

Kazakhstan Renewable Energy Financing Facility (KazREFF) - Strategic Environmental Review

Appendix A – Receptor ‘value’, ‘vulnerability’ and ‘sensitivity’



Appendix A: Receptor 'value', 'vulnerability' and 'sensitivity'

This SER has used expert judgement to determine the sensitivity of receptors based on the value of each receptor against the vulnerability of that receptor to changes resulting from each renewable energy scenario (Table A1 –A7). The value, vulnerability and sensitivity of receptors are defined as follows:

Value: the value of a receptor (either high or low) is based on the scale of geographic reference, rarity, importance for biodiversity, social or economic reasons, and level of legal protection;

Vulnerability: the vulnerability of a receptor (either high, medium, low or none) is based on likelihood of a receptor being exposed to an environmental effect from the KazREFF programme, and the receptor's tolerance and resilience to a given environmental effect;

Sensitivity: the sensitivity of a receptor is determined as being either high, medium, low or none, based on the combination of the receptor value and vulnerability, as identified below matrix.

		Value	
		High – receptor is rare, important for social or economic reasons, legally protected, of international or national designation	Low – receptor is common, of local or regional designation
Vulnerability	High e.g. potential pathways exist for environmental change in receptors as a result of KazREFF, receptor is in a declining condition, dependent on a narrow range of environmental conditions	High	Medium
	Medium e.g. few pathways exist for environmental change in receptors as a result of KazREFF, receptor is only expected to recover from disturbance over a prolonged period of time, if at all	Medium	Medium
	Low e.g. limited or no pathways exist for environmental change in receptors as a result of KazREFF, receptor is in stable or favourable condition &/ or dependent on wide range of environmental conditions	Medium	Low

	None e.g. no pathways exist between environmental changes and receptors, receptor is insensitive to disturbance	None	None
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1. Climate and Air quality

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-1.

Table A-1: Sensitivity of receptors for Climate and Air quality

Receptor		Wind		Solar PV		Small Hydro		Biogas	
Type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Climate	High - Climate is an global issue	None - Installation of wind turbine will not affect the climate	None	None - Installation of solar PV will not affect the climate	None	None - Installation of SSH will not affect the climate	None	None - Installation of biogas facility will not affect the climate	None
Air quality	High - Air quality is national priority which could be a trans boundary issue	Low - Limited impact is expected during the construction.	Medium	Low - There is limited impact during the construction.	Medium	Low - Limited impact is expected during the construction.	Medium	Low - Limited impact is expected during the construction.	Medium
Odour	Low - Odour is an issue with a limited area.	None - Wind power does not generate odours; therefore, there is no pathway.	None	None - Solar power does not generate odours; therefore, there is no pathway.	None	None - SSH power does not generate odours; therefore, there is no pathway.	None	None - Biogas can only occur on capped landfill, which reduces odours. Emissions are used to generate electricity and decrease emissions	None

2. Surface Water and Groundwater

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-2.

Table A-2: Sensitivity of receptors for Surface Water and Groundwater

Receptor		Wind		Solar PV		Small Hydro		Biogas	
type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Surface water resource	<p>High - Availability of surface water resources is of national importance, especially given water scarcity issues forecast for Kazakhstan.</p> <p>May also be a trans-boundary issue in some locations.</p>	<p>None - Wind farm development will not utilize water resources; therefore, there is no pathway for environmental change.</p>	<p>None</p>	<p>None - Solar PV plant development will not utilize water resources; therefore, there is no pathway for environmental change.</p>	<p>None</p>	<p>Medium - There is a potential to change surface water resources due to changes and usage of water as a power source in SSH systems.</p>	<p>Medium</p>	<p>None - Biogas plant development will not utilize water resources; therefore, there is no pathway for environmental change.</p>	<p>None</p>
Surface water quality	<p>High - Quality of surface water resources is of national importance, especially given water scarcity issues forecast for Kazakhstan.</p>	<p>High - Construction works, such as installation of turbine foundations and access roads, may cause erosion, surface run-off and sedimentation of surface waters if placed in close proximity to surface water resources.</p>	<p>High</p>	<p>High - Construction works, such as installation of solar panel and access roads, may cause erosion, surface run-off and sedimentation of surface waters if placed in close proximity to surface water resources.</p>	<p>High</p>	<p>High - Construction works may cause erosion, surface run-off and sedimentation of surface waters.</p> <p>Potential operational impact upon water quality due to disruption of flow, sediment dynamics, etc.</p>	<p>High</p>	<p>High - Construction works, such as installation of solar panel and access roads, may cause erosion, surface run-off and sedimentation of surface waters if placed in close proximity to surface water resources.</p>	<p>High</p>

3. Geology and soils

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-3.

Table A-3: Sensitivity of receptors for Geology and Soils

Receptors		Wind		Solar PV		Small Hydro		Biogas	
Type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Bedrock Geology	Low - Geology common to localities or region	Low - Pathways limited to construction blasting, drilling and foundations	Low	None - No likely potential pathway - construction of facilities are unlikely to require construction at depths that would affect bedrock geology	None	Low - Pathways limited to dam construction blasting, drilling and foundations	Low	None - No likely potential pathway - construction of facilities are unlikely to require construction at depths that would affect bedrock geology	None
Various receptors in Mudflow Hazard Areas (only in mudflow prone areas)	High - Mudflow hazards mostly in mountainous regions, adjacent to steep river banks, and along southern border mostly detrimental to environment, public health & welfare	None Mudflow prone areas are a siting constraint and facilities will not be sited in these areas. Therefore, there are no pathways.	None	None Mudflow prone areas are a siting constraint and facilities will not be sited in these areas. Therefore, there are no pathways.	None	Medium - Project construction activities, land clearing, vegetation removal, inundation along rivers in mudflow prone areas could increase chances for inducing mudflows in higher risk areas.	Medium	None - Mudflow prone areas are a siting constraint and facilities will not be sited in these areas. Therefore, there are no pathways.	None
High Value Soils (only where geographically present)	High - Primarily in Northern Kazakhstan, chernozems and other high value soils critical to agricultural productivity and economy	Medium - Facility footprint and construction activities can result in loss of use for agricultural purposes.	Medium	Medium - Facility footprint and construction activities can result in loss of use for agricultural purposes.	Medium	Medium - Small run-of-river project footprint limits pathways but impoundment can impact broader area. Construction activities, land clearing, removal of vegetation, alteration of drainage can increase erosion / loss of receptor	Medium	None - Most, if not all, biogas projects would be on previously degraded lands.	None
General Soil Characteristics	Low - General soils of all classifications are common and local	Medium - Removal of vegetation, erosion, potential release of chemicals, and compaction under heavy equipment and facilities can effect changes to soil characteristics.	Medium	Medium - Removal of vegetation, erosion, potential release of chemicals, and compaction under heavy equipment and facilities can effect changes to soil characteristics.	Medium	Medium - Removal of vegetation, erosion, potential release of chemicals, and compaction under heavy equipment and facilities can effect changes to soil characteristics.	Medium	Medium - Removal of vegetation, erosion, potential release of chemicals, and compaction under heavy equipment and facilities can effect changes to soil characteristics.	Medium

4. Landscape and Biodiversity

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-4.

Table A-4: Sensitivity of receptors for Landscape and Biodiversity

Receptor		Wind		Solar PV		Small Hydro		Biogas	
type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Protected areas	High - Protected areas are internationally, nationally and regionally important areas of natural habitat, supporting rare, endangered species.	High - There could be permanent loss of the large land areas occupied by the wind turbine development if sited in or near these areas. Receptors are dependent on narrow range of conditions.	High	High - There could be permanent loss of the large land areas occupied by the solar PV development if sited in or near these areas. Receptors are dependent on narrow range of conditions.	High	Medium - There would be limited area of footprint occupied by small hydro. Receptors are dependent on narrow range of conditions.	Medium	None - Candidate landfills for biogas facilities are not likely to be present in or near protected areas; however, transmission lines could impact these areas	None
Bird and bat species (migratory species)	High - Migratory species in Kazakhstan are internationally, nationally and regionally important.	High - There could be loss of population of migratory bird due to strike associated with turbine and additional above ground transmission line. Receptors are dependent on narrow range of conditions.	High	High - There could be loss of population of migratory bird due to additional above ground transmission line. Receptors are dependent on narrow range of conditions.	High	High - There could be loss of population of migratory bird due to additional above ground transmission line. Receptors are dependent on narrow range of conditions.	High	High - There could be loss of population of migratory bird due to additional above ground transmission line. Receptors are dependent on narrow range of conditions.	High
Important terrestrial species	High - Vulnerable or endangered species such as those species cited under the IUCN red list and Kazakhstan red list.	High - There could be loss of habitat of important terrestrial species by the wind turbine and transmission line development, particularly during construction. Receptors are in decline and dependent on narrow range of conditions.	High	High - There could be loss of habitat of important terrestrial species by the solar PV and transmission line development, particularly during construction. Receptors are in decline and dependent on narrow range of conditions.	High	High- There could be loss of habitat of important terrestrial species by the SSH and transmission line development, particularly during construction. Receptors are in decline and dependent on narrow range of conditions.	High	Medium - Candidate landfills for biogas facilities are not likely to provide useful habitat and would not support important terrestrial species. However, transmission lines could impact these species	Medium

Receptor		Wind		Solar PV		Small Hydro		Biogas	
type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Important Aquatic species	High - Vulnerable or endangered species such as those species cited under the IUCN red list and Kazakhstan red list.	High - Aquatic species could be affected by stormwater runoff, particularly during construction if sited close to water supporting important aquatic species	High	High - Aquatic species could be affected by stormwater runoff, particularly during construction if sited close to water supporting important aquatic species.	High	High - Change in water environment by withdrawal or discharge can have local and regional scale impact on affected water bodies and have potential to disrupt protected fish species if sited close to water supporting important aquatic species.	High	None	None
Forest Areas	High - Forest areas are limited in Kazakhstan	High - There could be permanent loss of the large land areas occupied by the wind turbine and transmission line development if sited in or near these areas.	High	High - There could be permanent loss of the large land areas occupied by the solar PV and transmission line development if sited in or near these areas.	High	Medium - There would be limited area of footprint occupied by small hydro; however, transmission lines could impact forested areas	Medium	Medium - Candidate landfills for biogas facility are not likely to have forest areas; however, transmission lines could impact these species	Medium
Unprotected natural ecosystems	Low- Network of general natural ecosystem	Low- There could be permanent loss of the large land areas occupied by the wind turbine development; however, the receptor is stable and common.	Low	Low- There could be permanent loss of the large land areas occupied by the solar PV development; however, the receptor is stable and common.	Low	Low- There would be limited area of footprint occupied by small hydro and the receptor is stable and common.	Low	None- Biogas facilities are not likely to be present in or near valued natural ecosystems - no pathway..	None
High quality landscape	High - Protected and forested areas are an important resources for visual amenity and unique landscapes character	High - The presence of wind turbine could directly affect the value of landscape of protected area, their setting and people experience of these landscapes.	High	High - The presence of Solar PV could directly affect the value of landscape of protected area, their setting and people experience of these landscapes.	High	Medium - Small Hydro facility may have local scale landscape impact.	Medium	None- Biogas facilities would be located on existing landfills, which already have a degraded visual character..	None

5. Community and Socio-economics

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-5.

Table A-5: Sensitivity of receptors for Community and Socio-economics

Receptor		Wind		Solar PV		Small Hydro		Biogas	
Type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Housing and Livelihood	High - Housing and livelihood are important and sensitive community issues.	High - If facility or transmission lines are sited in high density areas, could require resettlement or loss of livelihood.	High	High - If facility or transmission lines are sited in high density areas, could require resettlement or loss of livelihood.	High	High - If facility or transmission lines are sited in high density areas, could require resettlement or loss of livelihood.	High	Low - Possible resettlement for transmission lines.	Medium
Health	High - human health is a National importance	High - possible noise and dust during construction and noise and vibration during operation. Possible injury during construction and installation of transmission lines.	High	Medium - possible noise and dust disturbances during construction. Possible injury during construction and installation of transmission lines.	Medium	Medium - possible noise and dust disturbances during construction. Possible injury during construction and installation of transmission lines.	Medium	Low - possible noise and dust disturbances during construction. Positive impact to air quality by replacing fossil fuel and capping open landfill. Possible injury during construction and installation of transmission lines.	Medium
Local employment/income	Low - Unemployment rate is generally low and similar jobs are comment	Medium - Few pathways for increasing employment after construction.	Medium	Medium- Few pathways for increasing employment after construction.	Medium	Medium - Few pathways for increasing employment after construction.	Medium	Medium - Few pathways for increasing employment after construction.	Medium
Economy	High - balanced development of major sectors is critical for stable development	Medium - improvement in energy security. Permanent loss of	Medium	Medium - improvement in energy security. Permanent loss of	Medium	Medium - improvement in energy security. Water availability and quality for industry, mining and agriculture	Medium	Medium - improvement in energy security. Possibility of loss of land	Medium

Receptor		Wind		Solar PV		Small Hydro		Biogas	
Type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
		productive land (agriculture, grazing and mineral etc.) due to installation of equipment.		productive land (agriculture, grazing and mineral etc.) due to installation of equipment.		may be affected during construction and operation.		nutrients from the soil by using biogas for power generation.	
Tourism	Low - contribution of tourism to national economy is underdeveloped.	Low - Transmission lines might detract from the scenery but very limited pathways for change.	Low	Low - Transmission lines might detract from the scenery but very limited pathways for change.	Low	Low - Transmission lines might detract from the scenery but very limited pathways for change. Water impoundments may create additional recreation opportunities	Low	Low - Transmission lines might detract from the scenery but very limited pathways for change.	Low

6. Cultural Heritage

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-6.

Table A-6: Sensitivity of receptors for Cultural Heritage

Receptor		Wind		Solar PV		Small Hydro		Biogas	
type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
UNESCO World Heritage Sites and sites on the UNESCO Tentative List	High -	High - If project is sited on or near receptor.	High	High - If project is sited on or near receptor.	High	High - If project is sited on or near receptor.	High	High - If project is sited on or near receptor.	High
Registered cultural heritage sites.	High -	High - If project is sited on or near receptor.	High	High - If project is sited on or near receptor.	High	High - If project is sited on or near receptor.	High	High - If project is sited on or near receptor.	High
Unregistered or unknown cultural heritage sites	High to Low -	High - If project is sited on or near receptor.	High to Medium	High - If project is sited on or near receptor.	High to Medium	High - If project is sited on or near receptor.	High to Medium	High - If project is sited on or near receptor.	High to Medium
Intangible cultural heritage	High to Low -	Low - Possibility to cause change is unlikely, however impact should be evaluated locally.	Medium to Low	Low - Possibility to cause change is unlikely, however impact should be evaluated locally.	Medium to Low	Low - Possibility to cause change is unlikely, however impact should be evaluated locally.	Medium to Low	Low - Possibility to cause change is unlikely, however impact should be evaluated locally.	Medium to Low

7. Material assets

The value, vulnerability, and sensitivity of the environmental receptors for this topic are shown in Table A-7.

Table A-7: Sensitivity of receptors for Material assets

Receptor		Wind		Solar PV		Small Hydro		Biogas	
type	Value	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity	Vulnerability	Sensitivity
Infrastructure	High - Infrastructure is critical for stable development	Medium - Temporary impact to traffic during construction. Need to construct new transmission lines to connect with grid. Possible impact to the existing infrastructure due to equipment installation. Possible improvement in energy access and stability.	Medium	Medium - Temporary impact to traffic during construction. Need to construct new transmission lines to connect with grid. Possible impact to the existing infrastructure due to equipment installation. Possible improvement in energy access and stability.	Medium	Medium - Temporary impact to traffic during construction. Need to construct new transmission lines to connect with grid. Possible improvement in energy access and stability.	Medium	Medium - Temporary impact to traffic during construction. Possible impact to the existing facility due to equipment installation. Need to construct new transmission lines to connect with grid. Possible improvement in energy access and stability.	Medium

