TECH mahindra

Scenario Analysis

Experience the Future. **NOW.**

Scenario Analysis

Introduction

- **Scenario analysis** is a strategic planning tool used to explore how an organization might perform (based on its flexibility, resilience, or robustness) in different future states (sometimes referred to as “alternative worlds”). Regarding climate-related risks and opportunities, scenario analysis enables an organization to explore and develop an understanding of how climate change might impact their business over time.
- It focuses on a range of forward-looking variables rather than historic data. Crucially, scenario analysis not only identifies potential risks but can also offer insights into opportunities, including energy efficiency, changes in energy sources and/or technologies, new products and services, new markets or assets, and increased resilience.
- At **Tech Mahindra**, we are cognizant of climate-related risks and how they affect our resilience and financial stability. To further understand the impact that climate change can have on our business in future, we performed a high-level assessment of the impact of **RCP4.5** & **RCP8.5** and **IEA NZE 2050** & **IEA 2DS** scenarios for Physical & Transition risks, respectively. Moreover, these scenario models are aligned with the recommendations of TCFD (Task Force on Climate-Related Financial Disclosures).

Physical Risks

Representative Concentration Pathway (RCP)

Introduction

- RCP scenarios are developed by **IPCC (Intergovernmental Panel on Climate Change)**.
- RCPs are time and space dependent trajectories of concentrations of GHGs and pollutants from human activities (including changes in land use).
- RCP's provide a quantitative description of atmospheric pollutants over time as well as radiative forces in **2100**.
- Originally, the RCPs include a stringent mitigation scenario (**RCP2.6**), two intermediate scenarios (**RCP4.5** and **RCP6.0**), and one scenario with very high GHG concentration (**RCP8.5**) – all of which are labelled after a possible range of radiative forcing values in the year **2100** (**2.6**, **4.5**, **6**, and **8.5 W/m2**, respectively).
- Scenarios without additional efforts to constrain emissions ('baseline scenarios') lead to pathways ranging between **RCP6.0** and **RCP8.5**.

Scenario 1

RCP4.5

- **RCP4.5** is a stabilization scenario in which total radiative forcing is stabilized to **4.5 W/m2** shortly after **2100**, without overshooting the long-run radiative forcing target level. It is consistent with relatively ambitious emissions reductions and GHG emissions increasing slightly before declining around **2040**. **RCP4.5** is broadly aligned with the 2015 NDC's (until 2030), followed rapidly by peaking and then a 50% reduction in global emissions by 2080.
- Based on the assumptions for **RCP4.5**, we analyzed the effect of Radiative Forcing on Increased Precipitation, i.e., excessive rainfall leading to flooding (considering India operations).
- Assumptions – Research suggests that more than **30 mm** of rainfall per hour or **720 mm** per day can be considered as high intensity rainfall and can lead to floods.
- Additionally, a Trend analysis of annual rainfall and its impact over the cities of India using **CMIP5** models under different RCP scenarios shows Future climate projection, the results of which reveal that the annual mean rainfall is expected to change by:

RCP4.5		
Term	Min.	Max.
Near (2011-39)	0.10%	2.20%
Mid (2040-69)	-0.30%	0.70%
Late (2070-99)	1.50%	3.20%

Increased Precipitation Scenario (Near Term)

RCP4.5

Term	Near (2011-39)
Scenario	RCP4.5

	Annual Mean Rainfall (mm)										
City	2016	2017	2018	2019	2020	2021	2022	Average	Min	Max	Scenario Average
Hyderabad	874.78	544.40	745.00	699.70	1340.10	1044.70	1377.50	**946.60**	947.54	967.42	957.48
Noida	584.20	770.00	798.00	784.00	651.90	721.00	700.00	**715.59**	716.30	731.33	723.81
Bangalore	798.00	1700.00	1050.00	950.00	1210.00	1510.00	1956.99	**1310.71**	1312.02	1339.55	1325.79
Pune	941.20	1091.80	941.00	750.00	763.00	721.60	925.00	**876.23**	877.10	895.51	886.31
Chennai	1036.60	1393.80	754.80	1227.00	984.10	1866.00	867.40	**1161.39**	1162.55	1186.94	1174.74
Bhubaneshwar	1185.00	1530.00	1430.00	1888.60	1515.36	1628.00	1621.53	**1542.64**	1544.18	1576.58	1560.38
Mumbai	2894.50	2946.30	2239.60	2514.00	3686.80	3000.00	2317.00	**2799.74**	2802.54	2861.34	2831.94
Vizag	1170.10	1014.90	943.60	1074.90	1037.20	1071.00	1120.20	**1061.70**	1062.76	1085.06	1073.91
Chandigarh	656.56	1067.80	883.00	938.70	1202.67	735.50	1171.44	**950.81**	951.76	971.73	961.74
Nagpur	908.00	896.70	1058.30	1243.60	999.90	1064.10	938.50	**1015.59**	1016.60	1037.93	1027.26
Kolkata	1689.40	1920.30	1467.00	1815.20	1852.32	1582.00	1338.08	**1666.33**	1667.99	1702.99	1685.49
Gandhinagar	653.60	1207.20	326.50	906.60	750.00	769.00	793.36	**772.32**	773.10	789.31	781.20

Increased Precipitation Scenario (Mid Term)

RCP4.5

Term	Mid (2040-69)
Scenario	RCP4.5

	Annual Mean Rainfall (mm)										
City	2016	2017	2018	2019	2020	2021	2022	Average	Min	Max	Scenario Average
Hyderabad	874.78	544.40	745.00	699.70	1340.10	1044.70	1377.50	**946.60**	943.76	953.22	948.49
Noida	584.20	770.00	798.00	784.00	651.90	721.00	700.00	**715.59**	713.44	720.59	717.02
Bangalore	798.00	1700.00	1050.00	950.00	1210.00	1510.00	1956.99	**1310.71**	1306.78	1319.89	1313.33
Pune	941.20	1091.80	941.00	750.00	763.00	721.60	925.00	**876.23**	873.60	882.36	877.98
Chennai	1036.60	1393.80	754.80	1227.00	984.10	1866.00	867.40	**1161.39**	1157.90	1169.52	1163.71
Bhubaneshwar	1185.00	1530.00	1430.00	1888.60	1515.36	1628.00	1621.53	**1542.64**	1538.01	1553.44	1545.73
Mumbai	2894.50	2946.30	2239.60	2514.00	3686.80	3000.00	2317.00	**2799.74**	2791.34	2819.34	2805.34
Vizag	1170.10	1014.90	943.60	1074.90	1037.20	1071.00	1120.20	**1061.70**	1058.51	1069.13	1063.82
Chandigarh	656.56	1067.80	883.00	938.70	1202.67	735.50	1171.44	**950.81**	947.96	957.47	952.71
Nagpur	908.00	896.70	1058.30	1243.60	999.90	1064.10	938.50	**1015.59**	1012.54	1022.69	1017.62
Kolkata	1689.40	1920.30	1467.00	1815.20	1852.32	1582.00	1338.08	**1666.33**	1661.33	1677.99	1669.66
Gandhinagar	653.60	1207.20	326.50	906.60	750.00	769.00	793.36	**772.32**	770.01	777.73	773.87

Increased Precipitation Scenario (Late Term)

RCP4.5

Term	Late (2070-99)
Scenario	RCP4.5

	Annual Mean Rainfall (mm)										
City	2016	2017	2018	2019	2020	2021	2022	Average	Min	Max	Scenario Average
Hyderabad	874.78	544.40	745.00	699.70	1340.10	1044.70	1377.50	**946.60**	960.80	976.89	968.84
Noida	584.20	770.00	798.00	784.00	651.90	721.00	700.00	**715.59**	726.32	738.48	732.40
Bangalore	798.00	1700.00	1050.00	950.00	1210.00	1510.00	1956.99	**1310.71**	1330.37	1352.66	1341.51
Pune	941.20	1091.80	941.00	750.00	763.00	721.60	925.00	**876.23**	889.37	904.27	896.82
Chennai	1036.60	1393.80	754.80	1227.00	984.10	1866.00	867.40	**1161.39**	1178.81	1198.55	1188.68
Bhubaneshwar	1185.00	1530.00	1430.00	1888.60	1515.36	1628.00	1621.53	**1542.64**	1565.78	1592.01	1578.89
Mumbai	2894.50	2946.30	2239.60	2514.00	3686.80	3000.00	2317.00	**2799.74**	2841.74	2889.33	2865.54
Vizag	1170.10	1014.90	943.60	1074.90	1037.20	1071.00	1120.20	**1061.70**	1077.63	1095.67	1086.65
Chandigarh	656.56	1067.80	883.00	938.70	1202.67	735.50	1171.44	**950.81**	965.07	981.24	973.15
Nagpur	908.00	896.70	1058.30	1243.60	999.90	1064.10	938.50	**1015.59**	1030.82	1048.08	1039.45
Kolkata	1689.40	1920.30	1467.00	1815.20	1852.32	1582.00	1338.08	**1666.33**	1691.32	1719.65	1705.49
Gandhinagar	653.60	1207.20	326.50	906.60	750.00	769.00	793.36	**772.32**	783.91	797.04	790.47

Scenario 2

RCP8.5

- **RCP8.5** is characterized by increasing GHG emissions over time and rising radiative forcing to **8.5 W/m2** in **2100**. It is representative of scenarios in the IPCC's literature that lead to high GHG concentration levels. It is consistent with a future of no policy changes to reduce emissions and increasing GHG emissions. **RCP8.5** is broadly aligned with current policies or business-as-usual scenario.
- Based on the assumptions for **RCP8.5**, we analyzed the effect of Radiative Forcing on Increased Precipitation, i.e., excessive rainfall leading to flooding (considering India operations).
- Assumptions – Research suggests that more than **30 mm** of rainfall per hour or **720 mm** per day can be considered as high intensity rainfall and can lead to floods.
- Additionally, a Trend analysis of annual rainfall and its impact over the cities of India using **CMIP5** models under different RCP scenarios shows Future climate projection, the results of which reveal that the annual mean rainfall is expected to change by:

RCP8.5		
Term	Min.	Max.
Near (2011-39)	3.60%	7.90%
Mid (2040-69)	3.70%	6.60%
Late (2070-99)	8.50%	14.00%

Increased Precipitation Scenario (Near Term)

RCP8.5

Term	Near (2011-39)
Scenario	RCP8.5

	Annual Mean Rainfall (mm)										
City	2016	2017	2018	2019	2020	2021	2022	Average	Min	Max	Scenario Average
Hyderabad	874.78	544.40	745.00	699.70	1340.10	1044.70	1377.50	**946.60**	980.67	1021.38	1001.03
Noida	584.20	770.00	798.00	784.00	651.90	721.00	700.00	**715.59**	741.35	772.12	756.73
Bangalore	798.00	1700.00	1050.00	950.00	1210.00	1510.00	1956.99	**1310.71**	1357.90	1414.26	1386.08
Pune	941.20	1091.80	941.00	750.00	763.00	721.60	925.00	**876.23**	907.77	945.45	926.61
Chennai	1036.60	1393.80	754.80	1227.00	984.10	1866.00	867.40	**1161.39**	1203.20	1253.14	1228.17
Bhubaneshwar	1185.00	1530.00	1430.00	1888.60	1515.36	1628.00	1621.53	**1542.64**	1598.18	1664.51	1631.34
Mumbai	2894.50	2946.30	2239.60	2514.00	3686.80	3000.00	2317.00	**2799.74**	2900.53	3020.92	2960.73
Vizag	1170.10	1014.90	943.60	1074.90	1037.20	1071.00	1120.20	**1061.70**	1099.92	1145.57	1122.75
Chandigarh	656.56	1067.80	883.00	938.70	1202.67	735.50	1171.44	**950.81**	985.04	1025.92	1005.48
Nagpur	908.00	896.70	1058.30	1243.60	999.90	1064.10	938.50	**1015.59**	1052.15	1095.82	1073.98
Kolkata	1689.40	1920.30	1467.00	1815.20	1852.32	1582.00	1338.08	**1666.33**	1726.32	1797.97	1762.14
Gandhinagar	653.60	1207.20	326.50	906.60	750.00	769.00	793.36	**772.32**	800.13	833.34	816.73

Increased Precipitation Scenario (Mid Term)

RCP8.5

Term	Mid (2040-69)
Scenario	RCP8.5

	Annual Mean Rainfall (mm)										
City	2016	2017	2018	2019	2020	2021	2022	Average	Min	Max	Scenario Average
Hyderabad	874.78	544.40	745.00	699.70	1340.10	1044.70	1377.50	**946.60**	981.62	1009.07	995.35
Noida	584.20	770.00	798.00	784.00	651.90	721.00	700.00	**715.59**	742.06	762.81	752.44
Bangalore	798.00	1700.00	1050.00	950.00	1210.00	1510.00	1956.99	**1310.71**	1359.21	1397.22	1378.21
Pune	941.20	1091.80	941.00	750.00	763.00	721.60	925.00	**876.23**	908.65	934.06	921.35
Chennai	1036.60	1393.80	754.80	1227.00	984.10	1866.00	867.40	**1161.39**	1204.36	1238.04	1221.20
Bhubaneshwar	1185.00	1530.00	1430.00	1888.60	1515.36	1628.00	1621.53	**1542.64**	1599.72	1644.46	1622.09
Mumbai	2894.50	2946.30	2239.60	2514.00	3686.80	3000.00	2317.00	**2799.74**	2903.33	2984.53	2943.93
Vizag	1170.10	1014.90	943.60	1074.90	1037.20	1071.00	1120.20	**1061.70**	1100.98	1131.77	1116.38
Chandigarh	656.56	1067.80	883.00	938.70	1202.67	735.50	1171.44	**950.81**	985.99	1013.56	999.78
Nagpur	908.00	896.70	1058.30	1243.60	999.90	1064.10	938.50	**1015.59**	1053.16	1082.61	1067.89
Kolkata	1689.40	1920.30	1467.00	1815.20	1852.32	1582.00	1338.08	**1666.33**	1727.98	1776.31	1752.14
Gandhinagar	653.60	1207.20	326.50	906.60	750.00	769.00	793.36	**772.32**	800.90	823.30	812.10

Increased Precipitation Scenario (Late Term)

RCP8.5

Term	Late (2070-99)
Scenario	RCP8.5

	Annual Mean Rainfall (mm)										
City	2016	2017	2018	2019	2020	2021	2022	Average	Min	Max	Scenario Average
Hyderabad	874.78	544.40	745.00	699.70	1340.10	1044.70	1377.50	**946.60**	1027.06	1079.12	1053.09
Noida	584.20	770.00	798.00	784.00	651.90	721.00	700.00	**715.59**	776.41	815.77	796.09
Bangalore	798.00	1700.00	1050.00	950.00	1210.00	1510.00	1956.99	**1310.71**	1422.12	1494.21	1458.17
Pune	941.20	1091.80	941.00	750.00	763.00	721.60	925.00	**876.23**	950.71	998.90	974.80
Chennai	1036.60	1393.80	754.80	1227.00	984.10	1866.00	867.40	**1161.39**	1260.10	1323.98	1292.04
Bhubaneshwar	1185.00	1530.00	1430.00	1888.60	1515.36	1628.00	1621.53	**1542.64**	1673.77	1758.61	1716.19
Mumbai	2894.50	2946.30	2239.60	2514.00	3686.80	3000.00	2317.00	**2799.74**	3037.72	3191.71	3114.71
Vizag	1170.10	1014.90	943.60	1074.90	1037.20	1071.00	1120.20	**1061.70**	1151.94	1210.34	1181.14
Chandigarh	656.56	1067.80	883.00	938.70	1202.67	735.50	1171.44	**950.81**	1031.63	1083.92	1057.78
Nagpur	908.00	896.70	1058.30	1243.60	999.90	1064.10	938.50	**1015.59**	1101.91	1157.77	1129.84
Kolkata	1689.40	1920.30	1467.00	1815.20	1852.32	1582.00	1338.08	**1666.33**	1807.97	1899.61	1853.79
Gandhinagar	653.60	1207.20	326.50	906.60	750.00	769.00	793.36	**772.32**	837.97	880.45	859.21

Transition Risks

IEA NZE 2050

Introduction

- The Net Zero Emissions by 2050 Scenario (NZE) is a normative IEA (International Energy Agency) scenario that shows a pathway for the global energy sector to achieve net zero CO2 emissions by **2050**, with advanced economies reaching net zero emissions in advance of others.
- This scenario also meets key energy-related United Nations Sustainable Development Goals (SDGs), in particular by achieving universal energy access by **2030** and major improvements in air quality.
- It is consistent with limiting the global temperature rise to **1.5°C** with no or limited temperature overshoot (with a **50%** probability), in line with reductions assessed in the IPCC in its Sixth Assessment Report.
- The IEA NZE scenario uses more renewables, energy efficiency, and hydrogen – and less CO2 capture, negative emissions and bioenergy – than IPCC scenarios of a comparable ambition.

IEA NZE 2050

Scenario

- As per IEA, by **2030**, **renewable energy capacity** needs to be increased by **4 times**, **EV sales** by **18 times** & **energy intensity (GDP as denominator)** reduction of **4% per year** as per **2020** levels to achieve net zero goals for **2050**.
- In this scenario, the energy intensity is going down by **4%** each year starting from **2020** and going till **2030**. So, a model of Tech Mahindra's Energy consumption with respect to the Purchasing Power Parity (PPP) of the employees and power and fuel expenses ranging from **2020** to **2030** is created.
- The examination of energy intensity, power consumption and fuel usage per capita reveals a significant correlation between development and energy consumption patterns. Companies experiencing rapid growth tend to exhibit higher energy intensity, indicating an increased reliance on energy resources to support industrialization and infrastructure expansion. Conversely, developed companies show comparatively lower energy intensity as a result of more efficient energy utilization and a shift towards cleaner energy resources.

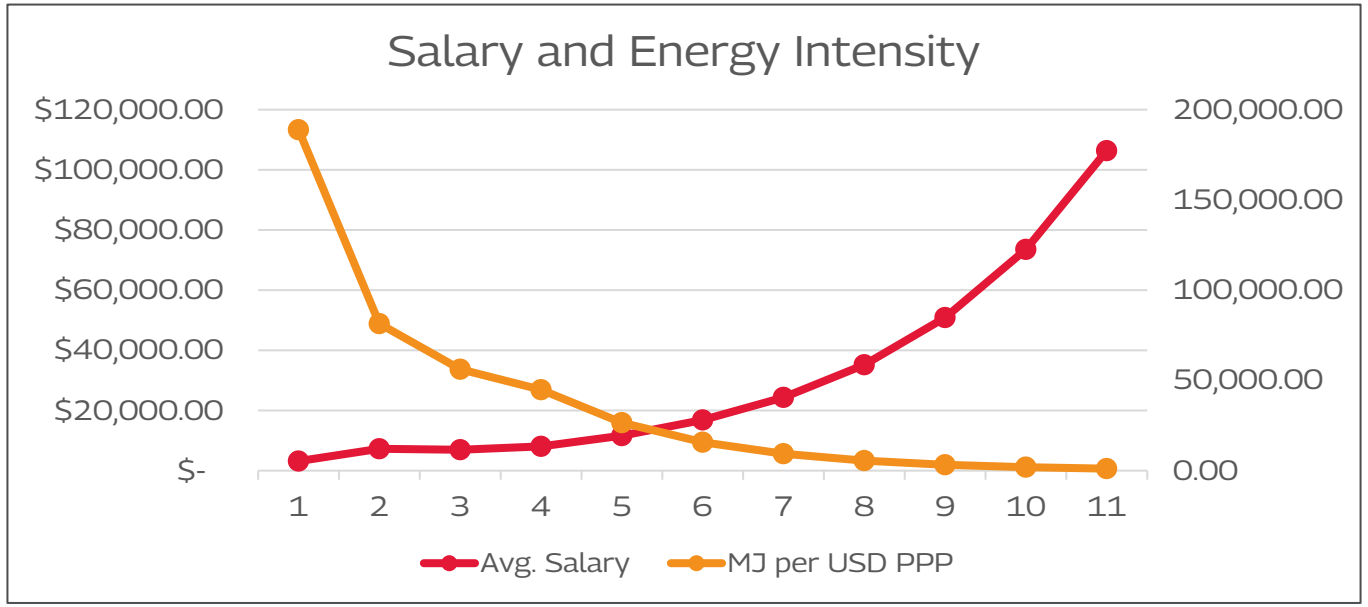
IEA NZE 2050

Analysis

- Here, the energy consumption of Tech Mahindra in Gigajoules (until **2023**) is taken and forecasted using the average method till **2030**, which gives us a declining pattern for the consumption of the energy.
- After that, the energy consumption is converted into Megajoules for the follow up calculation which includes the Average basic salary of an employee of Tech Mahindra.
- Then, the energy intensity with respect to the Purchasing Power Parity (PPP) of the employees of Tech Mahindra is calculated which also shows a declining trendline indicating that the company is moving towards more energy efficient methods and cleaner energy resources.
- But, as of now, there is still a difference of around **$50k** as compared to the scenario of **4%** decline each year. However, the calculations still show that Tech Mahindra can achieve this energy intensity in the upcoming years by moving with a rate of **17%** which is much higher than the expected scenario.

IEA NZE 2050

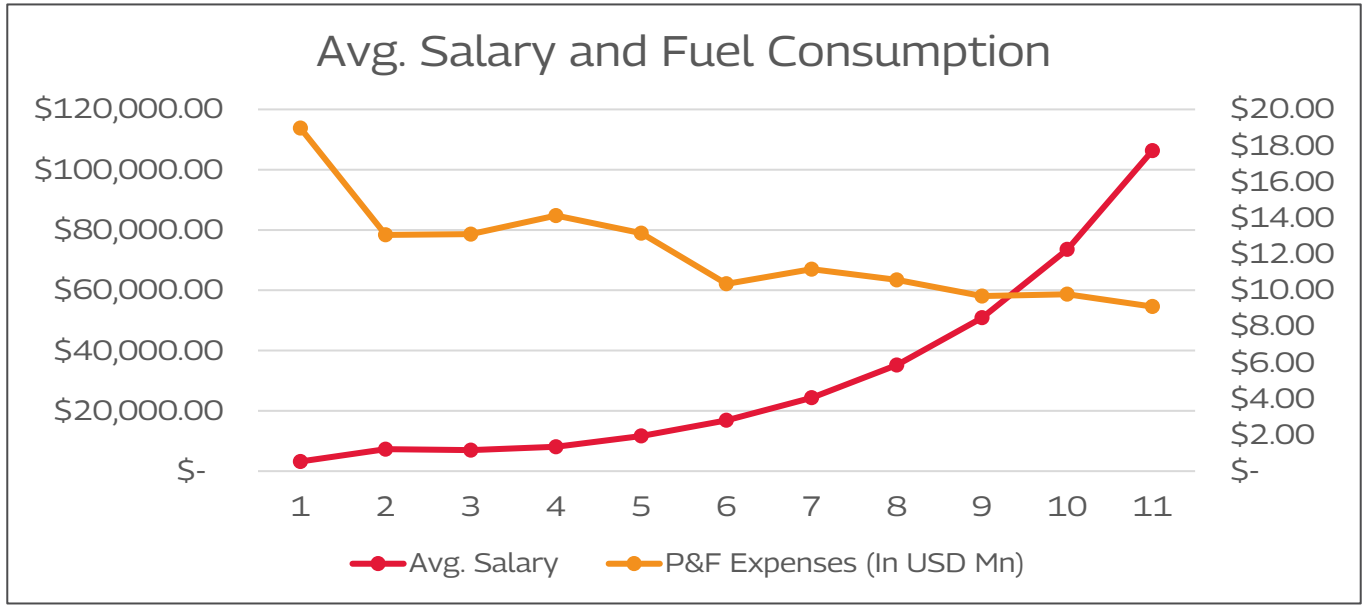
Analysis



		Actual				Projected						
		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy	Energy Consumed (GJ)	599,391.00	592,145.00	390,521.52	361,013.00	309,490.72	265,321.49	227,455.90	194,994.34	167,165.56	143,308.38	122,856.00
	Energy Consumed (MJ)	599,391,000	592,145,000	390,521,520	361,013,000	309,490,721	265,321,487	227,455,904	194,994,340	167,165,555	143,308,380	122,856,002
Average Salary ~PPP	INR	240,000.00	532,000.00	527,000.00	662,076.00	985,076.26	1,465,655.35	2,180,689.66	3,244,560.46	4,827,451.04	7,182,570.29	10,686,657.51
	USD	3,173.76	7,276.71	6,953.42	8,057.39	11,647.98	16,838.62	24,342.34	35,189.92	50,871.46	73,541.10	106,312.92
Energy Intensity	MJ per USD PPP	188,858.11	81,375.42	56,162.48	44,805.19	26,570.34	15,756.73	9,344.52	5,541.20	3,286.04	1,948.68	1,155.61

IEA NZE 2050

Analysis



Here, we can see that the Power and fuel consumption is decreasing every year due to which the Average salary of the employees is getting increased.

Correlation b/w Salary & Fuel Expenses	**-0.75634891**

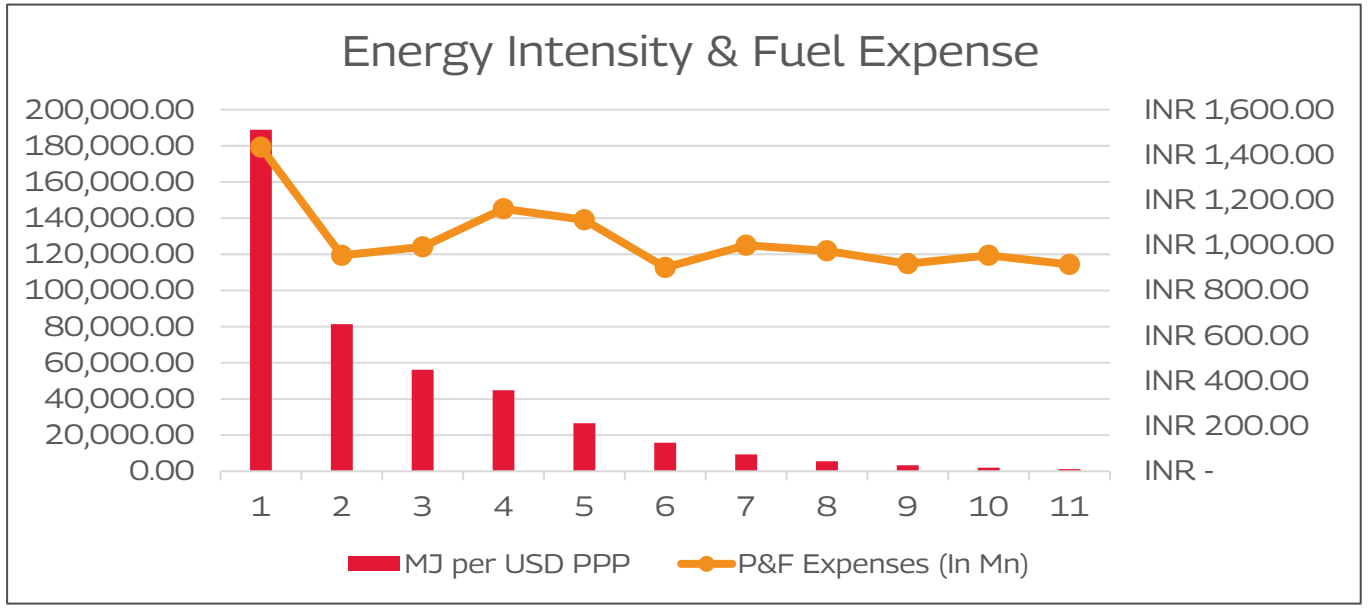
IEA NZE 2050

Analysis

- Finally, the power and fuel expenses of Tech Mahindra is considered for each year (until **2023**) and using the average method, forecasted it till **2030**, to find a correlation between energy intensity and fuel consumption.
- It shows a positive correlation (**0.92**) which implies that as Tech Mahindra is moving towards and adapting more renewable energy resources, their energy intensity is also getting lowered which results in lower consumption of Power and hence, fossil fuels. Although, this increases the consumption of electricity and the associated costs, it is far more efficient in the long run to achieve net zero targets.

IEA NZE 2050

Analysis



		Actual				Projected						
		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy Intensity	MJ per USD PPP	118,858.11	81,375.42	56,162.48	44,805.19	26,570.34	15,756.73	9,344.04	5,541.20	3,286.04	1,948.68	1,155.61
Power & Fuel Expenses	P&F Expenses (in INR million)	1,434.00	955.00	993.00	1,161.00	1,112.60	901.30	1000.00	974.85	918.54	955.32	914.59
	P&F Expenses (in USD million)	18.96	13.06	13.10	14.13	13.16	10.35	11.16	10.57	9.68	9.78	9.10

Correlation b/w Energy Intensity & Fuel Consumption	**0.92**

IEA 2DS

Introduction

- IEA's WEO (World Energy Outlook) 2DS scenario is built on a projected warming limit of **2°C** and is part of the publication – *"Energy Technology Perspective"*, providing scenario analysis based on the development of lower carbon technology and deployment in various sectors.

- The ETP 2DS:
  1. Sets out an energy system development pathway and an emissions trajectory consistent with at least a **50%** chance of limiting the average global temperature rise to **2°C**.
  2. Sets the target of cutting CO2 emissions by almost **60%** by **2050** (compared with 2013), followed by continued decline after **2050** until carbon neutrality is reached.
  3. Identifies changes that help ensure a secure and affordable energy system in the long run, while emphasizing that transforming the energy sector is vital, but not enough on its own.

IEA 2DS

Scenario

- According to IMF, the world needs a global tax of **USD 75 per tonne** by **2030** to reduce emissions to a level consistent with a **2˚C** warming target.
- Being a Service- based organization, most of our energy consumption is from Electricity purchased from Grid.
- Since, most of the electricity sourced from grid is generated from Non-Renewable sources, i.e., fossil fuels etc. Therefore, in a country like India, the impact of carbon taxes, i.e., taxing fossil fuels can lead to increased costs of Grid electricity.
- Although, such taxes can accelerate the development of clean energy solutions, they can have a significant impact on the Operating costs of an organization up to **2050**, considering a **2DS** scenario.
- Hence, a scenario analysis of the impact of caron tax on per unit price of electricity in India shows a significant increase in costs.

IEA 2DS	
˚C	Emissions Reduction
2	60%

IEA 2DS

Analysis

Year	2050
Scenario	IEA 2DS

	Annual Electricity Tariff (INR/kWh)											
City	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average	Scenario Price
Hyderabad	6.94	7.17	7.41	7.65	7.91	8.17	8.44	8.72	9.00	10.00	8.14	**INR 15.62**
Noida	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	6.50	8.30	**INR 15.78**
Bangalore	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.15	8.02	**INR 15.50**
Pune	7.93	7.99	8.04	8.10	8.16	8.22	8.28	8.34	8.40	11.86	8.53	**INR 16.01**
Chennai	14.41	13.41	12.47	11.61	10.80	10.05	9.35	8.70	8.05	7.10	10.59	**INR 18.08**
Bhubaneshwar	7.80	7.80	7.80	7.80	7.80	7.80	7.80	7.80	7.80	7.80	7.80	**INR 15.28**
Mumbai	7.93	7.99	8.04	8.10	8.16	8.22	8.28	8.34	8.40	8.55	8.20	**INR 15.68**
Vizag	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	9.75	7.28	**INR 14.76**
Chandigarh	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	5.00	6.26	**INR 13.74**
Nagpur	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	9.38	7.24	**INR 14.72**
Kolkata	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.45	8.05	**INR 15.53**
Gandhinagar	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	4.50	7.65	**INR 15.13**

Thank You

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