) (e.g. control code generation for the machine or 3D printer), «product tree» etc.)

Simulation of kinematics and dynamics of the product and its manufacturing process. Virtual manufacturing.



# Case Study 1: SPbSPU-에너지진(주) cooperation

<http://www.energyn.com/>



## Wind Turbine and Artificial Diamond Process Preliminary Study Agreement

This agreement, made 2012/04/12 by and between SPbSPU (referred as University hereafter) located at 29, Polytechnicheskaya street Saint-Petersburg 195251, Russia and ENERGYN Inc. (referred as Company hereafter) located at 145B 9L, 714-4 Gojang dong, Nam dong Gu, Incheon, Korea....



# Cross-section shape optimization and expected power evaluation



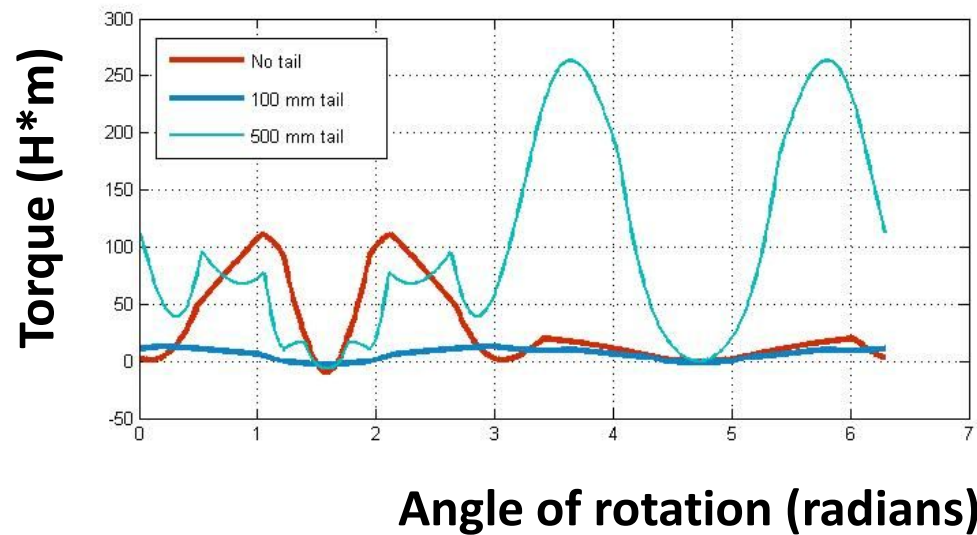
**0 tail**



**100 tail**



**500 tail**



## Outputs:

1. Tail length optimization
2. Angle optimization
3. Evaluation of torque for various wind speeds

## Resources

1 post-graduate student +  
ANSYS



## Case Study 2. Example of Conceptual Design + Engineering

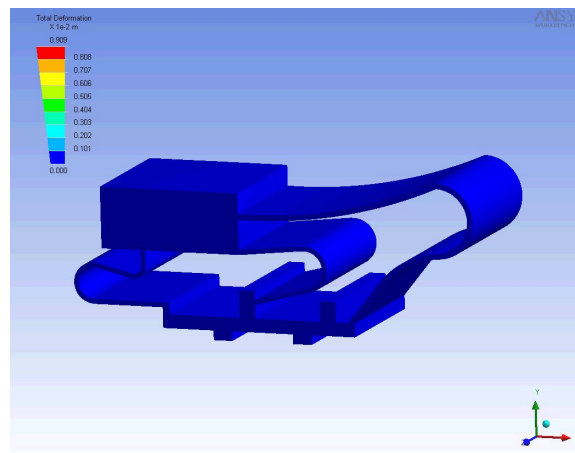
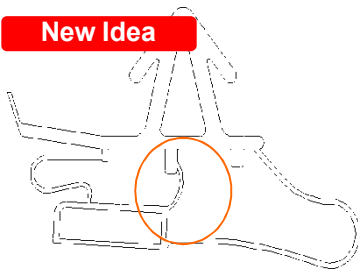
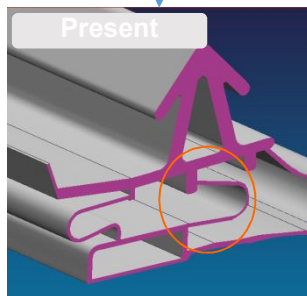




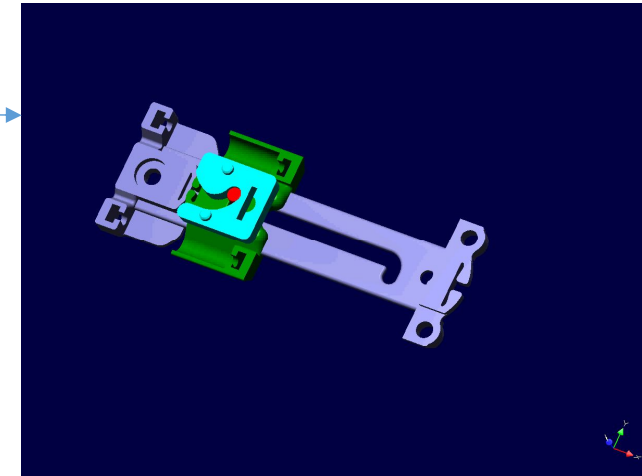
## TRIZ Contradiction Analysis

### Rail Slider Spring and Sealing

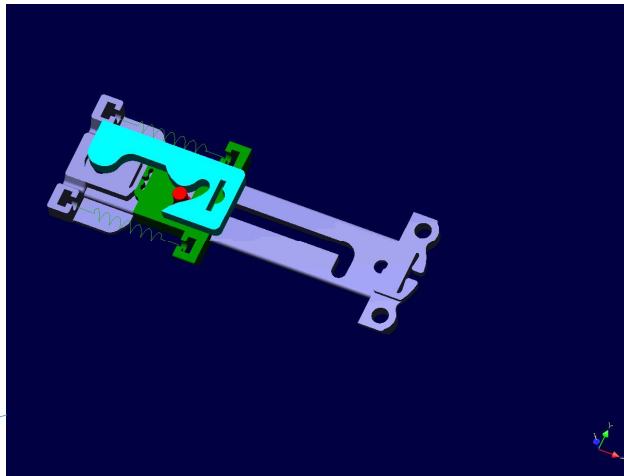
- *should be strong* to prove complete closing
- *should be weak* to open door easily



Present



New Idea



About 30% opening force reduction



# Conclusions



Possible product design elements to be outsourced from Russia



1. **Information** (patent, scientific papers, networking) **search**, analysis
2. **TRIZ** and other conceptual design tools
3. **Physics, Material Science**, Product visualization and simulation, **CAD/CAM/CAE**, Detail Design.



## With whom to co-operate?

1. Individual researchers (from post-grad to professor level)
2. Labs and Departments at SPbSPU or LUT
3. Spin-off companies and start-ups at university's business incubator
4. ....Your suggestion?

## How to cooperate?

1. Master Degree/PhD thesis on the subject of interest for Korean partner.
2. Short research visit/on spot practical placements/training of Russian or Korean representatives in Korea or Russia.

*Example: **Winter and Summer Schools for TRIZ** at Lappeenranta University or SPbSPU.*

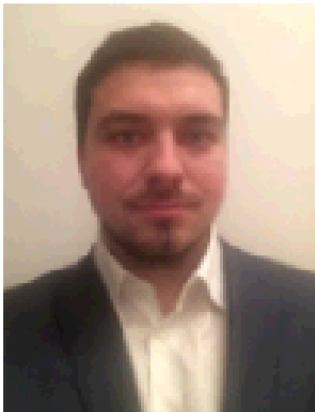
3. Join proposal on R&D for financing from Russian and Korean authorities.

*Example: Urgent call for proposals from Russian Federal Targeted Programme for joint Research. Subject: **Nanostructured coatings of ordered arrays of metallic and dielectric nanoantennas for more efficient solar panel**. Amount: **200.000USD** from Russian side in case of equal financing from Korean side. Deadline: **20 NOV 2014**.*

4. ...Your suggestion?



Dr. German Andreev.



"Eurotex Russia" R&D .

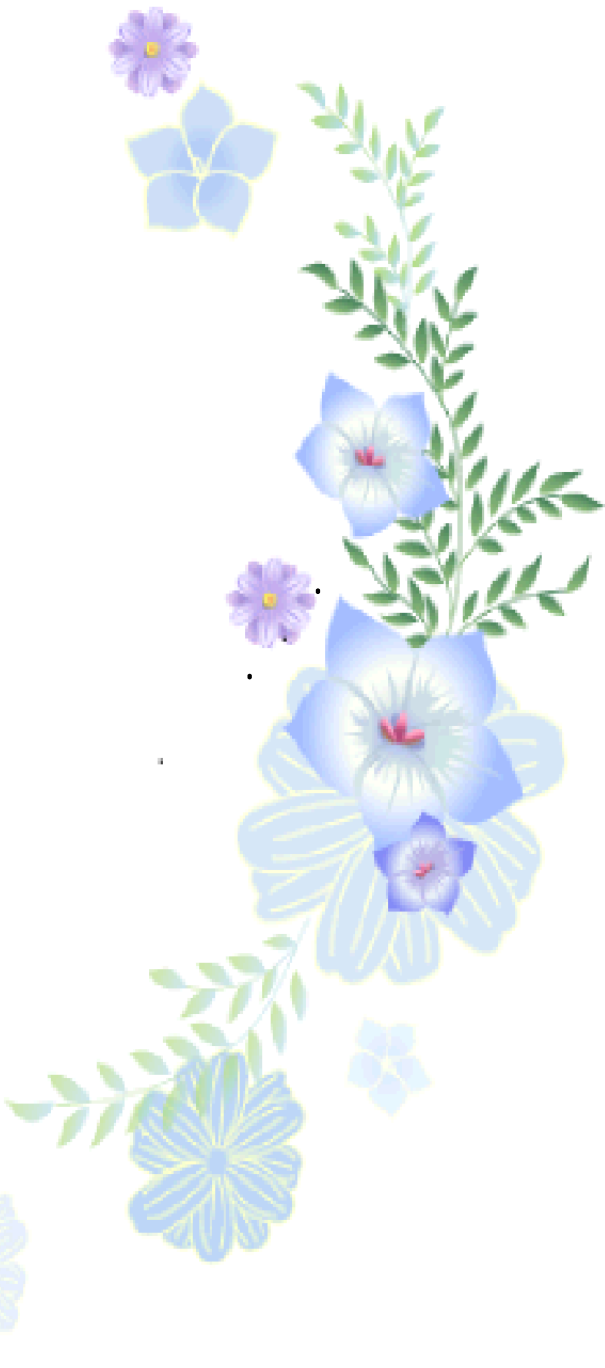
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" & "

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# *Applying Practice of Electro-Sorption Equipment*

## **WATER ELECTROCONDITIONERS “CASCADE”®**

191007, Saint-Petersburg,  
Marata str. 43, office.1,  
tel/fax: +7 (812) 717 94 04  
E-mail: 412spb@gmail.com



**Now revitalized water is accessible not only for  
heroes of fairy tales,  
but also for a large number of users of  
decentralized water supply systems, constructed on  
the basis of electroconditioners "CASCADE" ®**

*Vitalized water ("Aqua Vitae")  
is extremely pure water with  
antioxidant properties  
due to decreased redox-potential*



# THE MAIN IDEAS OF WATER ELECTROCONDITION

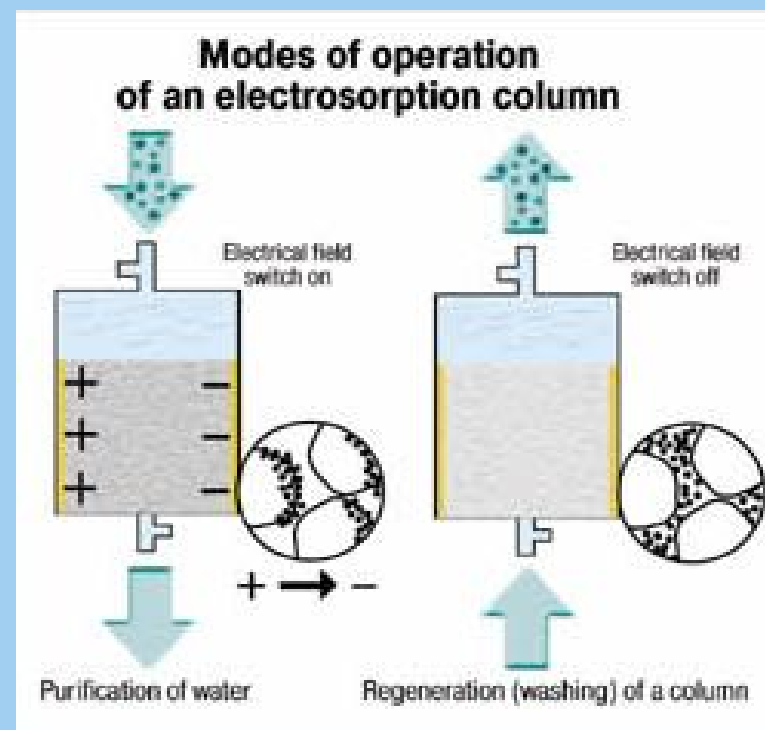
## The basic groups of the physical and chemical phenomena at electrosorption:

- 1. Electrical field and current distribution in the working chamber, which is filled with dispersion packing and purified water;*
- 2. Interaction between pollutants, which are contained in water, and materials of dispersion packing*
- 3. Interaction between electrical charges and molecules of water pollutants on electrodes and in next to electrode space*

## Ideological credo of water electrocondition with “CASCADE” devices:

Processes of cleaning should remove from water everything, that harmful and alien to a human organism (xenobiotics) and keep all that is useful not harmful. And there should not be replaceable working elements in devices.

It is provided only short-term periodic wash of sludge, which is formed in work processes, but does not worsen of treating water quality but only straiten its flux





Patented by the *EET* in 20 economically advanced countries,  
devices personify achievements of modern physics,  
chemistry, electronics and biology

---

*Devices with "electrochemical intelligence" -  
electroconditioners of water are intended  
for complex water treatment:  
revitalizing + cleaning from all kinds of pollutions  
will protect your health, sanitary and water-heating  
equipment in your house, and will create necessary  
conditions for effective work of your enterprise*



## Electroconditioners of water "Cascade" will provide:

---

- *replacement of multistage systems of the water purification which are used now, having allowed to decrease capital costs of equipment, and operational expenses counted upon unit of volume of the cleared water, at least in 2 times;*
- *purification of water from any sources, irrespective of its initial characteristics or a kind of preliminary processing, not only for water from water supply systems, but also for any fresh water from natural surface reservoirs and wells*



**As against filters of other types, electroconditioners will manage with physiologically important problems of water quality which are not being solved at usual technologies purification,**

**Namely:**

- 
- will allow to correct composition of potable water bearing in mind the majority of the normalized chemical parameters, which may be checked objectively, and the characteristics which are usually being perceived subjectively and not measured by analytical instruments;
  - will provide stability of a complex of quality characteristics of water at a level of recommended sanitary norms under various seasonal conditions, sudden emergency deterioration of a condition of water sources or pipelines;
  - will improve structural characteristics of water (due to the local electric influences), having provided higher availability of water molecules to use by cells of the most various biological tissues, i.e. the best biocompatibility of water with various organic structures; will decrease redox- potential of water and as a result its bioenergy, metabolic and immune properties will be improved as well as condition of human internal, integument, mucous membranes, joints and hair. Development of normal microflora of a human body will be stimulated and negative consequences of a disbacteriosis will be reduced



# The important advantage of “CASCADE”

---

*Electroconditioners of water  
do not pollute an environment neither in an operating  
time, nor at regeneration  
while other technologies are connected to problems of  
recycling of replaced working elements or infringements of  
ecological standards at use concentrated salts and  
frequently toxic solutions*



# Electroconditioners have different models and are capable:

---

- to guarantee purification of water from all kinds of microparticles: bacteria, viruses, the elementary organisms (together with products of their metabolism), particles of humus and minerals, oil and lubricants;
- to clear water of such toxic mineral and organic components as ions of heavy metals, phosphates, sulfides, nitrites, cyanide mercaptans, phenols, toluene, unhealthy anions and cations);
- to provide individual and shared swimming pools with turnaround water of the highest quality in which there are no such toxic and allergenic components as compounds of chlorine, ozone, peroxide of hydrogen, and also coagulants and flocculants повышенный - the water having more high cleanliness and regenerative ability



**Pledge of long effective work of devices  
is the opportunity  
of periodic regeneration of their fillings  
and electrode systems**

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**Electroconditioners “CASCADE”® only are  
able to ensure cleaning of  
hot water  
from many various impurities**



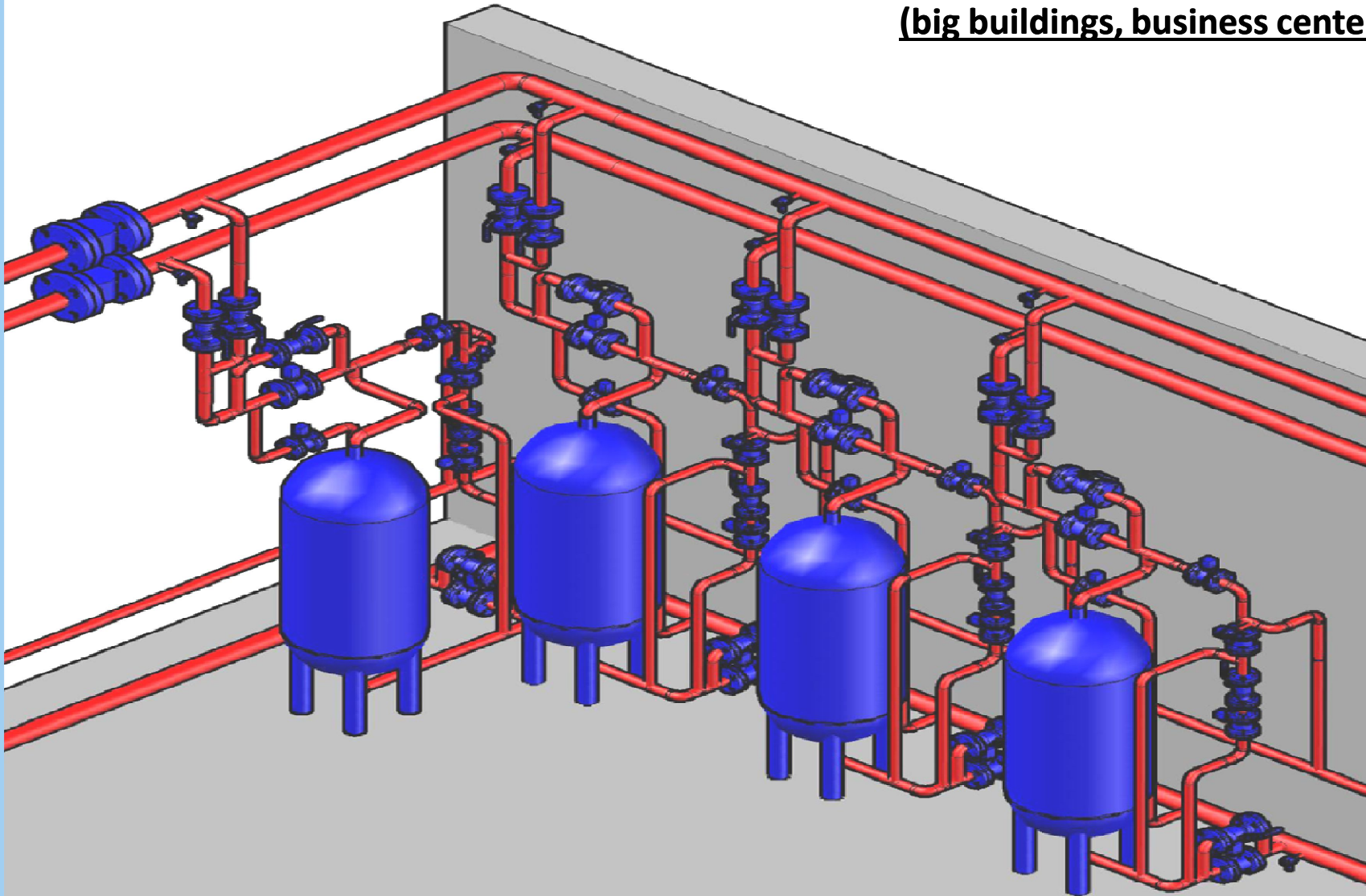
## THE BASIC TECHNICAL PARAMETERS OF DIFFERENT MODELS OF ELECTROCONDITIONERS «CASCADES»®

MODEL OF THE DEVICE	CONNECTING SIZE OF PIPELINES	WEIGHT OF THE DEVICE WITH WATER, kg	OVERALL DIMENSIONS, mm	AVERAGE INTAKE, kW
<b>AVE-0,5/0,5 («elecon»)</b>	<b>½ "</b>	<b>5</b>	<b>185 x 392 x 485</b>	<b>0,04</b>
<b>AVE-07/20</b>	<b>1½ "</b>	<b>62</b>	<b>624 x 400 x 1114</b>	<b>0.05-0,1</b>
<b>AVE-07/40</b>	<b>1½ "</b>	<b>82</b>	<b>624 x 400 x 1314</b>	<b>0.10-0,2</b>
<b>AVE-13/35</b>	<b>1½ "</b>	<b>85</b>	<b>724 x 470 x 1245</b>	<b>0,2-03</b>
<b>AVE-13/70</b>	<b>1½ "</b>	<b>102</b>	<b>724 x 470 x 1545</b>	<b>0,2-03</b>
<b>AVE-32/150</b>	<b>1½ "</b>	<b>750</b>	<b>755 x 755 x 1830</b>	<b>0,3-0,4</b>
<b>AVE-32/300</b>	<b>1½ "</b>	<b>868</b>	<b>755 x 755 x 2130</b>	<b>0,3-0,4</b>



# Variants of hookup of installations with electroconditioners “CASCADE” in different projects

For large objects  
(big buildings, business centers, etc)





# Where already drink and use “Revitalized water”?

(only a few examples from two hundreds objects)

- Cottage settlement « Russian Switzerland » companies " HONKA " (Leningrad region)
- The newest pharmaceutical enterprise " Polysan " (Saint-Petersburg)
- Hotels in Saint-Petersburg and Nyagan ("Smolninskaya", "Ambassador", etc.)
- Mounting skiing resort "The Gold valley" about settlement Korobitsyno (Leningrad region)
- Motel and autocamping at lakes Vandlitz (Germany)
- St.Petersburg office of the Federal Trust "Spetsstroy"
- Summer residence of the firm "Eagle Group" (Hamina, Finland)
- Factory of carpet coverings "Neva Taft" (Saint-Petesburg)
- Apartment house and a business centre "Mont Blanc" (development company "Stroymontage", St. Petersburg)
- Apartment house "Dominant" (development company "Elis", St. Petersburg)
- High-rise apartment building "Finansist" ("Gerasimov's Architectural workshop" and the Public Company "ProjectService", St.Petersburg)
- Apartment house "Van - Vitelli" ( the development company "Business Link Estate, St.Petersburg)



Cottages at a village  
of the Congress Hall  
“Konstantinovsky”



## How does electroconditioners of water "Cascade"® look?





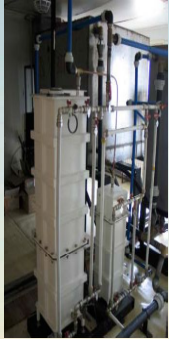
**System of water-preparation on the basis of electroconditioners "Cascade" AVE-32/300 at the pharmaceutical enterprise "POLYSAN" in Saint-Petersburg (output 20,000 l/h)**

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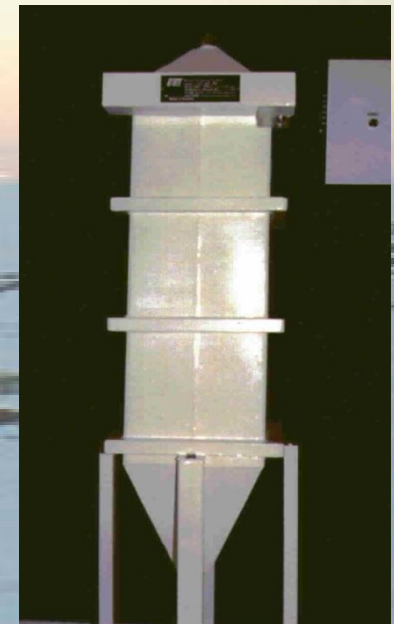


**Systems "CASCADE" for drinking water (from lake Stepped) and sewage treatment in severe conditions of Antarctica (a housing space "Lena", station " Progress ")**



**Drinking water system**

**Waste water treatment system**





## A scene of installation of devices "Cascade" in field conditions (auto camping near the lake Lipnitzsee Germany, 2001)

*Second generation of models*





# Units "Cascade" placed in a concrete shaft the autocamping near the lake Lipnitzsee

---

*Second generation of models*





## Episode of installation of electroconditioner "CASCADE " by Finnish technicians



**Second generation of models in the summer residence in Hamina (Finland)**



## Installation “CASCADE” for purification of waste water from laundry (Hotel “Ambassador”, Saint-Petersburg)

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## **"CASCADE" installation for clearing of municipal sewages in the village Grebs (Potsdam, GERMANY)**

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# What's news in swimming pool technologies?



**Application of electroconditioners in turnaround water supply allows to reduce sharply (and at desire to exclude completely) use harmful disinfectants (chlorine, ozone, peroxide of hydrogen, various coagulants, etc.)**



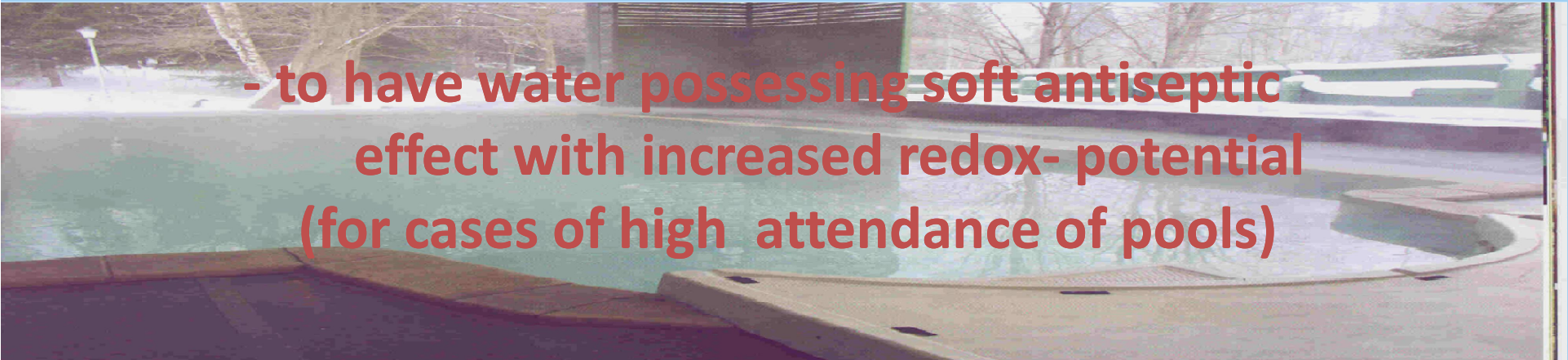


## Conditioners "CASCADE"®

give a choice between two unprecedented opportunities due to ability of electrochemical activation of water

---

- to have sterile, chemically pure water in pool with low redox- potential, rendering to human organism vivifying physiological influence



- to have water possessing soft antiseptic effect with increased redox- potential (for cases of high attendance of pools)



# What else can revitalized water do?

## THE ANTIOXIDANT PROPERTIES OF REVITALIZED WATER

Photo 1. Top side view of the cups with paper clips



Photo 2. Side view of the cups with paper clips



Simple experiment that demonstrates the difference in the rates of oxidation processes in ordinary water and water with extremely low ORP.


The same paper clips, made from low-grade steel without protective coating, plunge into cups with ordinary tap water (left cup) water and treated with electroconditioners of water "CASCADE" (right cup). Despite the fact that the water after treatment in a conditioner additionally saturated with oxygen, rust on the clips it does not appear within many hours while preserving its antioxidant properties of water (low redox potential).

In the cup with tap water rust on clips with transition in the volume of water begins to develop almost 10-20 minutes after immersion in these clips. Photos were taken after 4.5 hours after the start of the experiment, when the antioxidant properties of the treated ("live") of the water is already largely weakened.



Thank YOU :)





- 

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Data Science and ISO 50001 to optimize energy  
(electricity, water, gas..) usage in public and industrial  
buildings

Anton Tyukov  
PhD, Volgograd State Technical University,  
Russia



People spend  
**80 %**  
of their time in buildings

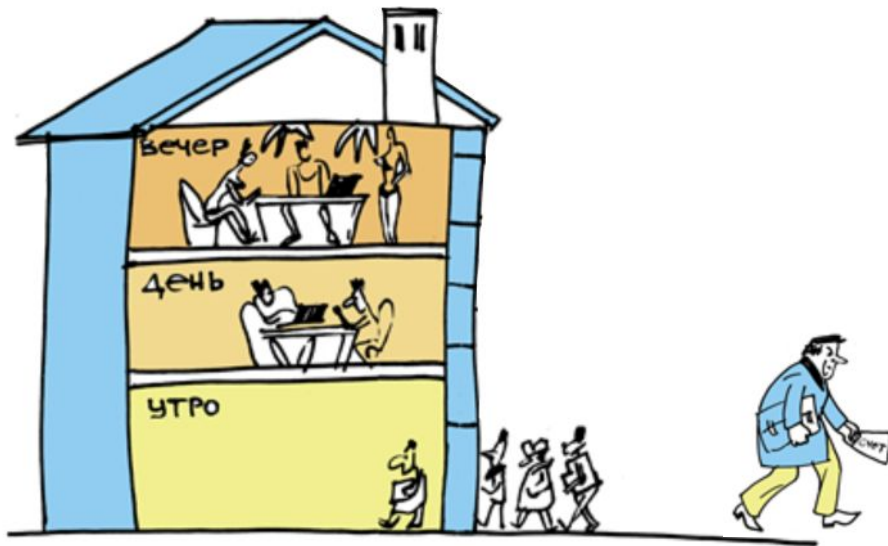


Annual building maintenance cost:  
Electricity: **\$0.3 – 1.5 mln**  
Gas ( For heating): **\$0.15 – 0.7 mln**  
Water: **\$0.1 – 0.4 mln**

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

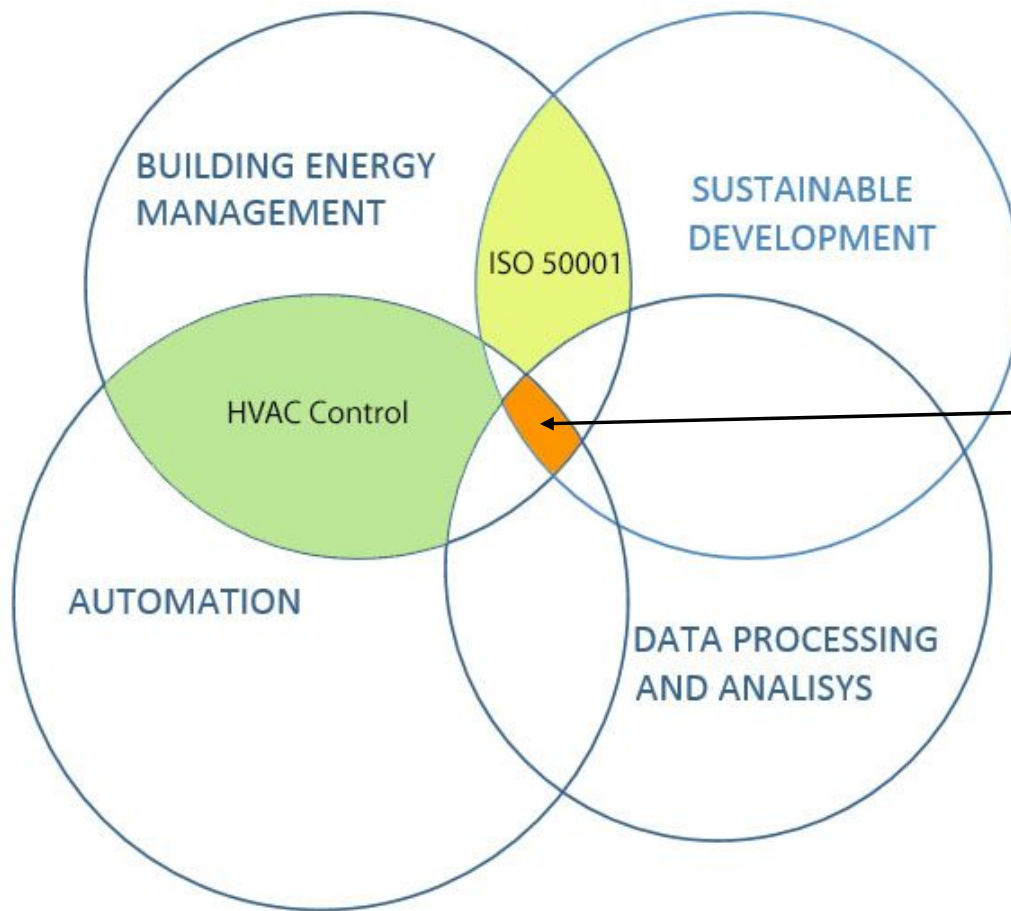


# Goals of governmental program till 2020

- 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







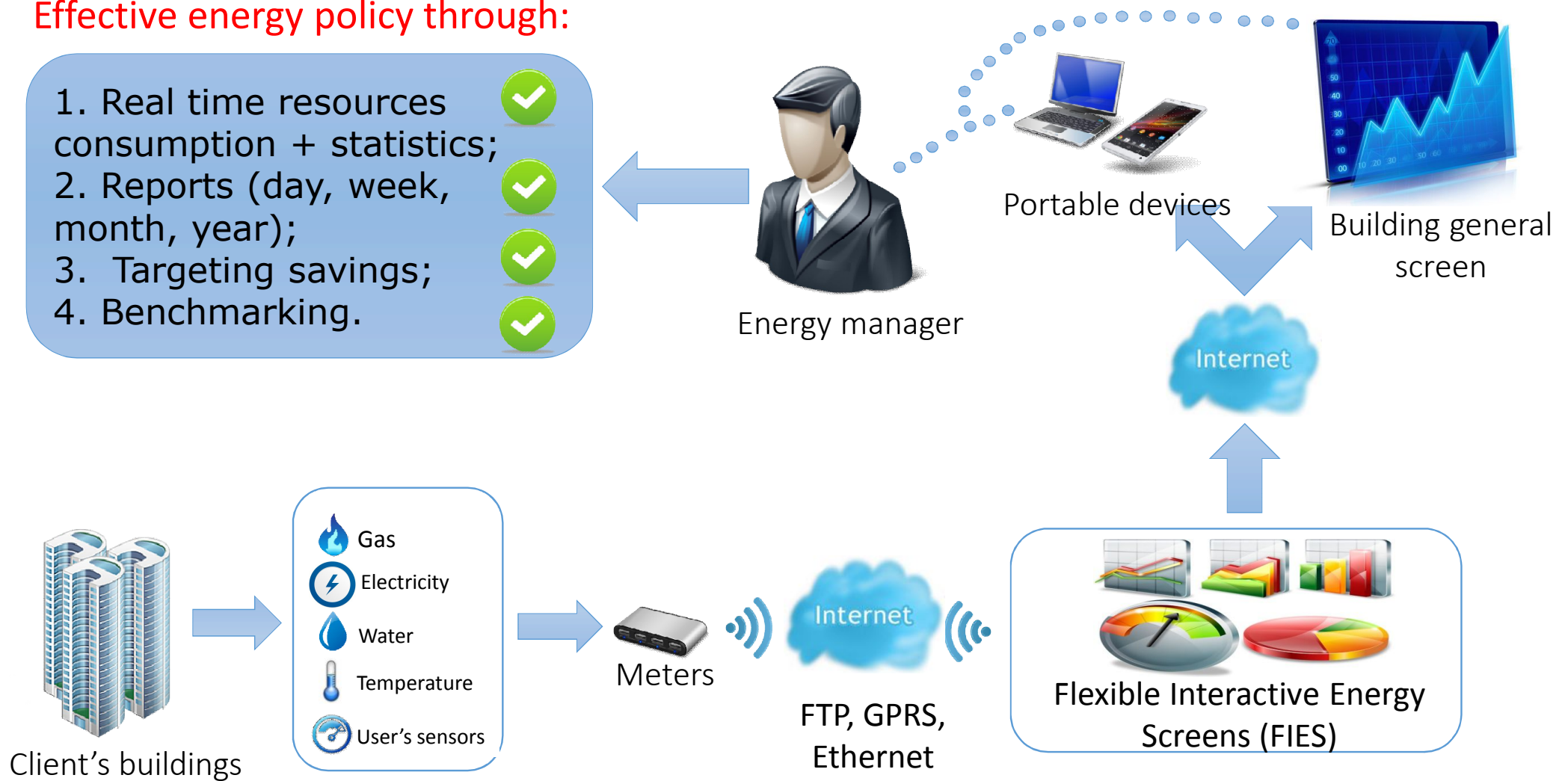
# Intelligent Energy Management System



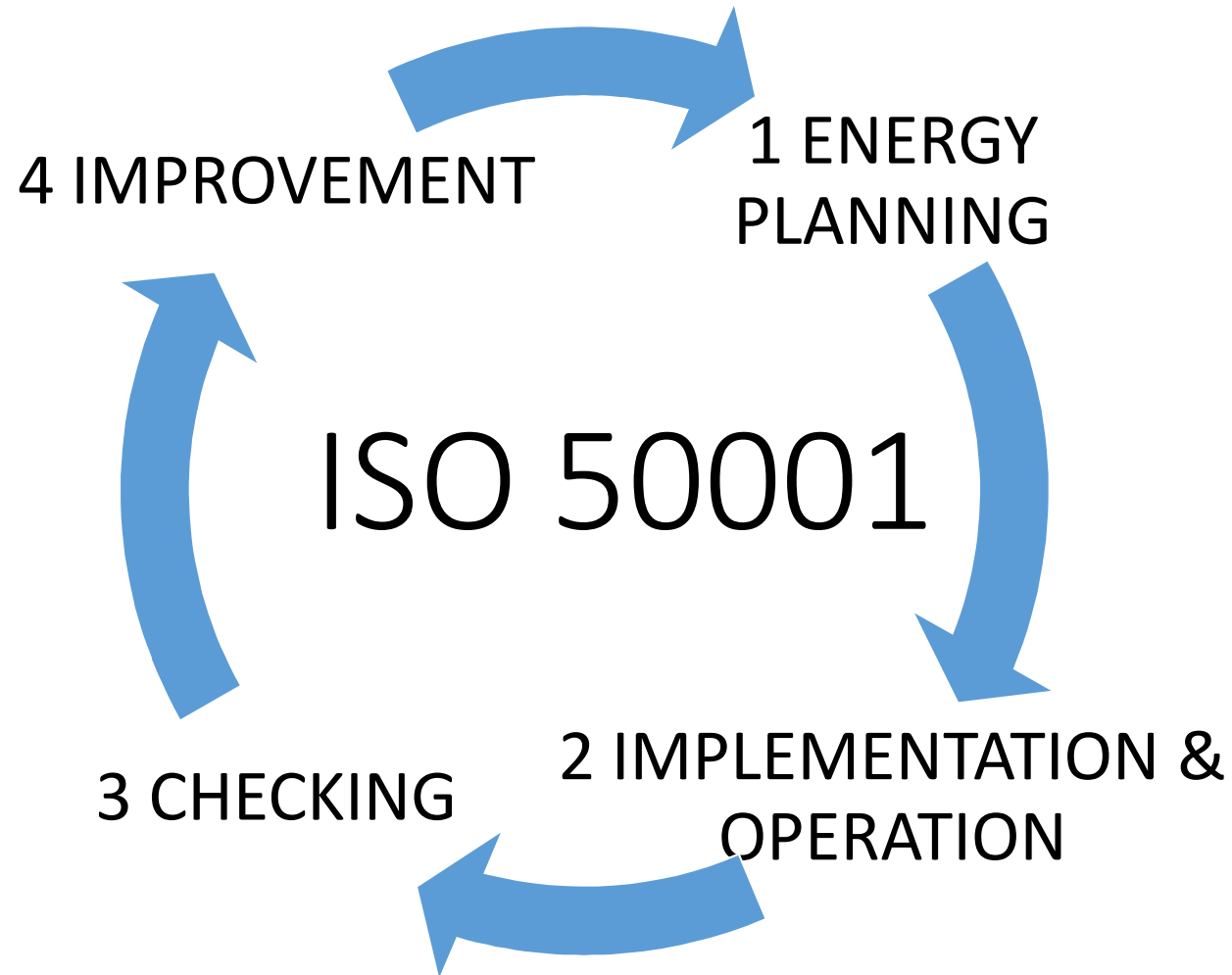
# Conceptual system design

## Effective energy policy through:

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





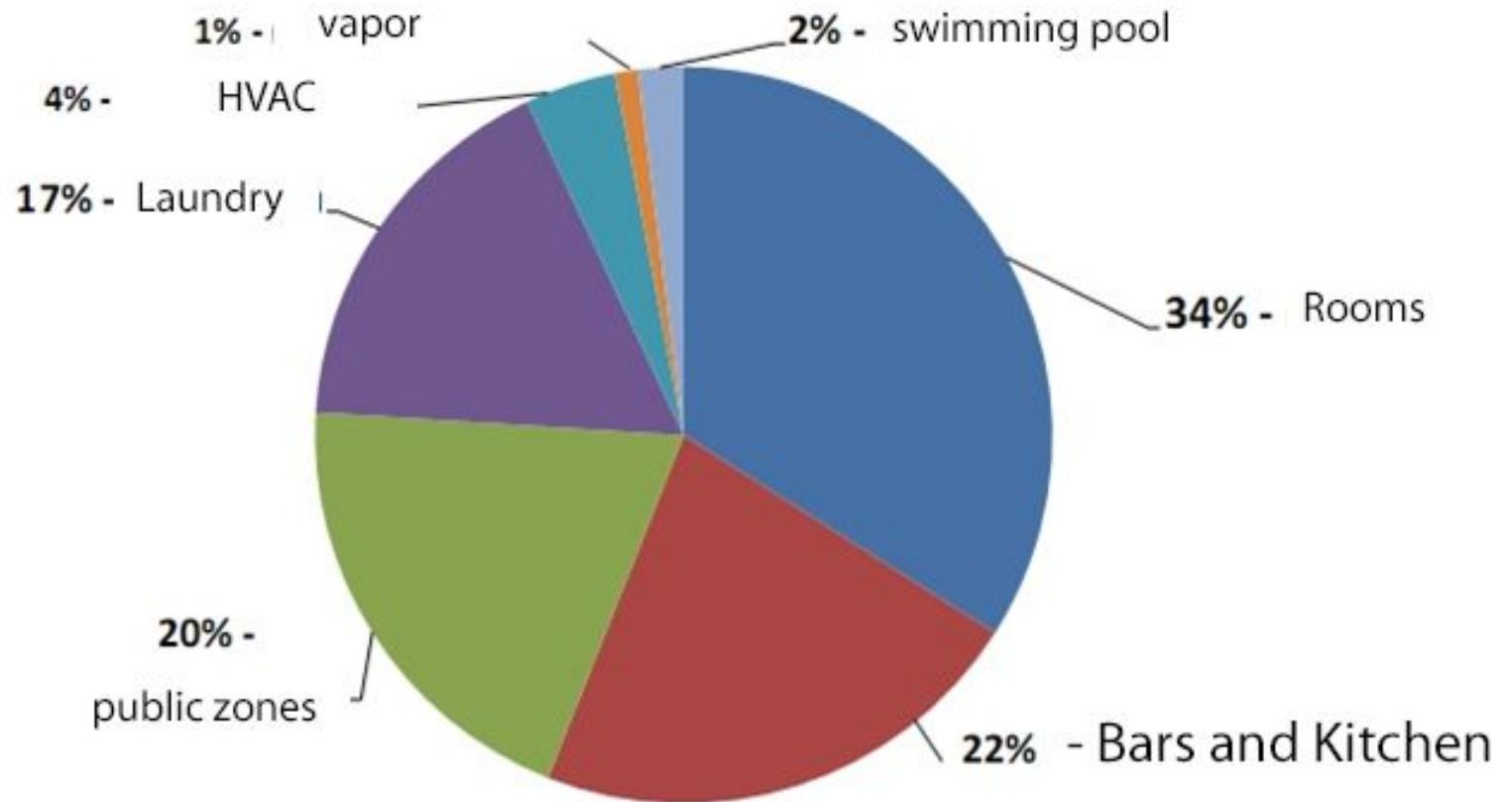




# Step 1: Energy Planning

## Example 1: Energy submetering

### WATER CONSUMPTION IN A HOTEL





# Step 1: Energy Planning

## Example 2: Saving of heating system

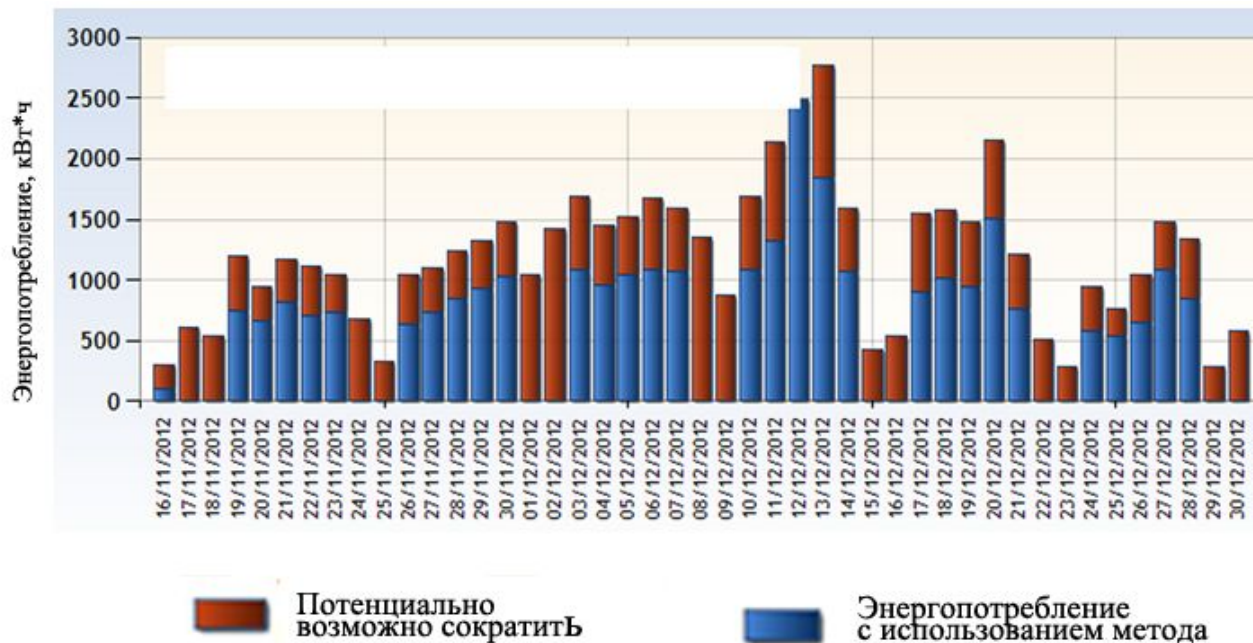


Fig 2 – Gas consumption in a building

Total energy consumption: **53 621 kWh**

Potential economy: **23 754 kWh** (44%)

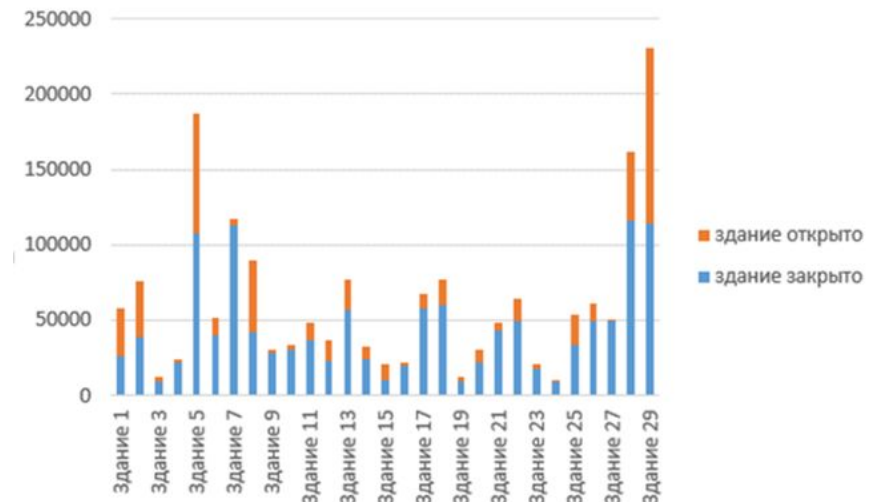


Fig 3 – Saving potential for 30 buildings



# Step 1: Energy Planning

## Example 3: Comparing objects



Fig 4 - Energy consumption of different periods

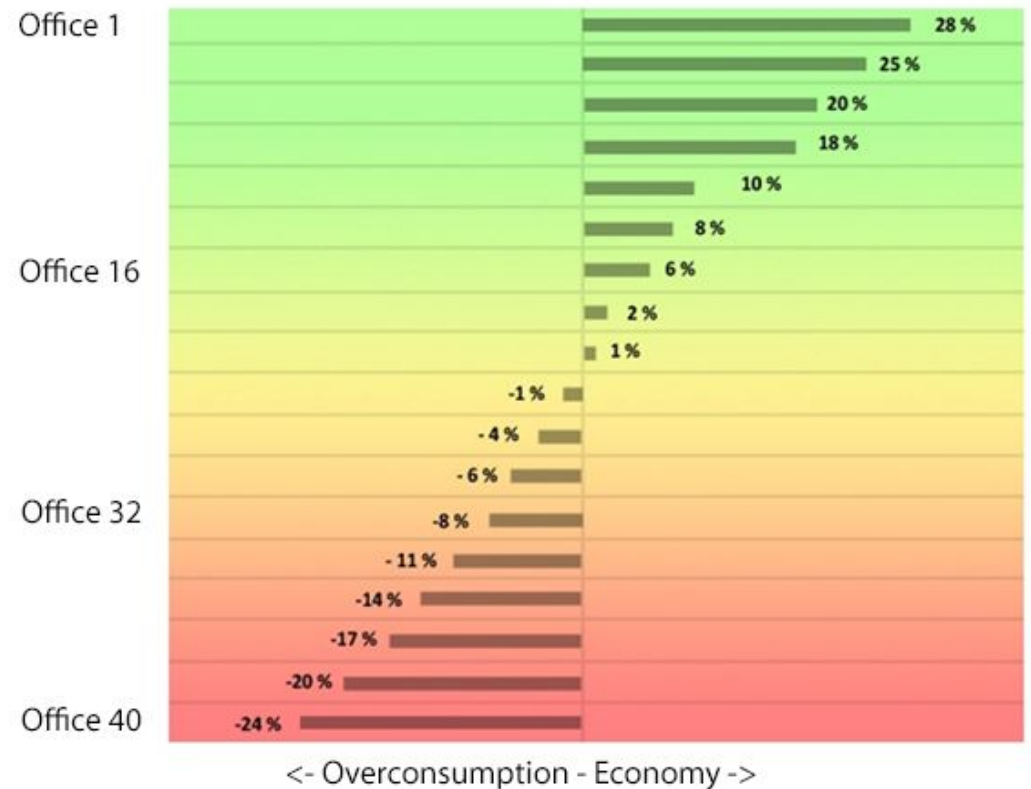


Fig 5 - Comparing energy consumption of different buildings



# Step 1: Energy Planning

## Example 3: Measuring internal comfort and productivity

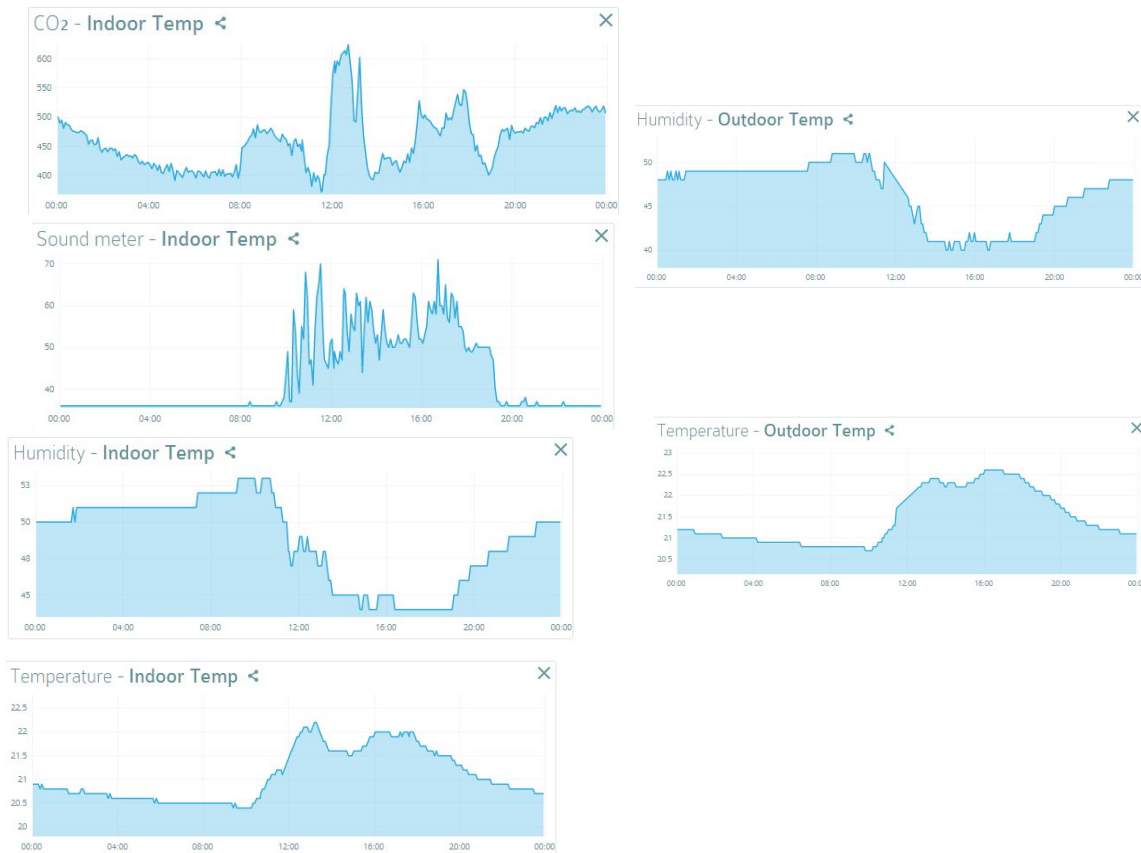


Fig 6 - Measuring comfort

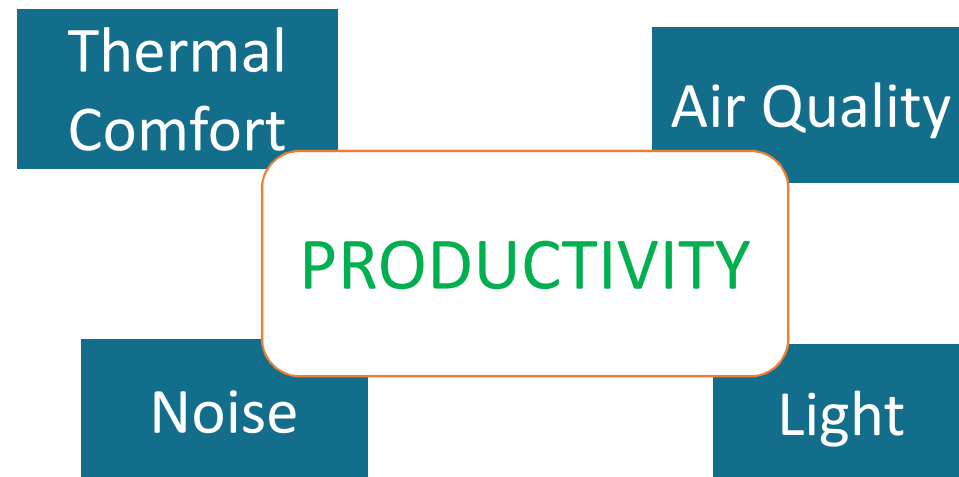


Fig 7 - Calculating productivity



## 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

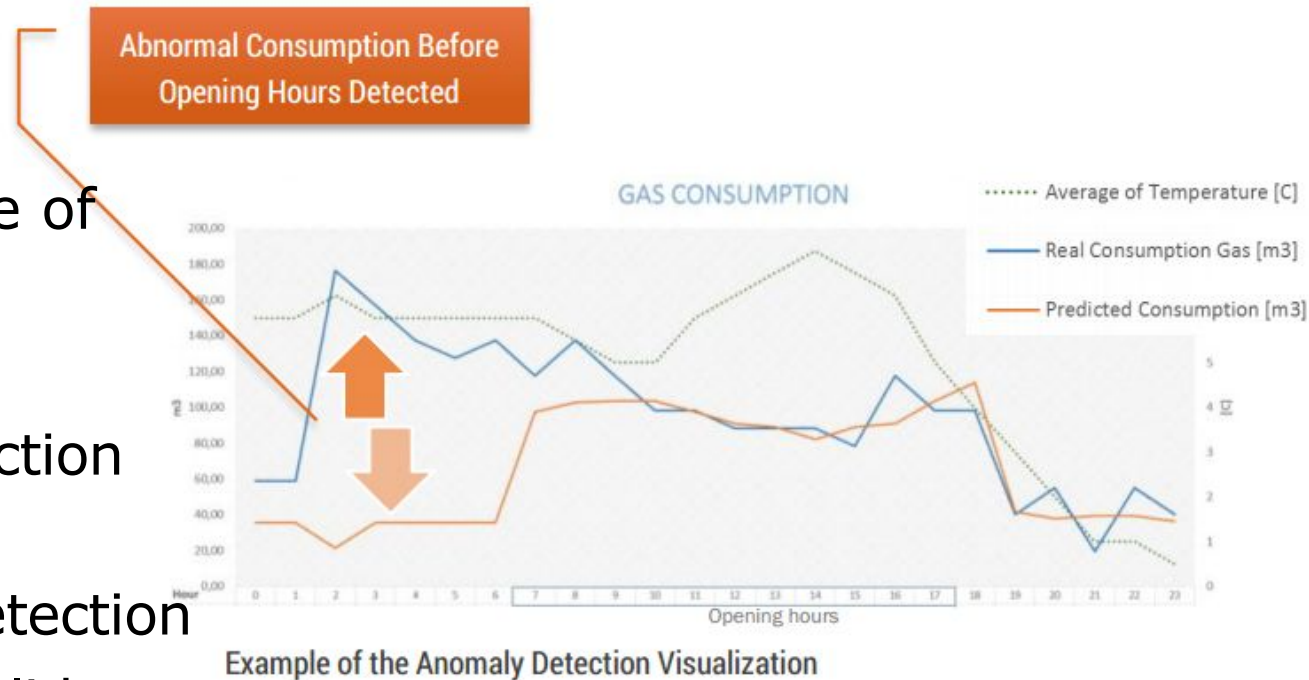


Fig 8 – Example of the Anomaly detection Visualization



# Step: 2 Implementation and operation

## Example 2: Anomalies examples

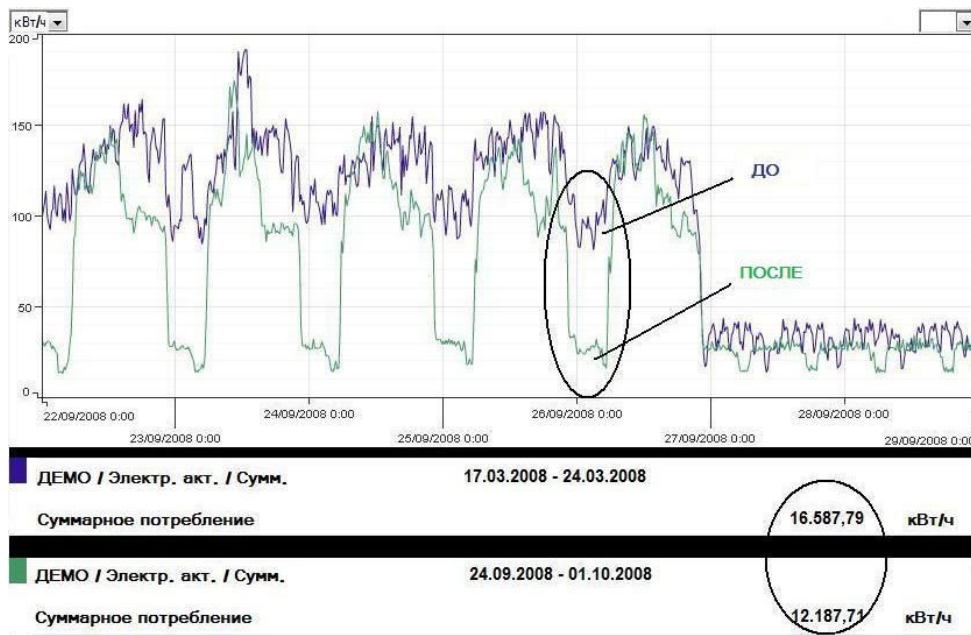


Fig 9 - Annual economy on electricity is **\$31 000**

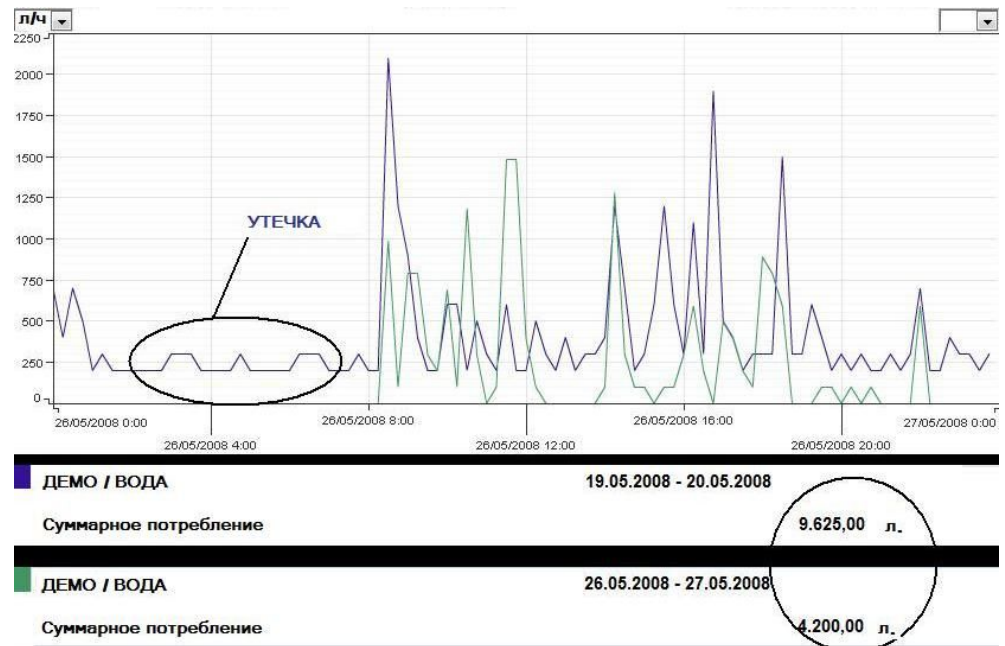


Fig 10 - Annual economy on water - **\$4 000**



# Step 2 - Implementation and operation

## Example 1: Analyzing anomalies

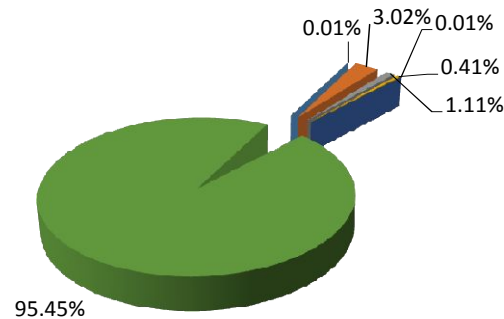
### SAVINGS PROGNoses

Understanding and reduction of energy costs

Identification of areas of potential energy savings

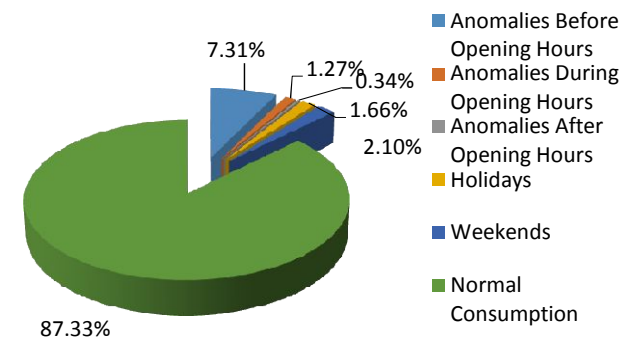
Highlights of opportunities for energy management improvements

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
<b>TOTAL</b>	<b>8027,4</b>	<b>4,55%</b>	<b>963 EUR</b>

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
<b>TOTAL</b>	<b>13265,6</b>	<b>12,67%</b>	<b>3.316 EUR</b>



# Step 2 - Implementation and operation

## Example 2: HVAC SYSTEM PERFORMANCE

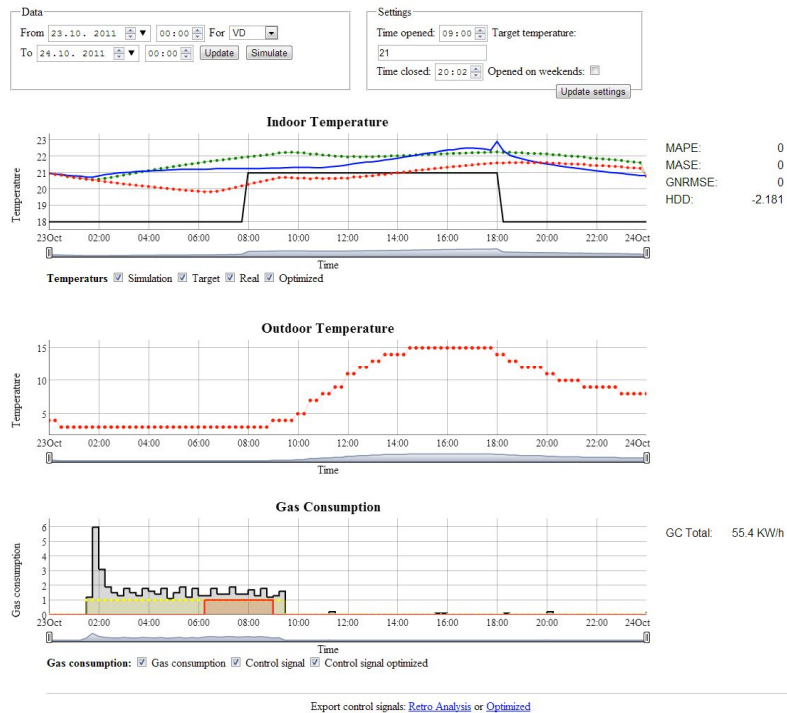


Fig 11 - HVAC system supervisory control

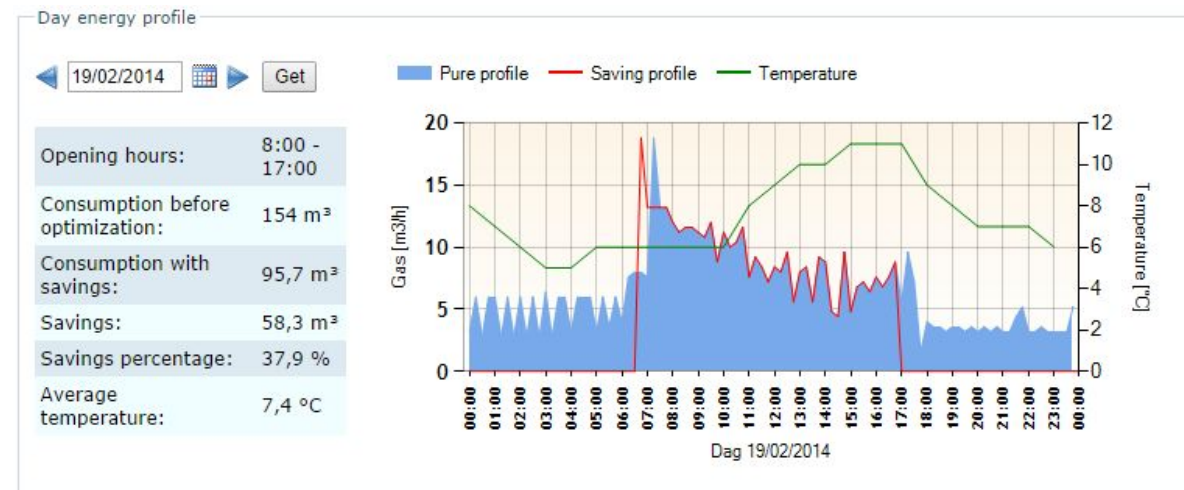


Fig 12 – Energy savings of heating system



## Step 3: Monitoring the Progress



Fig 13 - Monitoring the progress



## Step 4: Improvement

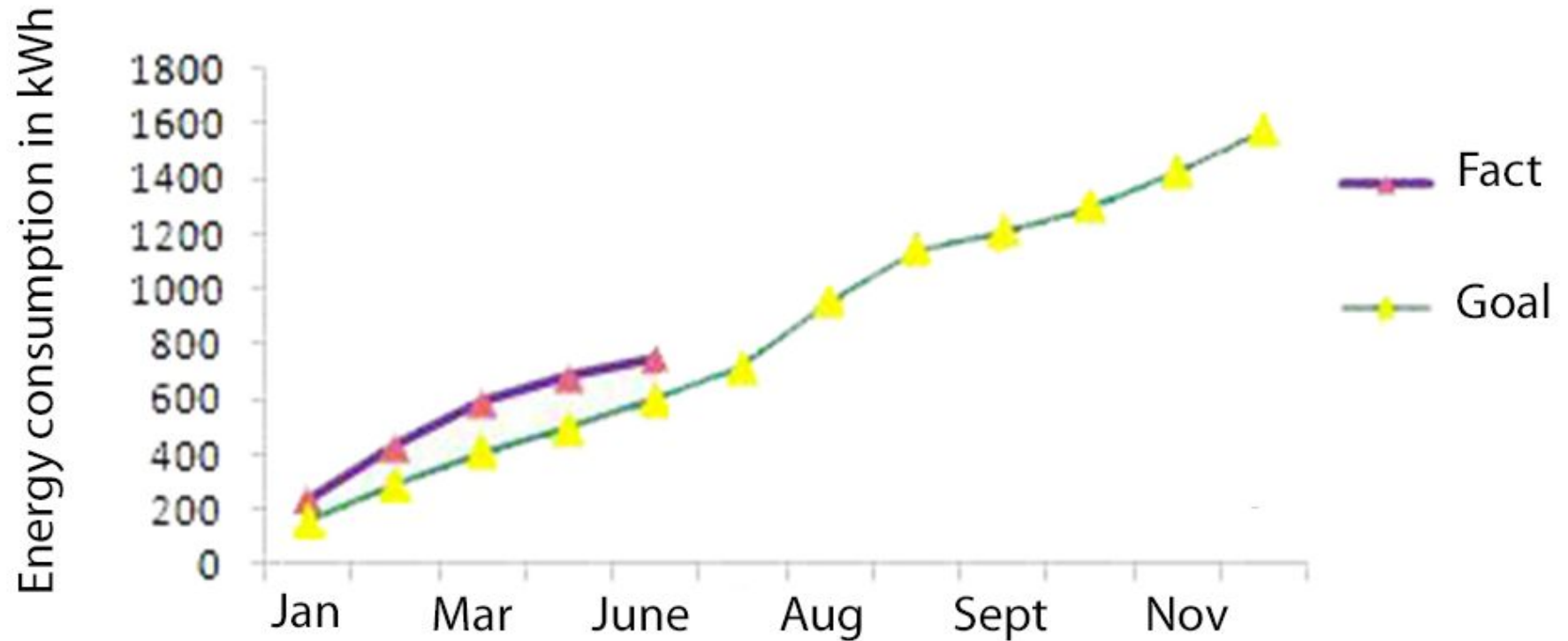
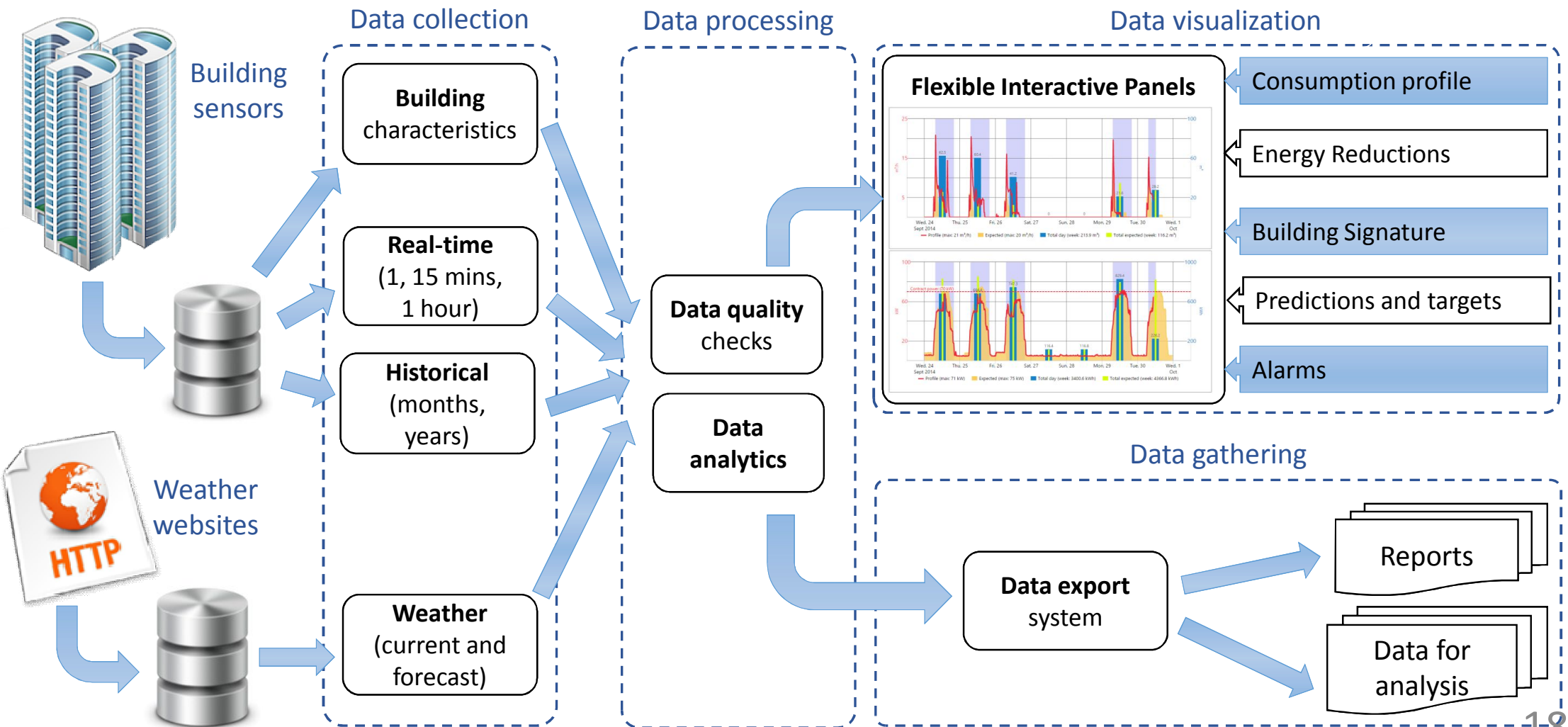


Fig 14 - Distribution of energy usage



# Technical system design: general overview





# Technical system design: sensors

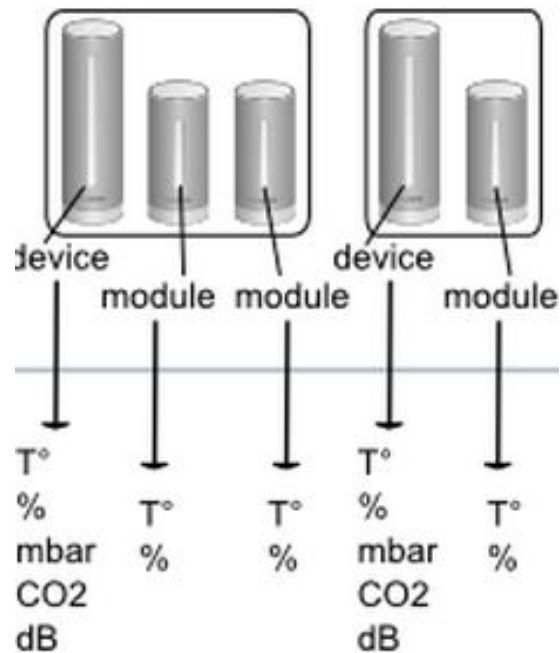


Fig 15 - Plug&Play sensors

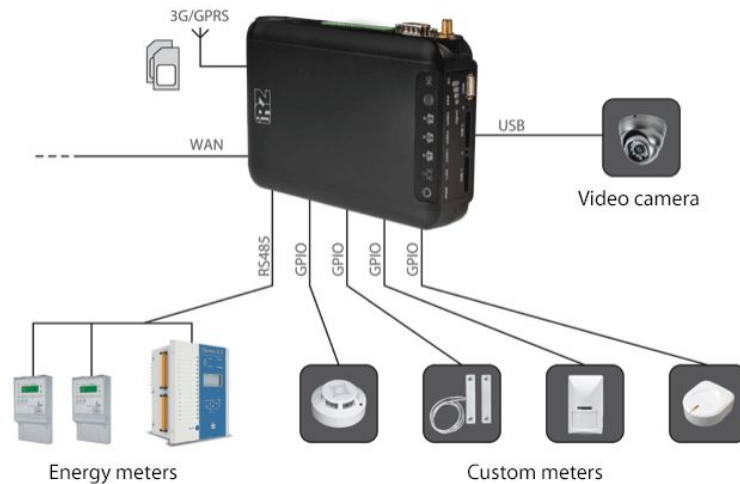


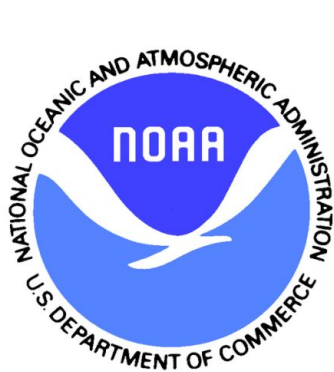
Fig 16 - Building automation



Fig 17 - Custom solutions



# Technical system design: data from meteorological institutes



YR.no



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



# Technical system design: Digital Information screens

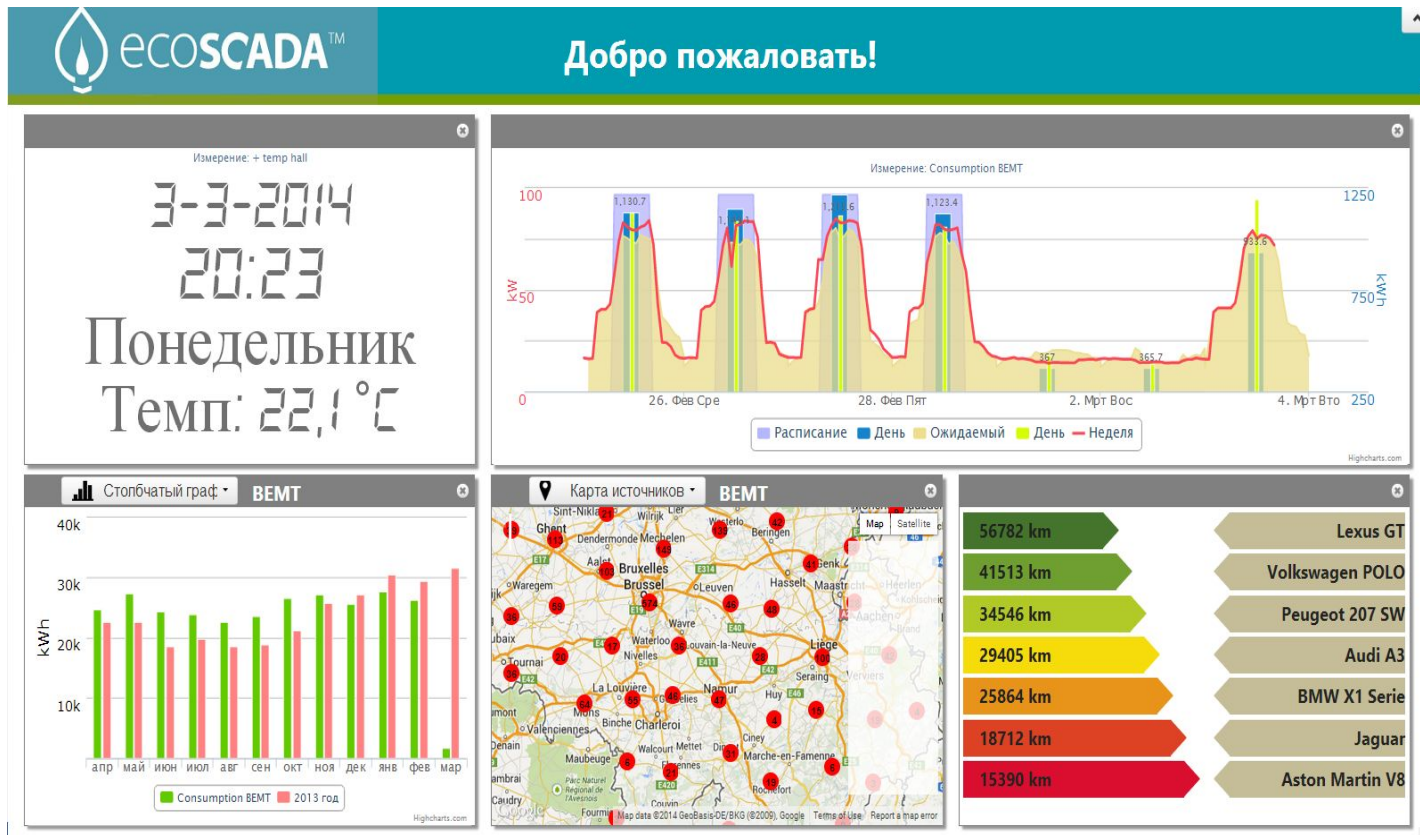


Fig 18 – Example of digital information screen



Fig 19 – Example of installation



# Technical system design: Data Export for researchers

reduced time on data preparation

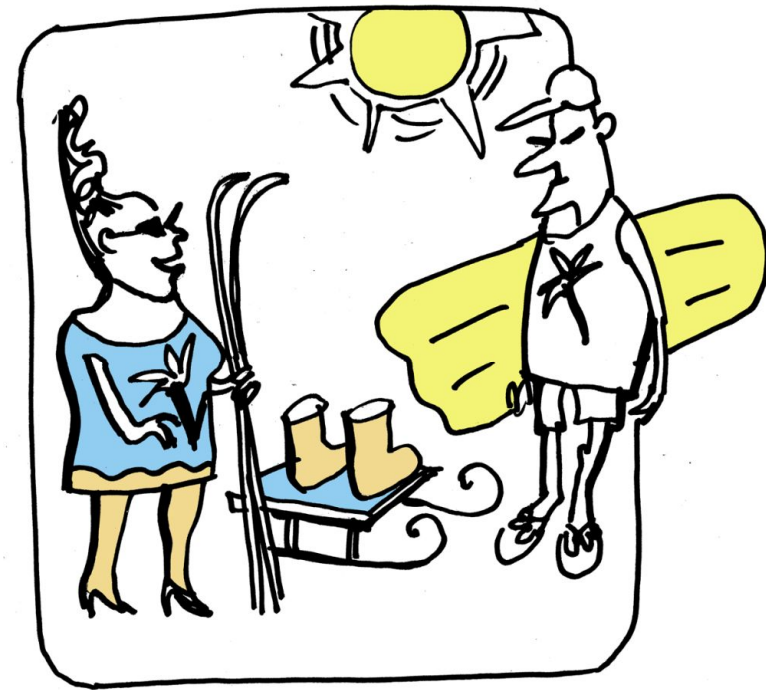


- Information fusion
  - Sensor information
  - Weather conditions
- Data exported for
  - R
  - Weka
  - Excel
  - Octave
  - Matlab
- Data Quality Certificate



# Conclusions

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





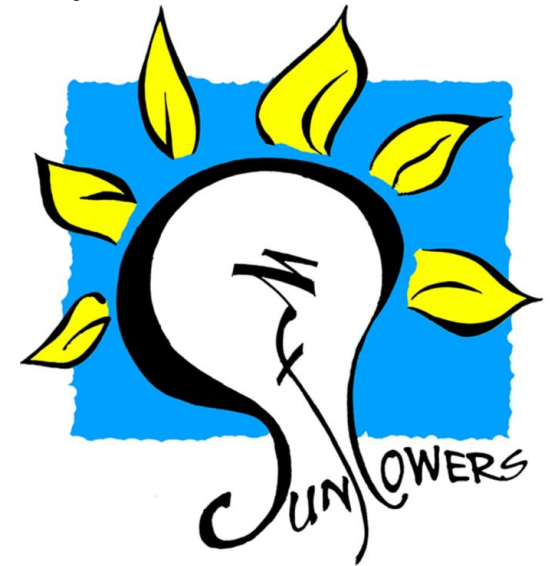
# Thank you. Write to [Anton.tyukov@gmail.com](mailto:Anton.tyukov@gmail.com)

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- +79050642601

- Research and Software development team

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





Thank You!







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