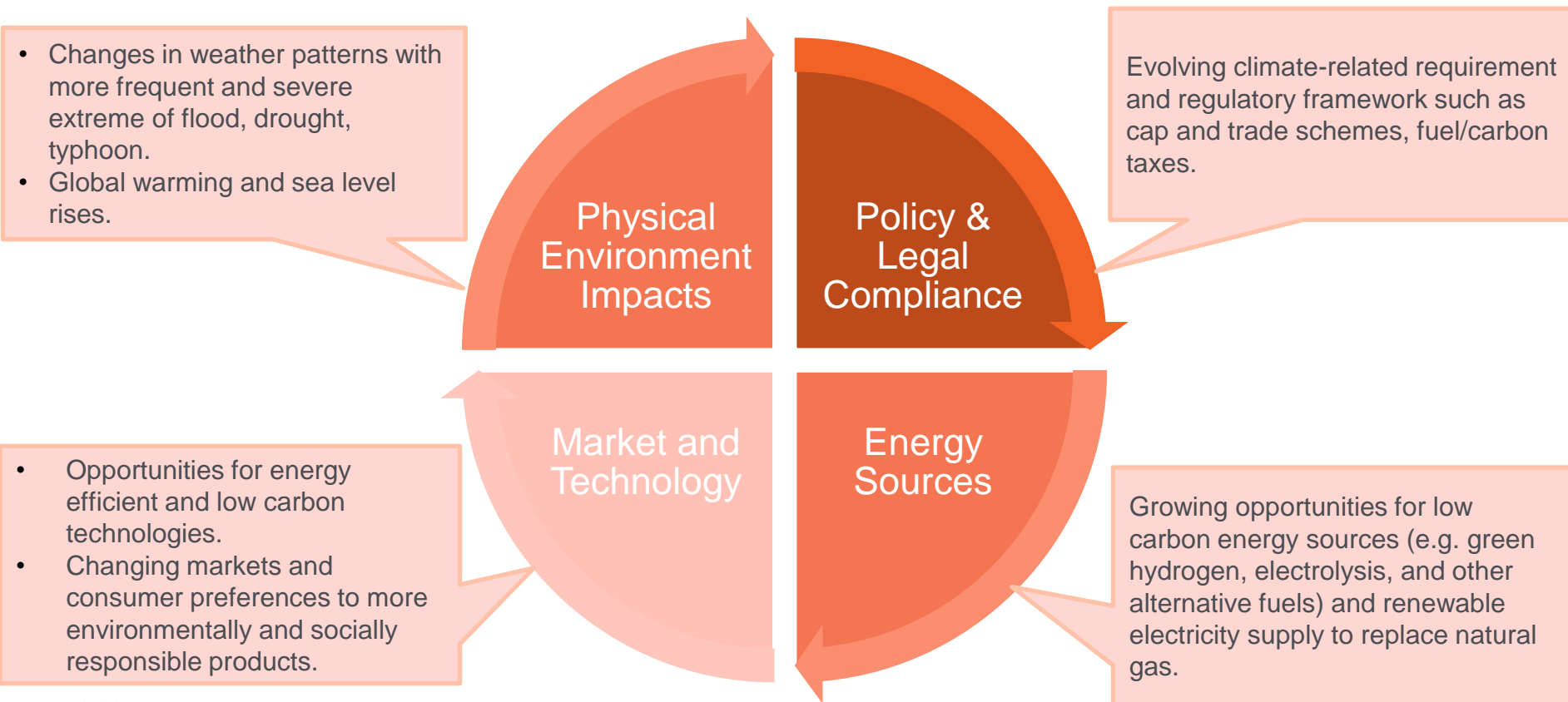


Physical climate risk adaptation plans

Climate change context – Risks and Opportunities



Physical risks

Physical risks	Aspects	Impact to businesses	Likelihood
Water Stress	Water shortage Sedimentation	<ul style="list-style-type: none"> Operational impact (steam turbine, potentially affect 25% of total electricity production). Affect to revenue and OPEX. 	5-10 years
Flooding	Flood	<ul style="list-style-type: none"> Affect to revenue, OPEX, CAPEX and maintenance. 	> 10 years
Typhoon	Damaged infrastructure	<ul style="list-style-type: none"> Impact transmission, solar panels, and ground infrastructure. Affect to revenue, OPEX, CAPEX and maintenance. 	5-10 years
Extreme heat	Temperature rise in cooling water, Possible damage and/or fire case in solar power plant	<ul style="list-style-type: none"> Lower efficiency of steam turbine, and solar panels. Disruption to distribution system. Affect to revenue, OPEX (gas consumption), and CAPEX (investment to temperature reduction). 	5-10 years
Sea level rise	Salinity in water supply	<ul style="list-style-type: none"> Affect to OPEX (chemicals for water treatment). 	Mostly > 10 years
Changing wind pattern	Altering wind direction and speed	<ul style="list-style-type: none"> Impact to energy output and overall financial performance for wind power plant. 	5-10 years

Adaptation Plans: Gas fired power plants

Consolidated Adaptation plans – Gas fired power plants

Physical risks	Likelihood	Adaptation plans	Implementation timeline
Water Stress Water Shortage	5-10 years	<ul style="list-style-type: none"> Monitoring of National Hydro Informatics. Emergency response plan, Business continuity plan, and Work Instruction in case of water shortage. Utilization of reclaimed water from water suppliers. List of suppliers who can provide backup water during crisis. Operational water-saving measures (e.g., maximize cooling water cycle, recycle water from clarifier). 	Continuous
		<ul style="list-style-type: none"> Upgrade wastewater treatment plant capacity 	< 5 years
Flooding	5-10 years	<ul style="list-style-type: none"> Monitoring of National Hydro Informatics, and flood water level from surrounding areas. Emergency response plan and Business continuity plan for flooding. Property insurance. Build flood wall/ dike, flood protection sump pumps, and maintain drainage system. 	Continuous
Typhoon Damaged infrastructure	5-10 years	<ul style="list-style-type: none"> Preventive maintenance on power plant and transmission line infrastructure. Emergency response plan and Business continuity plan for a transmission line. Monitoring climate from local Meteorological Department. 	Continuous
Extreme heat Temperature rise in cooling water	5-10 years	<ul style="list-style-type: none"> Upgrade equipment to withstand extreme heat conditions. Install Gas Turbine Air Intake Cooling System (Evaporative Cooler, Chiller). 	> 10 years < 5 years
Sea level rise Salinity in water supply	> 10 years	<ul style="list-style-type: none"> Online monitoring of raw water quality, National Hydro Informatics. Adjust the chemical or process of water treatment plants (e.g., resin). Upgrade equipment to prevent chloride corrosion. 	Continuous < 5 years
		<ul style="list-style-type: none"> Water desalination plant. 	> 10 years

Adaptation Plans: Solar power plant

Consolidated Adaptation plans – Solar power plants (Thailand)

Physical risks	Likelihood	Adaptation plans	Implementation timeline
Flooding	> 10 years	<ul style="list-style-type: none"> Monitoring of National Hydro Informatics, and flood water levels from surrounding areas. Emergency response plan and Business continuity plan for flooding. Property insurance. Build flood wall/ dike, maintain drainage system, sandbag. 	Continuous
Typhoon Damaged infrastructure	5-10 years	<ul style="list-style-type: none"> Preventive maintenance of power plant and transmission line infrastructure. Monitoring climate from the local Meteorological Department. Engineering design tolerates wind speed 0-25 or 0-30 m/s (location specific). 	Continuous
Extreme heat Possible damage and/or fire case on equipment	5-10 years	<ul style="list-style-type: none"> Emergency response plan on fire and short-circuit cases with periodic drills at plants. Daily visual inspection and monthly IR camera inspection to detect heat spots. Property Insurance. Study on solution to cooling PV module, and feasibility of installing additional batteries. 	Continuous 5-10 years

Adaptation Plans: Wind power plants

Consolidated Adaptation plans – Wind power plants

Physical risks	Likelihood	Adaptation plans	Implementation timeline
Flooding	5-10 years	<ul style="list-style-type: none"> Monitoring of National Hydro Informatics, and flood water level from surrounding areas. Emergency response plan and Business continuity plan for flooding. Property insurance. Build flood wall/dike and maintain drainage system. 	Continuous
Typhoon Damaged infrastructure	5-10 years	<ul style="list-style-type: none"> Preventive maintenance on power plant and transmission line infrastructure. Monitoring climate from local Meteorological Department. Engineering design tolerates wind speed of 20-30 m/s (location specific). 	Continuous
Changing Wind Pattern Altering wind direction and speed	5-10 years	<ul style="list-style-type: none"> Monitoring of Meteorology information and adjusting the production plan accordingly. More alternatives for wind adjustment mode. Improve equipment efficiency and storage capacity to buffer with deviation from production plan. 	Continuous < 5 years

Adaptation Plans: Hydropower plants

Consolidated Adaptation plans – Hydropower plants

Physical risks	Likelihood	Adaptation plans	Implementation timeline
Water Stress Water Shortage Sedimentation	Continuous	<ul style="list-style-type: none"> Monitoring of National Hydro Informatics, rainfall intensity, and flash flood. Emergency response plan and Business continuity plan for lack of raw water. Improve equipment efficiency and storage capacity to buffer with deviation from production plan. 	Continuous < 5 years
Flooding	5-10 years	<ul style="list-style-type: none"> Monitoring of National Hydro Informatics, and flood water level from surrounding areas. Emergency response plan and Business continuity plan for flooding. Property insurance. 	Continuous
Typhoon Damaged infrastructure	5-10 years	<ul style="list-style-type: none"> Preventive maintenance on power plant and transmission line infrastructure. Monitoring climate from the local Meteorological Department. Spillway design to protect the structure from high water volume. 	Continuous