

Development of Industry of Renewable Ecological Solar Autonomous Energy Station (Photovoltaic)

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Abstract — Republic of Moldova is located in zone of high Solar Energy. In the South – East part of Europe only Republic of Moldova have a semiconductor technology to production the Solar Cells on Gallium Arsenide (GaAs) crystals (by vapor phase epitaxial technology). Supplementary, Republic of Moldova have more then 100 plants and factories, who don't have the object of production (ex-USSR plants). In Moldova is a System of relatively good Engineers High Education (in Semiconductors, Electronics, Computer Science, Mechanics and other). These article provide idea to establish a new Industry – Industry of Renewable Solar Autonomous Energy Station.

Index Terms — photovoltaic, Solar Cells, Gallium Arsenide crystals.

I. INTRODUCTION

Business Sector / domain (e.g. – environmental): Renewable Energy: 1) Gallium Arsenide (GaAs) crystal micrometallurgy (ingot, plate); 2) Semiconductors (GaAs Photovoltaic Cells - gas phase epitaxial technology); 3) Optics (Optic Concentrator's Head); 4) Energetic (Turbine-Generator); 5) Electronics (Sun orientation System); 6) Mechanics (construction); 7) Assembly Photovoltaic Battery (Helios-Energy-Station); 8) Financial, Marketing and Sales, and Technical Service Divisions. Total requested financing / € 100.000.000. The project volume /€ 75.000.000

Investment Opportunity Profile: Renewable Energy Sources, Photovoltaic, High Temperature Power Electronics.

II. THE AMOUNT & PURPOSES OF AN INVESTMENT REQUEST

Estimative **Investment** (in case of renovation, reengineering, retechnologisation of existing ex-USSR plant in Moldova): I stage only (first 3 year) – € 75.000.000: 1) R&D, Engineering and Design Centre - €10.000.000; 2) GaAs crystal's ingot and plate Plant - € 10.000.000; 3) GaAs Photovoltaic Cells Plant (gas phase epitaxial technology) - € 10.000.000; 4) Solar optic concentrator's Plant – € 10.000.000; 5) Support construction (mechanic) Plant - € 5.000.000; 6) Thermo – Generator Conversion Plant – € 10.000.000; 7) Assembly Photovoltaic battery Plant - € 10.000.000; 8) R&D, Industrial Project – € 5.000.000; Market Promotion – € 5.000.000.

If the **Government** of Republic of Moldova will offer 5 plants for modernization the project will be have the **basis for the industrial platform**. Respectively, supplementary € 25.000.000.

Total requested financing / € 100.000.000.

Estimative Sales (in current price), per year: 1) I stage (after 3 year)– € 4.000.000; 2) II stage (after 5 year) – € 20.000.000; 3) III stage (after 7 year) – € 40.000.000. Profitability - 25%. Investment request – 20 years.

III. BRIEF DESCRIPTION OF THE PROJECT

1. **Applicative Formula** of current Photovoltaic Conception: **Solar-spectral dispersion – concentrator photovoltaic-system**. Included devices: 1) Solar optic concentrator's head; 2) Photovoltaic cells on GaAs; 3) Accumulation of thermo energy; 4) Turbine-Generator; 5) Construction; 6) Electro- and Thermo Energy distribution system.

2. **Industrial components** (Intelligent Manufacturing System's): 1) R&D, Engineering and Design Centre; 2) Gallium Arsenide (GaAs) crystal's Ingot and Plate Plant; 3) GaAs Photovoltaic Cells Plant (gas phase epitaxial technology); 4) Solar Optic

Concentrator's Plant; 5) Support construction (mechanic) Plant; 6) Turbine-Generator Plant; 7) Assembly Photovoltaic Battery (Helios-Energy-Station)

Plant; 8) Marketing and Sales Division; 9) Financial Department; 10. Technical Service.

3. **All devices** (Ingot, Plate, Photovoltaic Cells, Optic Concentrator's, Turbine-Generator, autonomous Photovoltaic Battery with capacity 2,5 kW, 5,0 kW, 10 kW, 20 kW, 50 kW) **present's commercial goods.**

4. **Estimative Production capacity** (per year): 1) I stage (after first 3 year) – 100.000 cm² photovoltaic cells (equivalent of **1,0 MW** Energy (500 kW – electro, 500 kW – thermo); 2) II stage (last 2 year) – 500.000 cm² photovoltaic cells (equivalent of **5,0 MW** Energy (2,5 MW – electro, 2,5 MW – thermo); 3) III stage (last 2 year) – 1.000.000 cm² photovoltaic cells (equivalent of **10,0 MW** Energy (5,0 MW – electro, 5,0 MW – thermo).

5. **Estimative Sales** (in current price), per year: 1) I stage (after 3 year) – € 4.000.000; 2) II stage (after 5 year) – € 20.000.000; 3) III stage (after 7 year) – € 40.000.000. Profitability - 25%.

6. **Basic technology** (Ingot, Plate, Photovoltaic Cells, Optic Concentrator's, Turbine-Generator, Photovoltaic Battery) **are developed** (or is being developing) in Informinstrument S.A. directly, or in cooperation. The extension of industrial engineering is necessary.

7. **Estimative Investment** (in case of renovation, reengineering, retechnologisation of existing ex-USSR plant in Moldova): I stage only (first 3 year) – € **75.000.000**: 1) R&D, Engineering and Design Centre - €10.000.000; 2) GaAs crystal's ingot and plate Plant - € 10.000.000; 3) GaAs Photovoltaic Cells Plant (gas phase epitaxial technology) - € 10.000.000; 4) Solar optic concentrator's Plant - € 10.000.000; 5) Support construction (mechanic) Plant - € 5.000.000; 6) Thermo - Generator Conversion Plant - € 10.000.000; 7) Assembly Photovoltaic battery Plant - € 10.000.000; 8) R&D, Industrial Project - € 5.000.000; Market Promotion – €5.000.000.

Centre of Science and Engineering INFORMINSTRUMENT S.A. currently have a R&D industrial platform in Chisinau (Moldavian State University Region) -1500m² offices, laboratories, glass/ and quarts workshops, mechanical workshops and

other, and Experimental Industrial Platform (3500 m² production area) – in the Chisinau International Airport Region. All need a reconstruction works.

In case of buy a new industrial plant territory and platform - Estimative Investment will be increase by a sum of buy. Supplementary needs 5 plants units. Marketing and Sales Division, Financial Department will be emplaced in a Design Centre offices (6, Pushkin Street, Chisinau). Technical Service - in offices of Assembly Photovoltaic battery Plant.

5 plants units up to € 5.000.000 each = € 25.000.000 (non Chisinau emplacement).

Total Project Investment - € 100.000.000. Reimbursed period - 20 years.

VI. COMPLEMENTARY:

Objectives: The aim of Project is to upgrade the Gallium Arsenide Semiconductor Technology (Informinstrument S.A.) for implementation in production the Gallium Arsenide Photovoltaic panels (and power Gallium Arsenide discrete semiconductor devices). This investment project aims the renovation of Moldavian Photovoltaic and Semiconductor Industry based on gallium arsenide (GaAs) technology (about structures synthesis by a vapor phase epitaxial method) for production **Autonomous Renewable Energy Power System** by **photovoltaic conversion**, and sales it. The basic works:

- 1) Developing **universal technological installation**, intended for automatic synthesis of Semiconductor structures by a vapor phase epitaxial method. Feature of projected technological installation is adjusting (programming) it for any technological processes. The technological installation should work automatically through management of the personal computer – the basic component of the Intelligent Manufacturing Systems. Applied Scientific and Engineering works.
- 2) Providing with **equipment and reengineering** all technological process of R&D, producing the gallium arsenide photovoltaic panels and semiconductor devices. Reengineering.
- 3) Extending the **list of Photovoltaic panels, Autonomous Renewable Energy Power System, discrete semiconductor devices**, power bipolar transistors, other power devices; Applied Scientific and Engineering works.
- 4) Designing and implementing the technology of production a GaAs **monocrystal support (ingot, plate)**. Create a Plant to produce a GaAs **monocrystal support (crystal micrometallurgy)**. Scientific Research, Applied Scientific, Design and Engineering works.

- 5) Designing, implementing a technology of production a GaAs **photovoltaic layers**. Create a Plant to produce a GaAs **photovoltaic layers and photovoltaic panels** with capacities of production up to 1.000.000 cm² crystal/year.
Scientific Research, Applied Scientific, Design and Engineering works.
- 6) Designing, implementing a technology of production a solar optic Concentrators. Create a Plant to produce a solar optic Concentrators.
Scientific Research, Applied Scientific, Design and Engineering works.
- 7) Designing, implementing a technology of production a Turbine-Generator (converter heat energy in electric energy). Create a Plant to produce Turbine-Generator.
Scientific Research, Applied Scientific, Design and Engineering works.
- 8) Designing, implementing a technology of production a support Sun orientation constructions of **Autonomous Renewable Energy Power System**. Create a Plant to produce a support Sun orientation constructions.
Scientific Research, Applied Scientific, Design and Engineering works.
- 9) Designing, implementing a technology of assembling **Autonomous Renewable Energy Power System**. Create a Plant to assembling **Autonomous Renewable Energy Power System**.
Scientific Research, Applied Scientific, Design and Engineering works.
- 10) Designing, implementing a **technology of production a GaAs semiconductor layers**. Create an **Operational hall** to produce a GaAs **discrete semiconductor devices**.
Scientific Research, Applied Scientific, Design and Engineering works.
- 11) Creation of adequate **multifunctional R&D** and industrial **infrastructure** for semiconductor production.
Reengineering.
- 12) **Reconstructing the Center of Science and Engineering Informinstrument S.A.** (gallium arsenide (GaAs) photovoltaic and semiconductor R&D Center) in Chisinau. Reconstruction works.
- 13) **Reconstructing the Photovoltaic manufacture and other Plants.** Reconstruction works.
- 14) **Education R&D, industrial and commercial staff.**
Educational and structural works.
- 15) Establish a Marketing and Sales Division.
Structural works
- 16) Create a Technical Services Division.
Structural works

V. CONCLUSION

1). Alternative solution - defining the production capacity depending of financial resources;

2). Currently, in the Republic of Moldova exist **more than 100 plants**, which don't have the object of production (ex-USSR planned and build). They have industrial infrastructure, energetic, constructions, communications, other utilities. All plants need to be reengineered and retechnologized, reconstructed and a new education staff to be hired and trained.

If the **Government** of Republic of Moldova will offer a part (5 plants) of these plants for modernization the project will be have the **basis for the industrial platform**.

3). **Agriculture sector** concept now is based on use exclusively mechanical means (tractor). In case of extension of the autonomous photovoltaic station for the agriculture it would be possible to extend **ROBOTICS** in this area to reduce the manual works (up to 60 – 70 %), increase the industrial agriculture, improve the quality and security, and obtain other benefits. And **Moldova may be a country for this pilot experiment**.