



WORKING PAPER

ASSEMBLY — 41ST SESSION

ECONOMIC COMMISSION

Agenda Item 37: Aviation Data — Monitoring and Analysis

REPORT ON THE UPDATED LONG-TERM TRAFFIC FORECASTS WITH POST-COVID-19 PANDEMIC SCENARIOS

(Presented by the Council of ICAO)

EXECUTIVE SUMMARY

This working paper reports on activities in the area of forecasts and planning in accordance with Assembly Resolution A40-9, which requested the Council to continue to update the single set of long-term traffic forecasts (LTF). The pre-COVID-19 pandemic LTF indicated a 4.2 per cent compound annual growth rate (CAGR) of global passenger traffic from 2018 to 2050 while the CAGR for the same period in the mid scenario of the post-COVID-19 pandemic LTF was reduced to 3.6 per cent. The global freight traffic would maintain the same growth rate of 3.5 per cent. The paper also presents ICAO's plan for future work related to forecasting and planning (part of ICAO Business Plan 2023-2025 Operating Plan Output DEV 4 – Enhanced capabilities of States to maximize the utility of aviation data/statistics and long-term traffic forecasts). It is planned, inter alia, that the long-term traffic forecasts will be updated biannually so as to maximize the utility of LTF at granular level and that the econometric methodologies will be continuously refined.

Action: The Assembly is invited to:

- a) review the work accomplished by ICAO in paragraphs 2 and 3;
- b) endorse the Organization's work programme as presented in paragraph 4; and
- c) consider the information contained in this paper for the update of Assembly Resolution A40-9, Consolidated statement of continuing ICAO policies in the air transport field.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objective — <i>Economic Development of Air Transport</i> .
<i>Financial implications:</i>	The activities referred to in this paper will be undertaken subject to the resources available in the 2023-2025 Regular Programme Budget and/or from extra budgetary contributions, including the Voluntary Air Transport Fund (TRAF).
<i>References:</i>	Doc 10140, <i>Assembly Resolutions in Force</i> (as of 4 October 2019) Doc 10139, <i>Report of the Economic Commission of the 40th Session of the Assembly</i> A40-WP/20-EC/5, Report on the Updated Long-term Traffic Forecasts A41-WP/15-EC/5, ICAO Statistics Programme and Big Data Analytics A41-WP/17-EC/7, Consolidated Statement of Continuing ICAO Policies in the Air Transport Field ICAO Business Plan 2023-2025

1. BACKGROUND

1.1 Since the development of the ICAO single set of long-term traffic forecasts (LTF) in 2016, the Secretariat has been regularly updating the forecasts in accordance with Assembly Resolution A40-9 (Appendix E), through working with the Multi-disciplinary Working Group on Long-term Traffic Forecasts (MDWG-LTF)¹ under the Aviation Data and Analysis Panel (ADAP).

1.2 The LTF presented to the 40th Session of the Assembly had used year 2015 as a baseline (A40-WP/20-EC/5 refers). As a follow up to A40-9, and in response to the request of the Committee on Aviation Environmental Protection (CAEP), it was updated in early 2020, using year 2018 as a baseline and extending the forecast period to 2050 (hereinafter referred to as pre-COVID-19 LTF). Because of the significant impact of the COVID-19 pandemic, further update was made in early 2021 to account for both the estimated traffic decline and recovery paths during the pandemic years as well as the impact on long-term projection (hereinafter referred to as post-COVID-19 LTF).

2. PRE-COVID-19 LTF

2.1 The pre-COVID-19 LTF was presented in terms of annual Revenue Passenger-Kilometres (RPK) for 50 route groups and annual Freight Tonnes-Kilometres (FTK) for six statistical regions. The data and model specification is summarized in Appendix A. The predicted values of RPKs and FTKs were used to compute the Compound Annual Growth Rate (CAGR) of passenger and freight traffic for a 10-year (2018-2028), 20-year (2018-2038), 30-year (2018-2048), and 32-year (2018-2050) period. The detailed results are presented in Appendix B.

2.2 According to this projection, global passenger traffic was expected to grow at 4.2 per cent annually from 2018 to 2038. The top 15 fastest-growing route groups were dominated by those involving Central South West Asia, among which the Central South West Asia – Middle East was estimated to have the highest annual growth rate at 8.3 per cent. Route groups within/between Africa, Central America/Caribbean and the Middle East would grow around the global pace. Lower growth rates were forecasted for route groups within/between mature markets such as domestic Europe, North America, and North Asia.

2.3 Global freight traffic was expected to grow at 3.5 per cent annually for the same period. The Middle East would have the highest growth outpacing global estimate by 2.7 percentage points, followed by Africa. Asia/Pacific was expected to grow at an almost identical pace to the global estimate. The growth rate of North America and Europe would be slightly slower than the global estimate while Latin America/Caribbean was expected to grow the slowest among all regions at lower than 2 per cent.

3. POST-COVID-19 LTF

3.1 It is certain that the pre-COVID-19 LTF could no longer be held due to the significant impact of the COVID-19 pandemic. Given the high uncertainties surrounding the recovery,

¹ Membership of the MDWG-LTF consists of: Canada, China, France, India, Kenya, Tunisia, Turkey, United Kingdom, United States, Airports Council International (ACI), EUROCONTROL, International Air Transport Association (IATA), International Coordinating Council of Aerospace Industries (ICCAIA) and International Transport Forum at the Organisation for Economic Co-operation and Development (ITF-OECD)

post-COVID-19 LTF was structured with three indicative scenarios, i.e. mid, high and low, as described in **Appendix C**.

3.2 In updating the passenger LTF, while the coefficients of variables in the pre-COVID-19 LTF model remain unchanged, the latest socio-economic projections were applied to reflect the COVID-19 related changes in real gross domestic product (GDP) and population. In addition, short-term impacts of the pandemic on air traffic and possible recovery paths were accounted for by introducing adjustment factors that align the mid scenario with the assumptions used for the forecasts of the International Air Transport Association (IATA). In the mid scenario, air traffic was estimated to return to 2019 levels in 2024.

3.3 Results of passenger LTF are presented in Appendix D. The first table provides a comparison of global RPK CAGRs between the pre-COVID-19 LTF (2018 baseline) and three post-COVID-19 scenarios. The second table presents 32-year RPK CAGRs comparison by route group for the three scenarios. The global 32-year mid CAGR is at 3.6 per cent, down from 4.2 per cent estimated by the pre-COVID-19 LTF. This reduction can be translated into a loss of up to USD 40 trillion to global economies and up to 100 trillion reduction in seat capacity (measured in Available Seat Kilometres) over the 2020-2050 period.

3.4 The freight LTF was also recalculated in the similar manner to the passenger LTF, using the pre-COVID-19 LTF model with updated economic projections and taking into account the scale of the 2020 downturn and short-term recovery based on inputs from the MDWG-LTF and information from IATA.

3.5 Results of freight LTF are presented in Appendix E. The first table provides a comparison of global FTK CAGRs between the pre-COVID-19 LTF (2018 baseline) and three post-COVID-19 scenarios. The second table presents 32-year FTK CAGRs comparison by region for the three scenarios. The global 32-year mid CAGR is at 3.5 per cent, similar to the level of pre-COVID-19 LTF.

4. FUTURE FORECASTING AND PLANNING WORK

4.1 Given the ever-changing market conditions and high traffic volatility during the recovery phase, it is imperative that Member States and aviation stakeholders can access updated forecasts to meet their post-pandemic planning and implementation needs. The more frequent update to the LTF will enable Member States and stakeholders to better align capacity with expected demand, thus reducing the risk associated with the uncertainties due to the COVID-19 pandemic.

4.2 The updated traffic forecasts are also critical to effectively deliver the results of all ICAO's Strategic Objectives, including but not limited to: estimation of future trends of noise, emissions and particulate matter; conduct of business case, cost-benefit analysis, economic impact analysis and cost-effectiveness analysis in developing aviation infrastructure programmes and plans, as well as the Aviation System Block Upgrades (ASBUs); and establishment of evaluation and monitoring frameworks in alignment with the Global Aviation Safety Plan (GASP), the Global Air Navigation Plan (GANP), the Global Aviation Security Plan (GASep) and adequate oversight system.

4.3 To meet all these needs, ICAO continues to update the LTF, utilizing official reported traffic data in its Statistics Programme as well as analyzing big data sources, i.e. Automatic Dependent

Surveillance-Broadcast (ADS-B) and Market Intelligence Data Transfer (MIDT) (A41-WP/15-EC/5 refers). These data will be used in conjunction with macro-economic data (such as GDP and population) obtained from external sources. The combination of these different data repositories with the econometric models of the LTF can generate biannual updates to the forecasts, besides reducing the lag between the current year and the start year of the forecasts. Through the ICAO Civil Aviation Data Solutions (iCADS) platform, updates of the forecasts (such as flights, seats, passengers and freight tonnes carried) will be made available to Member States at a granular level, ranging from airports, cities, countries to route-groups.

4.4 As described in the ICAO Business Plan 2023-2025, the focus and priority of future work in the area of forecasts and planning (a part of Output DEV 4 – Enhanced capabilities of States to maximize the utility of aviation data/statistics and long-term traffic forecasts) will be placed on: a) maximizing the utility of the LTF through the biannual updates at granular level and their customization according to the needs and; and b) continuous refinement of the econometric methodologies and data set by working with the MDWG-LTF under ADAP. Furthermore, the Organization will, inter alia, update the licensed aviation personnel forecasts (pilots, maintenance personnel and air traffic controllers). Considering the exponential growth of e-commerce cargo, ICAO will coordinate with the ITF-OECD, Universal Postal Union (UPU) and the United Nations Conference on Trade and Development (UNCTAD) to develop a methodology for forecasting the growth of e-commerce by mode of air transport.

APPENDIX A

DATA AND MODEL SPECIFICATION FOR PRE-COVID-19 LTF²

Passenger Forecasts

Demand for passenger air travel is measured by Revenue Passenger-Kilometres (RPKs). The historical time-series data set of RPKs by city-pair and carrier from 1995 to 2018 for both international and domestic operations was used for the passenger forecasts.

The compilation of the data sets includes following sources:

- a) *actual* traffic data reported by States to ICAO through the Air Transport Reporting Forms A, B and C, the coverage of which was over 90 per cent of passenger traffic and 95 per cent of freight traffic;
- b) *actual* origin and destination passenger traffic data collected through the Market Intelligence Data Transfer (MIDT) big data; and
- c) *estimated* traffic data based on the airline schedules published in the Official Airline Guide (OAG) and aircraft operations recorded in the Automatic Dependent Surveillance-Broadcast (ADS-B) big data, which were used to fill the gaps.

Similar to the previous LTF, passenger traffic data were segmented into 40 international and 10 domestic route groups. These 50 route groups were also assigned to six different “tiers” according to the income level and market maturity in the same manner as previous forecasts. The income thresholds to segregate the tiers were updated from the most recent World Bank data of low, lower-middle, upper-middle and high-income economies.

The model examines how passenger demand (passenger traffic in RPKs) is affected by real Gross Domestic Product (GDP) per capita and cost of travel (airfares), and predicts annual change in RPKs for each route group. The passenger forecasts model is as the following:

$$\Delta \log \widehat{RPK}_{PC_{rt}} = \sum_{i=1, j=1}^6 \beta_i (T_j * \Delta \log GDP_{PC_{rt}}) + \beta_{Oil} \Delta \log_{rt} Oil_{rt} Year Indicators$$

i: Tier Coefficient Index, j: Tier Index, t: Time, r: Route Group

² More details about the methodology followed by the MDWG-LTF can be found at this page: <https://www.icao.int/sustainability/Pages/eap-fp-guidance.aspx>

Economic and demographic data were sourced from the International Transport Forum at the Organization for Economic Co-operation and Development (ITF-OECD). This includes real GDP per capita in 2011 constant USD, which varies from the data in 2005 constant USD used for the previous forecasts.

Freight Forecasts

Demand for freight is measured by Freight Tonne-Kilometres (FTKs). The historical time-series data set of FTKs at the regional level were extended from 1995-2015 to 1995-2018 for both international and domestic operations. The data sets were compiled from the similar sources as for the passenger forecasts with the exception of MIDT data.

Economic data was taken from the same source as the passenger traffic forecasts and aggregated by region to preserve the relatively large heterogeneity amongst the different regions in terms of the relationship between FTKs and real GDP. Forecasting model remains similar to previous freight forecasts. The freight forecasts model is as the following:

$$\log FTK_{Rt} = \widehat{\alpha} + \beta \log GDP_{Rt}$$

t: Time, R: Region

APPENDIX B

PRE-COVID-19 LTF

PASSENGER TRAFFIC FORECASTS (RPKs)

Route Group	10 Year (2018-2028)	20 Year (2018-2038)	30 Year (2018-2048)	32 Year (2018-2050)
Africa	4.6%	5.0%	5.2%	5.3%
Africa - Asia/Pacific	5.8%	5.3%	5.1%	5.1%
Africa - Middle East	4.6%	5.2%	5.5%	5.6%
Africa - North America	1.8%	2.2%	2.6%	2.7%
Africa & Middle East - Central America/Caribbean	4.2%	4.7%	5.3%	5.5%
Africa & Middle East - South America	4.2%	4.6%	5.0%	5.0%
Central America/Caribbean	3.5%	3.9%	4.1%	4.1%
Central America/Caribbean - Europe	3.7%	3.9%	3.7%	3.7%
Central America/Caribbean - North America	3.2%	3.4%	3.3%	3.3%
Central America/Caribbean - South America	4.3%	4.5%	4.2%	4.2%
China & South West Asia - North Asia	8.7%	7.7%	6.9%	6.7%
China & South West Asia - Pacific South East Asia	6.5%	6.2%	6.2%	6.1%
Central Southwest Asia	6.9%	6.0%	5.2%	5.1%
Central Southwest Asia - Europe	5.2%	4.7%	4.5%	4.5%
Central Southwest Asia - Middle East	8.0%	8.3%	8.2%	8.2%
Central Southwest Asia - North America	5.9%	4.9%	4.5%	4.4%
Europe	2.6%	2.8%	3.0%	3.0%
Europe - Middle East	3.4%	3.2%	3.2%	3.3%
Europe - North Africa	3.6%	4.0%	4.2%	4.3%
Europe - North America	2.5%	2.7%	2.9%	2.9%
Europe - North Asia	2.5%	2.7%	2.9%	2.9%
Europe - Pacific South East Asia	4.3%	4.2%	4.1%	4.0%
Europe - South America	3.6%	3.3%	3.3%	3.3%
Europe - Sub Saharan Africa	1.9%	2.2%	2.5%	2.6%
Intra Africa	4.6%	5.0%	5.2%	5.3%
Intra Central America/Caribbean	3.5%	3.9%	4.1%	4.1%
Intra China & South West Asia	7.0%	5.9%	5.1%	5.0%
Intra Europe	2.6%	2.8%	3.0%	3.0%
Intra Middle East	3.6%	3.9%	4.0%	4.0%
Intra North America	2.3%	2.5%	2.7%	2.7%
Intra North Asia	2.2%	2.5%	2.5%	2.5%

Intra Pacific South East Asia	5.1%	5.1%	5.2%	5.2%
Intra South America	3.9%	3.6%	3.5%	3.4%
Latin America/Caribbean - China	6.5%	5.5%	4.8%	4.7%
Latin America/Caribbean - North Asia & Pacific South East Asia	5.0%	4.5%	4.2%	4.2%
Middle East	3.6%	3.9%	4.0%	4.0%
Middle East - North America	2.8%	2.8%	2.9%	3.0%
Middle East - North Asia & Pacific South East Asia	4.4%	4.1%	4.0%	4.0%
North America	2.3%	2.5%	2.7%	2.7%
North America - North Asia	2.3%	2.5%	2.7%	2.7%
North America - Pacific South East Asia	4.0%	4.1%	3.9%	3.9%
North America - South America	3.3%	3.1%	3.1%	3.1%
North Asia	2.2%	2.5%	2.5%	2.5%
North Asia - Pacific South East Asia	4.7%	4.7%	4.4%	4.3%
Pacific South East Asia	5.1%	5.1%	5.2%	5.2%
South America	3.9%	3.6%	3.5%	3.4%
World	4.2%	4.2%	4.2%	4.2%

FREIGHT TRAFFIC FORECASTS (FTKs)

Region	10 Year (2018-2028)	20 Year (2018-2038)	30 Year (2018-2048)	32 Year (2018-2050)
Middle East	6.1%	6.2%	6.1%	6.1%
Asia and Pacific	4.1%	3.5%	3.1%	3.0%
Africa	3.4%	3.9%	4.1%	4.1%
North America	3.0%	3.1%	3.2%	3.2%
Europe	1.4%	1.7%	1.9%	1.9%
Latin America/Caribbean	0.8%	1.1%	1.2%	1.2%
World Total	3.5%	3.5%	3.5%	3.5%

APPENDIX C

POST-COVID-19 FORECAST SCENARIO ASSUMPTIONS

Passenger LTF Assumptions

Commercial Passenger Market							
Scenario/Assumption	Vaccine	Global Economic Activity	Regional Variation	Route Variation -- Domestic/International	Business Travel Demand	Return to 2019 RPKs	Return to pre-crisis Trend (levels)
High	Announced early 2021 Available/wide spread use mid/late 2021	V-shaped recovery -- back to 2019 levels in early 2021	--Solid and sustained global recovery --Asia (China) pick-up quickly in 2021 --Recovery in traffic tracks economic growth (NA/EUR follow Asia)	--Domestic traffic responds quickly particularly in U.S./Europe/Asia (China) --International lags somewhat (2022) --solid income growth drives leisure travel	-- Business Travel growth resumes late 2021 --Returns to normal levels in 2022 -- Drives solid recovery in both markets (B2B and conferences)	2023	Yes -- around 2030
Mid	Announced mid-2021 Available/wide spread use early/mid 2022	Return to 2019 levels in late 2021/2022 (running behind the optimistic outlook)	-- Recovery lags economic growth (some behavioral changes/lower incomes) -- Resumption in domestic traffic first -- International lags --China/Asia leads the recovery, followed by NA and EUR	--Domestic traffic growth resumes in 2022 U.S./Europe/Asia (China) --International lags (2023) -- Lower incomes reduce leisure travel	--Business Travel growth resumes in late 2022/2023, but never fully returns to normal levels (i.e., some permanent reduction due to substitutes -- Zoom, etc.)	2024	No -- permanent shift due to substitution of online technologies for business and changes in household vacation/travel patterns

Commercial Passenger Market							
Scenario/Assumption	Vaccine	Global Economic Activity	Regional Variation	Route Variation -- Domestic/International	Business Travel Demand	Return to 2019 RPKs	Return to pre-crisis Trend (levels)
Low	Announced early 2022 Available/wide spread use late 2022/early 2023	Return to 2019 levels by 2023/2024	--Recovery lags economic growth -- resumption in domestic traffic slow to gain traction --International lags further behind --China/Asia and developing nations lead recovery. NA and EUR lag.	--Domestic traffic resumes growth in 2024 Asia (China) --International lags (2025) -- Lower incomes reduce leisure travel	--Business travel does not fully recover --Permanent and sustained loss in domestic/international travel as a result.	2027	No -- permanent shift due to substitution of online technologies for business and changes in household vacation/travel patterns

Freighter LTF Assumptions

Freighter Market					
Scenario/Assumption	Vaccine	Economic Activity	Regional Variation	Return to 2019 RTKs	Return to pre-crisis Trend (levels)
High	Announced early 2021 Available/wide spread use mid/late 2021	V-shaped recovery -- back to 2019 levels in early 2021	Regional variation will depend upon differences in regional economic activity -- Pacific/Asia & Asia/Middle East will lead, followed by North America/Europe	2021	Yes
Mid	Announced mid-2021 Available/wide spread use early/mid 2022	Return to 2019 levels in late 2021/2022 (running behind the optimistic outlook)	Regional variation will depend upon differences in regional economic activity -- Pacific/Asia & Asia/Middle East will lead, followed by North America/Europe	2022	Yes

Freighter Market					
Scenario/Assumption	Vaccine	Economic Activity	Regional Variation	Return to 2019 RTKs	Return to pre-crisis Trend (levels)
Low	Announced early 2022 Available/wide spread use late 2022/early 2023	Return to 2019 levels by 2023/2024	Regional variation will depend upon differences in regional economic activity -- Pacific/Asia & Asia/Middle East will lead, followed by North America/Europe	2023	Dependent upon economic forecast

APPENDIX D

POST-COVID-19 PASSENGER LTF

Global CAGR RPK Comparison

	10 Year (2018-2028)	20 Year (2018-2038)	30 Year (2018-2048)	32 Year (2018-2050)
COVID-19 : Low	1.2%	2.4%	2.8%	2.9%
COVID-19 : Mid	2.6%	3.3%	3.5%	3.6%
COVID-19 : High	3.6%	4.1%	4.2%	4.2%
2018 LTF	4.2%	4.2%	4.2%	4.2%

32-Year CAGR RPK Comparison by Route Group

Route Group	2018 LTF	COVID-19: High	COVID-19: Mid	COVID-19: Low
Africa	5.3%	5.0%	4.5%	4.0%
Africa - Asia/Pacific	5.1%	4.9%	4.3%	3.5%
Africa - Middle East	5.6%	5.2%	4.6%	3.8%
Africa - North America	2.7%	3.1%	2.5%	1.7%
Africa & Middle East - Central America/Caribbean	5.5%	4.8%	4.3%	3.6%
Africa & Middle East - South America	5.0%	4.7%	4.1%	3.3%
Central America/Caribbean	4.1%	3.9%	3.2%	2.8%
Central America/Caribbean – Europe	3.7%	3.8%	3.2%	2.6%
Central America/Caribbean - North America	3.3%	3.7%	3.0%	2.1%
Central America/Caribbean - South America	4.2%	3.9%	3.3%	2.6%
China – Europe	4.2%	4.0%	3.4%	2.7%
China - Middle East	4.7%	4.5%	3.8%	3.0%
China - North America	4.3%	4.2%	3.5%	2.7%
China & South West Asia - North Asia	6.7%	6.3%	5.5%	4.4%
China & South West Asia - Pacific South East Asia	6.1%	5.9%	5.2%	4.4%
China/Mongolia	4.7%	5.0%	4.3%	3.4%
Europe	3.0%	3.1%	2.7%	2.3%
Europe - Middle East	3.3%	3.3%	2.7%	2.2%
Europe - North Africa	4.3%	4.4%	3.8%	3.1%

Europe - North America	2.9%	3.2%	2.6%	2.1%
Europe - North Asia	2.9%	3.0%	2.5%	2.2%
Europe - Pacific South East Asia	4.0%	4.1%	3.5%	2.8%
Europe - South America	3.3%	3.3%	2.7%	2.2%
Europe - South West Asia	5.0%	5.0%	4.4%	3.7%
Europe - Sub Saharan Africa	2.6%	2.8%	2.3%	1.9%
Intra Africa	5.3%	5.0%	4.5%	4.0%
Intra Central America/Caribbean	4.1%	3.9%	3.2%	2.8%
Intra China & South West Asia	5.0%	4.8%	4.2%	3.4%
Intra Europe	3.0%	3.1%	2.7%	2.3%
Intra Middle East	4.0%	3.6%	3.0%	2.5%
Intra North America	2.7%	3.1%	2.5%	1.8%
Intra North Asia	2.5%	2.6%	2.2%	1.8%
Intra Pacific South East Asia	5.2%	4.9%	4.3%	3.6%
Intra South America	3.4%	3.2%	2.7%	2.2%
Latin America/Caribbean – China	4.7%	4.5%	3.9%	3.1%
Latin America/Caribbean - North Asia & Pacific South East Asia	4.2%	3.9%	3.3%	2.7%
Middle East	4.0%	3.6%	3.0%	2.5%
Middle East - North America	3.0%	3.3%	2.6%	1.8%
Middle East - North Asia & Pacific South East Asia	4.0%	3.8%	3.2%	2.5%
Middle East - South West Asia	8.7%	8.1%	7.3%	6.2%
North America	2.7%	3.1%	2.5%	1.8%
North America - North Asia	2.7%	3.0%	2.4%	1.8%
North America - Pacific South East Asia	3.9%	4.2%	3.5%	2.5%
North America - South America	3.1%	3.3%	2.6%	1.9%
North America - South West Asia	5.2%	5.3%	4.6%	3.5%
North Asia	2.5%	2.6%	2.2%	1.8%
North Asia - Pacific South East Asia	4.3%	4.2%	3.6%	2.9%
Pacific South East Asia	5.2%	4.9%	4.3%	3.6%
South America	3.4%	3.2%	2.7%	2.2%
South West Asia	6.8%	6.4%	5.8%	4.9%
World	4.2%	4.2%	3.6%	2.9%

APPENDIX E

POST-COVID-19 FREIGHTER LTF

Global CAGR FTK Comparison

	10 Year (2018-2028)	20 Year (2018-2038)	30 Year (2018-2048)	32 Year (2018-2050)
COVID-19 : Low	2.3%	2.5%	2.6%	2.6%
COVID-19 : Mid	3.5%	3.4%	3.5%	3.5%
COVID-19 : High	4.1%	4.1%	4.2%	4.2%
2018 LTF	3.5%	3.5%	3.5%	3.5%

32-Year CAGR FTK Comparison by region

Region	2018 LTF	COVID-19: High	COVID-19: Mid	COVID-19: Low
Middle East	6.1%	7.2%	6.0%	4.4%
Asia and Pacific	3.0%	3.5%	3.1%	2.6%
Africa	4.1%	4.6%	3.8%	3.0%
North America	3.2%	3.9%	3.2%	2.1%
Europe	1.9%	2.4%	1.9%	1.5%
Latin America/Caribbean	1.2%	1.5%	1.2%	0.8%
World Total	3.5%	4.2%	3.5%	2.6%

— END —