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Dear Sirs,

Investing in Patenting and Practical Commercialization

of a Unique Power Nanoengineering Portfolio

For many years Belarusian scientists have exerted their efforts to finally succeed in interpretation of quantum mechanisms of electron movement in solids. The newly acquired knowledge will underlie creation of highly efficient nanochips and nanomaterials, to be subsequently used in mass production of consumer goods. This, in turn, would make for drastic increase in competitive strength of a great variety of conventional goods in current production, allow gaining significant fuel and electric power economies, meeting higher standards of environmental safety in the transport and power sectors. It is quite possible to obtain the industrial standards and prototype pieces within next 18 to 20 months.

Having accomplished the preparatory phase (analysis of the findings and examination of the developers' patent history related to the power nanotechnologies), the Republican Centre for Technology Transfer (RCTT) has set about promoting the promising *nanotechnology portfolio*. RCTT was established in 2003 under the auspices of UNIDO, the UNDP, the Committee for Science and Technologies at the Council of Ministers of the Republic of Belarus and the National Academy of Sciences of Belarus.

The promoted power nanotechnologies are of purely applied nature and thus are being approached as the practical means to tackle the cardinal problems in today's power engineering, in particular:

- significant (up to 70%) rise in performance rates of solid-state energy converters, e.g. heat-to-electricity, solar energy-to-electricity converters, electricity-to-cold converters (in the transport sector this would allow to halve the fuel consumption rates, make engines noiseless and less harmful to the environment, which would finally make hybrid vehicles extremely efficient; more to this, with three- to fourfold increase in the performance factors of solar batteries and with their production cost halved, solar power engineering would become a highly competitive industry; in the cooling system engineering this would mean notably streamlined and simpler refrigerating equipment, yet twice as power saving and refrigerant-free);
- production of power accumulators of tenfold higher capacity, in comparison with the conventional lead-acid cells, while being environmentally safe and durable in operation temperature conditions ranging from -70° C to +300°C;
- superconductivity in low- or high-power circuitry at temperatures as high as 90°C (this would be the prerequisite for production of miniature computers ("nanoputers") and compact-size highly efficient electric motors, power generators, multichannel communication buses and links, power lines, etc.);
- production of brand-new transparent and non-transparent insulating thin sheet materials that would drastically reduce or stop heat loss in buildings, manufacture of compact-size "heat transformers" efficient in conversion of natural and low-grade "wasteheat" into high-grade heat for practical use in the power and public utility sectors, thereby discontinuing heavy consumption of hydrocarbon household fuels.

"Packaging" and promotion of the aforementioned technologies in "offer sets" is, in itself, a factor bringing considerable economies. Many alternative types of such "packaging" can

produce high synergic effects. The examples of the complex combinatory approach are abundant. Thus, it could be

- application of novel solar energy converters, nanoaccumulators and refrigerators with in-built nanochips to ensure stable around-the-clock power supply of cooling/refrigerating units (air conditioners), even in overcast and misty conditions;
- production of a hybrid vehicle with:
  - a nanochip allowing to simplify the engine design, while halving the fuel consumption rates, achieving noiseless operation and meeting much higher standards of environmental safety,
  - a reliable and durable, environmentally friendly nanoaccumulator of multiple permittivity,
  - compact-sized electric wheel-motors with nanosuperconductors of stable performance with high temperature up to +90°C, requiring neither cryogenic technologies nor rare-earth metals.

A complex of measures have been taken by RCTT to bridge and join the efforts of the interested enterprises and investors, the state committees in charge of the national innovation activity and power saving, with the aim of commercializing the aforementioned technologies. A number of large-scale enterprises in Belarus are ready to adopt and apply the nanotechnological approach in power engineering and develop the novel sector. The national Committee for Science and Technologies and the Committee for Energy Efficiency and Power Supervision second RCTT's initiatives. Since the effectiveness of the technology block and the final result of transfer thereof are highly dependent on the complex application approach, it is imperative to simultaneously develop the whole range of the novel industrial standards, make prototypes and initial production pieces of nanoproducts. In relation to complexity of every particular technique or technology, this phase would take 1.5 to 2.5 years. The budgetary resources of Belarusian R&D sector are limited and would not be sufficient for these purposes.

By using UNIDO's wide experience in international technology commercialization and transfer, certain steps are being taken to establish a specialized Power NanoEngineering Centre in Minsk under the auspices of UNIDO. The Centre would help joining and coordinating the efforts of various countries currently working on commercialization of energy-efficient, power-saving and environmentally clean technologies, for the world's benefit.

For all the nanotechnology-related projects it has been provided that prototypes are made locally and then put in full-scale production on other countries most eligible for investors, in order to null the investors' risks and obtain investment funds in considerable amounts.

The potential capacities of the Belarusian research and development communities in the nanotechnology fields were taken up as the focal issue at UNIDO International Expert Meeting on Nanotechnology (held in Minsk on 10 – 12 November 2003). Having considered the subject, the international group acknowledged presence of the basic prerequisites and facilities to make creation of production prototypes in Belarus quite a practicable venture, with the funding and financial support provided from abroad and close partnerships developed with the UNIDO nanotechnology centres.

The *Action Plan on the Most Efficient Methods of Employing Science and Technologies for the Purpose of Ensuring Sustainable Development* adopted at the 'G8' summit meeting in Evian in 2003 has provided for a wide scope of activities mainly focused on three areas as follows:

- global observation;
- cleaner and more efficient energy, as well as counteracting air pollution and climate change;
- agriculture and biodiversity.

Part 2 of the G8 Action Plan (related to acceleration of the research, development and diffusion of energy technologies) runs as follows:

"We will:

2.1 Promote energy efficiency of all sources and encourage the diffusion and uptake of advanced

energy efficient technologies, taking pollution reduction into account. Possible measures include standards, public procurement, economic incentives and instruments, information and labelling;

2.2 Promote rapid innovation and market introduction of clean technologies, in both developed and developing countries, including at the Milan Conference of the Parties of the *United Nations Framework Convention on Climate Change* and beyond, at the International Energy Agency (IEA) and other international fora such as the UN Economic Commission for Europe, the Expert Group on Technology Transfer, etc., finding appropriate methodologies to involve the private sector;

2.3 Support efforts aimed at substantially increasing the share of renewable energy sources in global energy use:

- stimulate fundamental research in renewable energies, such as solar photovoltaics, offshore wind energy, next generation wind turbines, wave/tidal and geothermal, biomass;
- collaborate on sharing research results, development and deployment of emerging technologies in this area;
- work towards making renewable energy technologies more price competitive;

…

2.6 Encourage the Global Environment Facility to include energy efficiency, renewables, cleaner fossil fuel technologies, and sustainable use of energy when setting up its programme;

2.7 Develop codes and standards for next generation vehicles, cleaner diesel and biodiesel, recognising that social needs for fuel quality are diverse among G8 countries;

2.8 In accordance with our national procedures, promote clean and efficient motor vehicles including next generation vehicles;

2.9 Work in consultation with industry to raise energy efficiency of electrical and electronic equipment;.."

The projects being proposed for the investments comply close with the directions laid down by the G8 and clearly stated in the above quoted items. With reference to the guidelines of the Plan, RCTT has developed a project for creating supply resources of brand-new next-level nanoelements, in order to provide good grounds to the solar and fuel energy sectors and a firm base to energy-saving activity. The aforementioned project is to be submitted to the Global Environment Facility for their consideration.

The Republican Centre for Technology Transfer will gladly welcome everybody who whish to invest in any of the mentioned nanotechnologies at every phase, starting from the patenting procedures throughout making prototype pieces to the commercial production stage. The list of the patents taken out or the information on particular projects in concern with specific types of nanoproducts will be readily sent upon your request or query. Some basic information is already available on RCTT's Web portal (***http://ictt.by***) in the “Power Nanoengineering” section.

Yours faithfully,

Dr Alexander A. Uspenskiy

Director