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Application of Kyoto mechanisms in attraction of carbon investments for implementation of projects on thermal utilization of solar energy.

CAPACT Project
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Contribution of thermal energy sector into gross emission of polluting matters of Uzbekistan

Gross emissions
- Transport: 68%
- Thermal energy sector: 12%
- Other sectors: 20%

Emissions from stationary resources
- Fuel mining and manufacturing sector: 42%
- Thermal energy sector: 35%
- Other sectors: 23%
Dynamics of emissions of pollutants in the Republic of Uzbekistan (stationary resources)
Thermal energy sector facilities produce biggest emission of sulphur dioxide in the Republic, i.e. - 44.16%.
Main functions of the Interstate Council on Clean Development Mechanism

(founded under Cabinet of Ministers by the Decree of the President of the Republic of Uzbekistan # PO-525 on December 6, 2006 “On implementation measures of investment projects in the frameworks of Clean Development Mechanism of Kyoto Protocol”)

- definition of priority directions of use of the Clean Development Mechanism;
- approval of rules and procedure for selection and endorsing of projects on Clean Development Mechanism on national level;
- approval of projects on Clean Development Mechanisms in national levels according to the results of conducted expertise from the side of authorized bodies;
- approval of draft Agreements on purchase of emission decrease between participants of the projects on Clean Development Mechanism.
Main tasks of the National Body of the Republic of Uzbekistan

(the Ministry of the Economy of the Republic is identified as the mentioned one by the Order # PO-525 on 6.12.2006)

- Preparation and selection of projects for implementation in the frameworks of the Clean Development Mechanism taking into consideration economic, environmental, social and technological interests of the republic of Uzbekistan, as well as creation of corresponding data base on them;
- Coordination of activity of authorized Ministries and departments on conduction of project expertise, proposed for implementation in the frames of the Clean Development Mechanism on accordance to the conditions of procedures, defined by article 12 of the Kyoto protocol, international and national criteria of sustainable development;
- Introduction of investment projects, proposed for implementation on Clean Development Mechanism, for approval to the Inter-departmental council.
National criteria of sustainable development

(defined by the Decree of the Cabinet of Ministers of the Republic of Uzbekistan # 9 on January 10, 2007 “On approval of Statement on order of preparation of investment projects in the frames of the Clean Development Mechanism of the Kyoto protocol”)

Economic:

- decrease of energy consumption and raw materials on end product unit;
- increase of production efficiency or use of natural resources through introduction of modern technologies;
- assistance in development of private sector market in the Republic of Uzbekistan.
National criteria of sustainable development

**Environmental:**
- Assistance to preservation and prevention of environment degradation;
- Minimization of natural resources use and production waste;
- Introduction of technologies, devoted to repeated use of raw materials and/or use of renewable energy sources (RES);
- Reduction of negative effect on environment.

**Social:**
- Assistance to growth of unemployment and increase of real incomes of community;
- Increase of health improvement of the personnel, involved in implementation of the project and community living in sides of project implementation;
- Increase of community awareness on issues of rational use of natural resources.
- **State support principle.**
  That principle can provide subsidizing of energy provision with use of solar energy objects, possessing strategic importance, as well as in cases when solar source is acting as a reserve energy source for objects, requiring high level of reliability of energy provision.

- **Municipal principle.**
  Energy provision of objects from RES, having social importance (for instance, far located villages) as well as objects being vulnerable from point of view of energy provision, should be organized based on that principle.

- **Sector principle.**
  According to that principle solar energy can be used for energy provision of objects, where technological and economical effects, covering unprofitability of solar station due to increase of reliability of the first ones.
Assessment of potential carbon investments for thermal utilization of solar energy projects

- Quantity of fuel (for instance, gas), which can be substituted due to thermal generation of solar collectors;
- Emission volume of greenhouse CO$_2$ at firing of calculated fuel content. It is required to know value of conversion fuel factor, carbon emission coefficient and degree of conversion of carbon to CO$_2$;
- Market value of unit (in equivalent tones) of predicted CO$_2$ emission;
- crediting period.
According to monitoring of several decades of years, annual radiation in Uzbekistan conditions is approximately equal to 2000 kWth/m².

Conversion to thermal units:

\[ 2000 \text{ kWth/m}^2 = 2 \times 10^3 \times 0.86 \times 10^3 \text{ kcal/m}^2 = 1.72 \text{ Gkal/m}^2 \]

At efficiency of solar collectors of 0.6, we get value of thermal specific quantity, generated by solar collector:

\[ Q = 1.72 \times 0.6 = 1 \text{ Gkal/m}^2 = 4.187 \text{ HJ/m}^2 \]

Definition of pure gas required for generation of mentioned quantity of thermo:

\[ V_0 = \frac{Q}{q} = \frac{4.187}{33.997} = 123 \text{ m}^3 \]

where \( q \) – caloric power of gas.

Taking into consideration losses at gas transportation, trap efficiency and losses whilst transportation of hot water, quantity of substituted gas is \( 180 \text{ cubic meters} \).
Reduction of CO$_2$ emission quantity from 1 m$^2$ of solar collectors

Definition of emission quantity of CO2 at firing of 180 cubic meters of gas

$$E_{CO} = V_0 q k_0 (44/12)$$

- $E_{CO}$ - CO2 emission volume, in tones;
- $V_0$ - gas volume, in thousand cubic meters – 0.180;
- $q$ - caloric capacity of fuel, in HJ/thousand cubic meters – 33,997;
- $c$ - carbon emission coefficient, in tones/HJ – 0.0153;
- $k_0$ - coefficient of carbon oxide fraction for this type of fuel - 0.995;
- $44/12$ – coefficient of conversion of carbon to CO2.

$$E_{CO} = 0.36 \text{ tones CO}_2.$$
Economic indicators at use of solar energy

- At market value of one ton of prevented CO$_2$ emission of 10 US dollars
- During crediting period of 10 years
- Total specific volume of attracted investments in the frames of the Clean Development Mechanism would be equal to 36 US dollars/square meter.
- It is approximately equal to 10% of total volume of required investments for implementation of the project.