**Terms of Reference**

**Study on the Potential of Agrivoltaic Systems in Uzbekistan for Agriculture and Livestock**

**Version of 28th of January 2025**

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| Project name | Uzbekistan Energy sector technical assistance program  23DDU0C027 |
| Assignment name | Consultancy for a study on the potential of agrivoltaic systems |
| Beneficiary | Ministry of Energy of Uzbekistan  Ministry of Agriculture of Uzbekistan |
| Country | Uzbekistan |
| Duration | 8 months |

**1. Background and Context**

Agrivoltaic systems, which combine solar photovoltaic (PV) energy generation with agricultural and livestock activities on the same land, offer a sustainable solution to optimize land use while enhancing both food and energy security. Uzbekistan, with its extensive agricultural lands, livestock sector, and abundant solar resources, stands to benefit from such integrated systems. This study aims to assess the potential of agrivoltaic systems in Uzbekistan, focusing on both crop production and livestock management.

**2. Objectives of the Study**

* **Primary Objective:** To evaluate the potential of agrivoltaic systems in Uzbekistan, specifically in the context of their application in agriculture and livestock management.
* **Specific Objectives:**
  1. Assess the solar energy potential across different regions of Uzbekistan suitable for agrivoltaic installations.
  2. Analyze the compatibility of various crops and livestock with agrivoltaic systems, considering local agricultural and livestock practices.
  3. Evaluate the economic feasibility of agrivoltaic systems in different agricultural and livestock settings.
  4. Analyse the impact of agrivoltaic on productivity and quality on agriculture and livestock (milk, meat, wool…)
  5. Identify environmental impacts and benefits of agrivoltaic systems, including water conservation, soil health, and livestock welfare.
  6. Assess the social implications, including potential benefits to local communities, impacts on food and livestock production, and challenges related to land use.
  7. Provide policy recommendations to support the development and adoption of agrivoltaic systems in Uzbekistan.

**3. Scope of Work**

The study will encompass the following tasks:

* **Task 1: Literature Review and Data Collection** 
  + Review best practices in agrivoltaic systems with a focus on agriculture and livestock integration (especially in France, Italy, Israel and USA or other countries demonstrating similarities with Uzbekistan).
  + Review of the different contractual existing schemes between the developers (in charge of developing, financing and operating the facility), the farmers (owner of the land) and the offtaker (in charge of buying the electricity produced) showing pros and cons of each contractual scheme.
  + Collect data on solar radiation, agricultural and livestock production, and land use in Uzbekistan.
* **Task 2: Technical Feasibility Assessment** 
  + Analyze the solar energy potential for agrivoltaic systems in different regions of Uzbekistan by identifying the various constraints (solar yield, soil erosion and drainage, wind resistance and use of trackers).
  + Assess the technical requirements for integrating PV systems with agricultural practices (e.g., crop selection, irrigation) and livestock management (e.g., shading, grazing patterns).
  + Assess the changes in resource management (water, food, grazing).
  + Field visit to Uzbekistan, assess agrovoltaic potential on croplands, pastures and greenhouses.
* **Task 3: Economic Analysis** 
  + Conduct a cost-benefit analysis of agrivoltaic systems, considering capital costs, operation and maintenance costs, crop yield, livestock productivity and quality (milk, meat, whool…), and energy production.
  + Evaluate potential revenue streams from agricultural produce, livestock products, and solar energy generation.
* **Task 4: Environmental Impact Assessment** 
  + Assess the environmental impacts of agrivoltaic systems, including effects on soil health, water usage, livestock welfare, and biodiversity.
  + Identify potential environmental benefits, such as improved microclimates for crops and livestock, reduced carbon emissions, and enhanced land use efficiency.
* **Task 5: Social Impact Assessment** 
  + Evaluate the social implications of agrivoltaic systems, including potential impacts on local communities, food security, and livelihoods.
  + Engage with stakeholders, including farmers, livestock herders, local communities, and government agencies, to gather insights and feedback.
* **Task 6: Policy and Regulatory Framework** 
  + Review existing policies and regulations relevant to agrivoltaic systems in Uzbekistan.
  + Provide recommendations for policy and regulatory adjustments to facilitate the adoption of agrivoltaic systems, especially those involving agriculture and livestock.
* **Task 7: Reporting and Dissemination** 
  + Compile the findings into a comprehensive report, including an executive summary, detailed analysis, and actionable recommendations.
  + Present the findings to relevant stakeholders through workshops or seminars.

**4. Methodology**

* **Data Collection:** Utilize both primary and secondary data sources, including satellite data for solar radiation, agricultural and livestock statistics, and interviews with stakeholders.
* **Analysis:** Apply quantitative and qualitative methods for analyzing technical feasibility, economic viability, and social and environmental impacts.
* **Stakeholder Engagement:** Conduct consultations with key stakeholders, including government agencies, farmers, livestock herders, local communities, and experts in renewable energy, agriculture, and livestock management.

**5. Deliverables**

* **Inception Report:** Detailed study plan, methodology, and work schedule.
* **Interim Reports:** Progress reports on key tasks, including preliminary findings.
* **Final Report:** Comprehensive analysis with recommendations and an executive summary.
* **Presentation Materials:** Slide deck summarizing the study’s key findings and recommendations.
* **Conducting presentation** to the Ministry of Energy and other national stakeholders.

All deliverables must be submitted in English and translated to Russian/or Uzbek. Meetings between the consulting team and Expertise France/AFD will be hold in English.

**6. Timeline**

The study is expected to be completed within 8 months from the start date. The timeline for key deliverables is as follows:

* **Month 1:** Inception Report
* **Month 3:** Completion of Literature Review and Data Collection
* **Month 4:** Interim Report on Technical and Economic Analysis
* **Month 5:** Interim Report on Environmental and Social Impact Assessments
* **Month 7:** Draft Final Report
* **Month 8:** Final Report and Presentation to Stakeholders

**7. Required Expertise**

The consulting team should possess the following expertise:

* Renewable energy experts with experience in solar PV systems.
* Agricultural specialists with knowledge of local farming practices and crop compatibility with agrivoltaic systems.
* Livestock management experts with experience in integrating livestock with PV systems.
* Environmental scientists with experience in impact assessments.
* Economists with expertise in cost-benefit analysis.
* Social scientists with experience in stakeholder engagement and social impact assessment.
* Partnership or consortium with local (Uzbekistan-based) firms or individual experts

**8. Submission**

Interested candidates are invited to submit a technical and financial offer in English including:

* A detailed curriculum vitae of experts;
* A technical proposal with the envisaged methodology;
* An estimated budget and work schedule;
* Relevant professional references.

**9. Selection criteria**

Applications will be assessed on the basis of the following criteria:

* Global understanding of the mission and compliance with the terms of reference
* Relevance of the proposed approach and methodology and of the work plan and timeline
* Relevance of the experience and competencies of the consulting team in relation with the profile defined in the terms of references
* Relevance of references and recommendations
* Price

**10. Reporting and Coordination**

The study will be managed by a designated Project Coordinator, who will ensure regular communication with the Client. The team will provide monthly progress updates and hold monthly/ or bi-monthly review meetings (or upon necessity) with the Client. In addition, the Ministry of Energy may appoint focal point to monitor the progress of assignment.