



ICAO PARIS UNITING AVIATION

Agenda Item 4

Air Navigation Performance Framework

ICAO EUR 2020 Performance Report

2019 data collection exercise

Version reflecting State submissions up to 26 November 2020

EASPG/02

Paris, France

1 -4 December 2020



Contents

- Executive summary
 - Slides 3-5
- Introduction
 - Slides 6-15
- Contextual data (Table A)
 - Slides 16-28
- Performance data (Table B)
 - Slides 29-76



Executive Summary





- a) The EUR region is characterised by a wide variety in the size of the airspace as well as of traffic density. The top 4 States included in the report cover two thirds of the continental airspace.
- b) The top-5 States account for 60% of the flight hours and 55% of all ATCOs in operations at ACCs. They control 50% of FR movements at airports
The top-7 States account for 80% of the flight hours and 70% of all ATCOs in operations at ACCs. They control 60% of IFR movements at airport. And their total share of domestic traffic accounts for just under 80%.
- c) The average IFR flight duration per State (in continental airspace) varies from 0.17 hrs (10 minutes) to 0.98 hrs (59 minutes).
- d) The vast majority of States have a single FIR. A smaller number has 2 (often a division between upper and lower), while only 10 States have 3 or more FIRs.
- e) The vast majority of States have a single ACC. A smaller number has 2, while only 8 States have 3 or more ACCs. The distribution is similar to the # of FIR distribution.



- f) Due to the on-going changes of the ICAO Performance Framework, no dedicated Safety Performance data collection took place.
- g) Two States account for about 55% of all en-route ATFM delay in the EUR Region, main reasons related to demand/capacity mismatch due to ATC capacity problems. The top-10 account for 90% of all en-route ATFM delay, thus the vast majority of States does not generate any significant delay.
- h) 6 airports are causing 50% of all airport ATFM delay in the EUR Region increasing to about 85% for 20 airports. Weather causes and ATC & aerodrome capacity causes are the biggest contributor to airport ATFM delay.
- i) The top-7 States are accountable for 68% of the EUR Region extra-distance and about 65% of theoretical CO2 emissions from a lack of horizontal flight efficiency.
- j) The data suggest that there is a variety of results in the ATCO productivity, a dozen of States perform better than the average while a dozen perform below the average.



Introduction

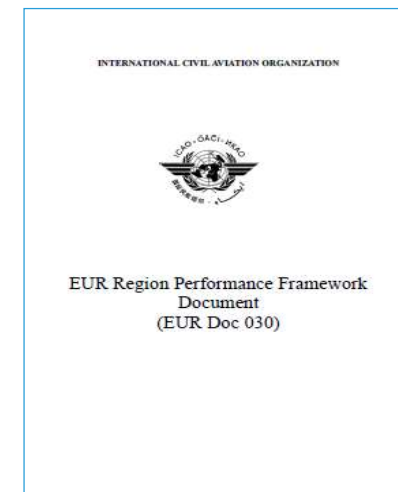




ICAO Performance Framework Document

ICAO EUR Doc 030 describes the performance Framework
(available in English/Russian language)

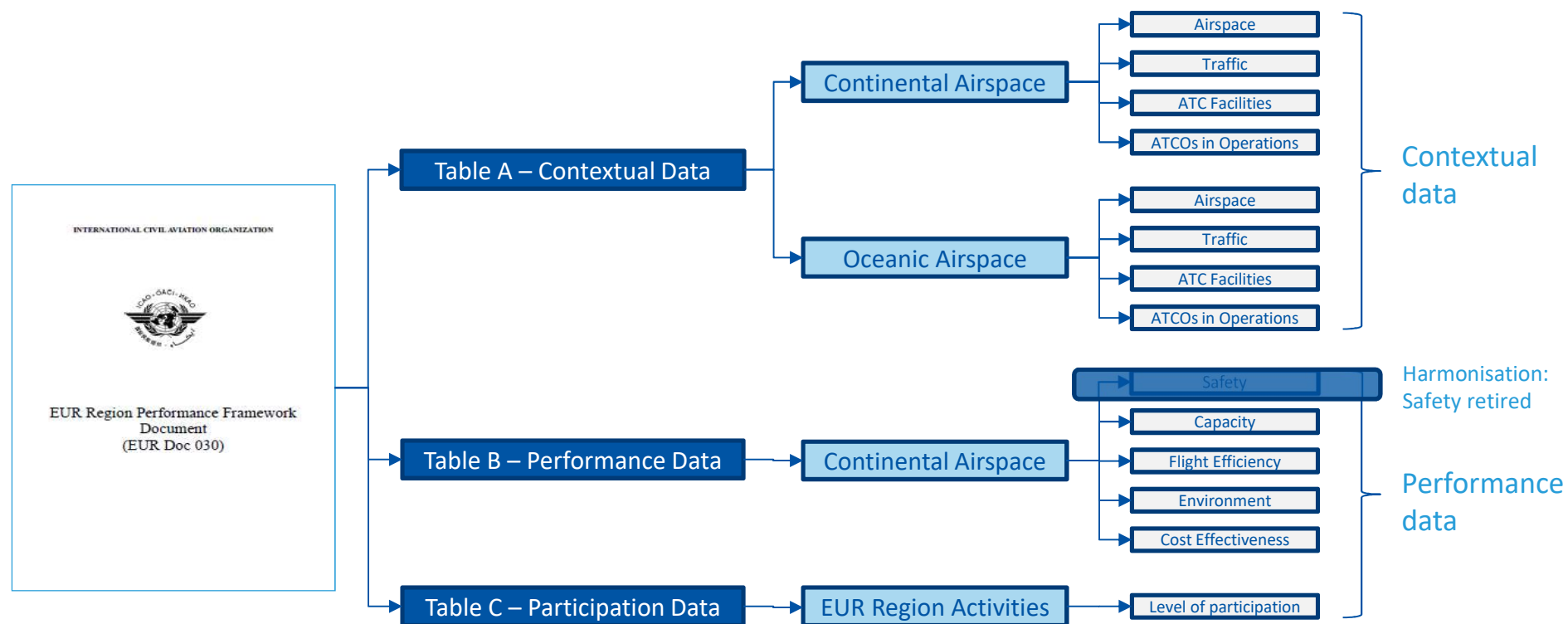
- Introduction
- Background
- Relationship with ICAO Global developments
- Relationship with the EU Performance Scheme
- Geographical scope
- Roles and responsibilities
- KPAs/KPIs/Metrics
- Monitoring and reporting at regional/national level
- Guidance material





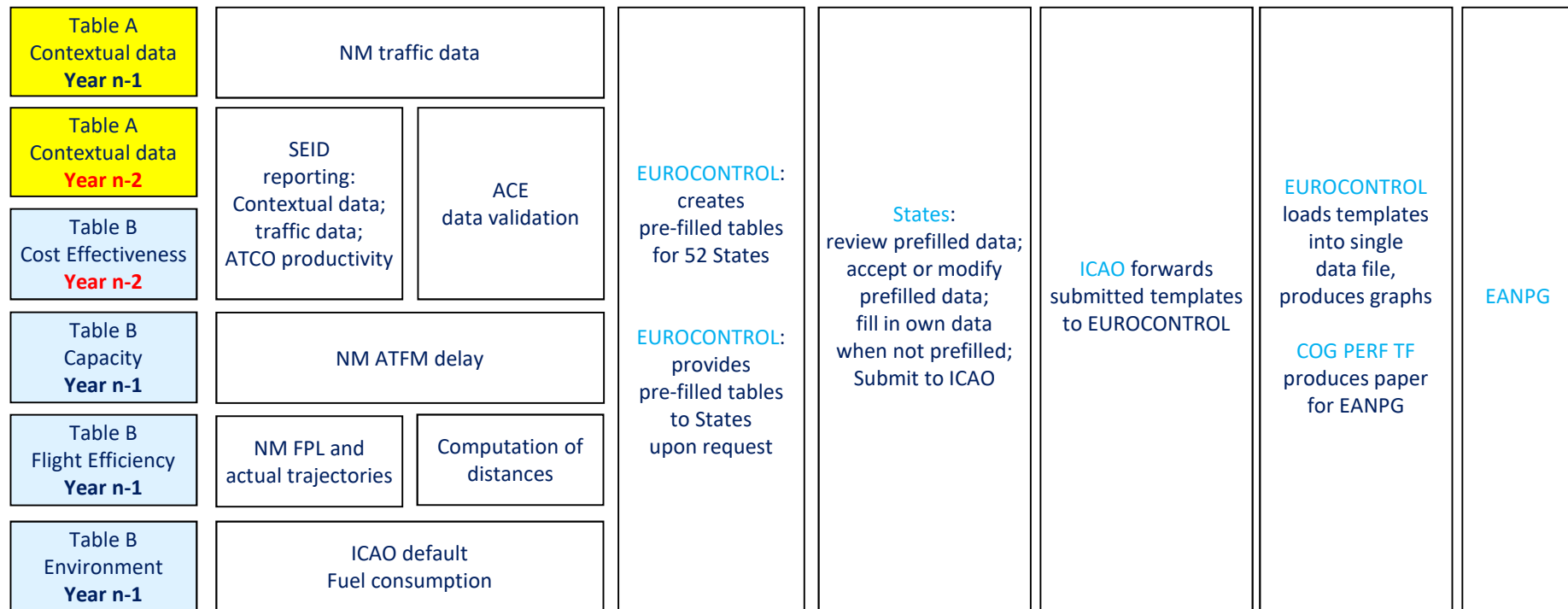
KPA	OBJECTIVES	FOCUS AREAS	INDICATORS
SAFETY	Ensure safety continuous improvement through harmonisation of ATM related safety occurrences and implementation of safety standards	Harmonisation of EUR Region reporting; Safety removed from this year's exercise	Effectiveness of Safety Management (Safety Maturity Questionnaire)
			Level of State Safety Just Culture (Safety Culture Questionnaire)
			Adoption of an harmonized occurrences severity classification methodology
CAPACITY	Capacity meets demand for en-route and at airports	En-route ATFM Delay	Average en-route ATFM delay generated by airspace volume
		Airport ATFM Delay	Average ATFM delay per flight in the main airports (to be identified by States)
EFFICIENCY	Ensure users may use most efficient routes	Horizontal Flight Efficiency	Average horizontal en route flight efficiency (length of the en route part of the actual trajectory/last flight planned route vs great circle)
ENVIRONMENT	Contribute to the protection of environment (fuel/CO2 emissions reduction)		CO2 emissions related to inefficiencies in route extension
COST EFFECTIVENESS	Contribute to optimization of costs for ANS	ATCO Productivity	IFR Flights (en-route) per ATCO hour duty
			IFR flight hours per ATCO hour on duty
			IFR movements per ATCO hour on duty
PARTICIPATION BY ATM COMMUNITY	Ensure States' participation to Regional planning and implementation activities		Level of participation to meetings
			Level of responses to planning activities
			Level of provision of performance results

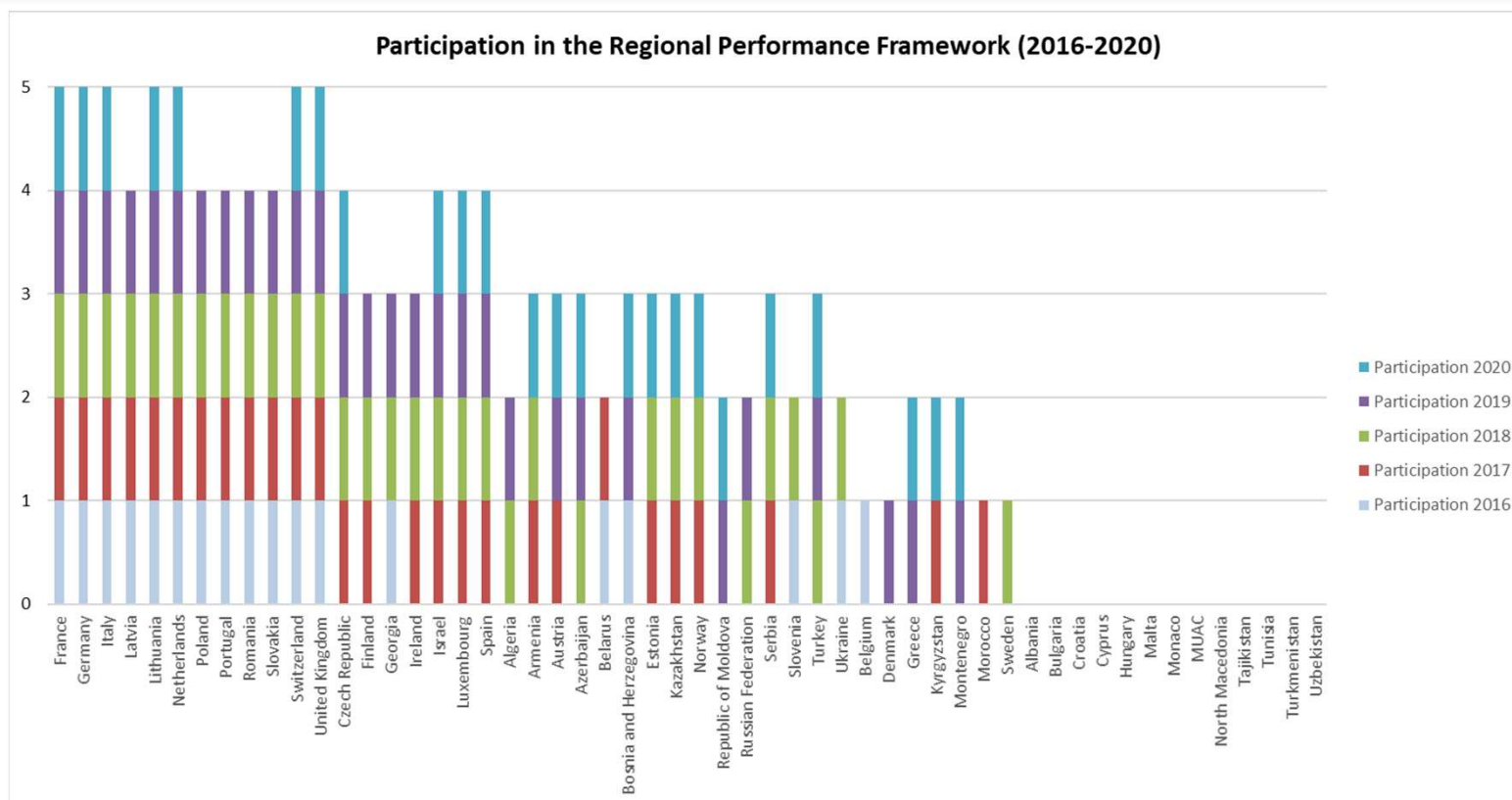






Data flow for Tables A & B



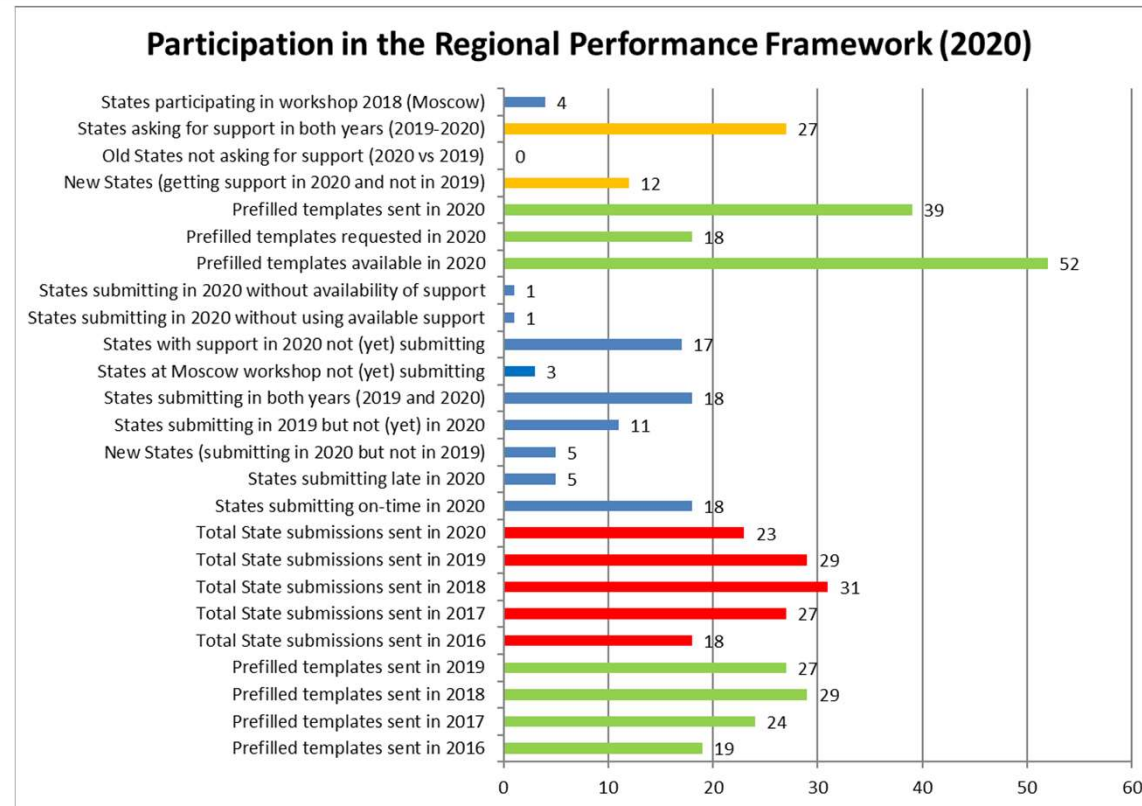


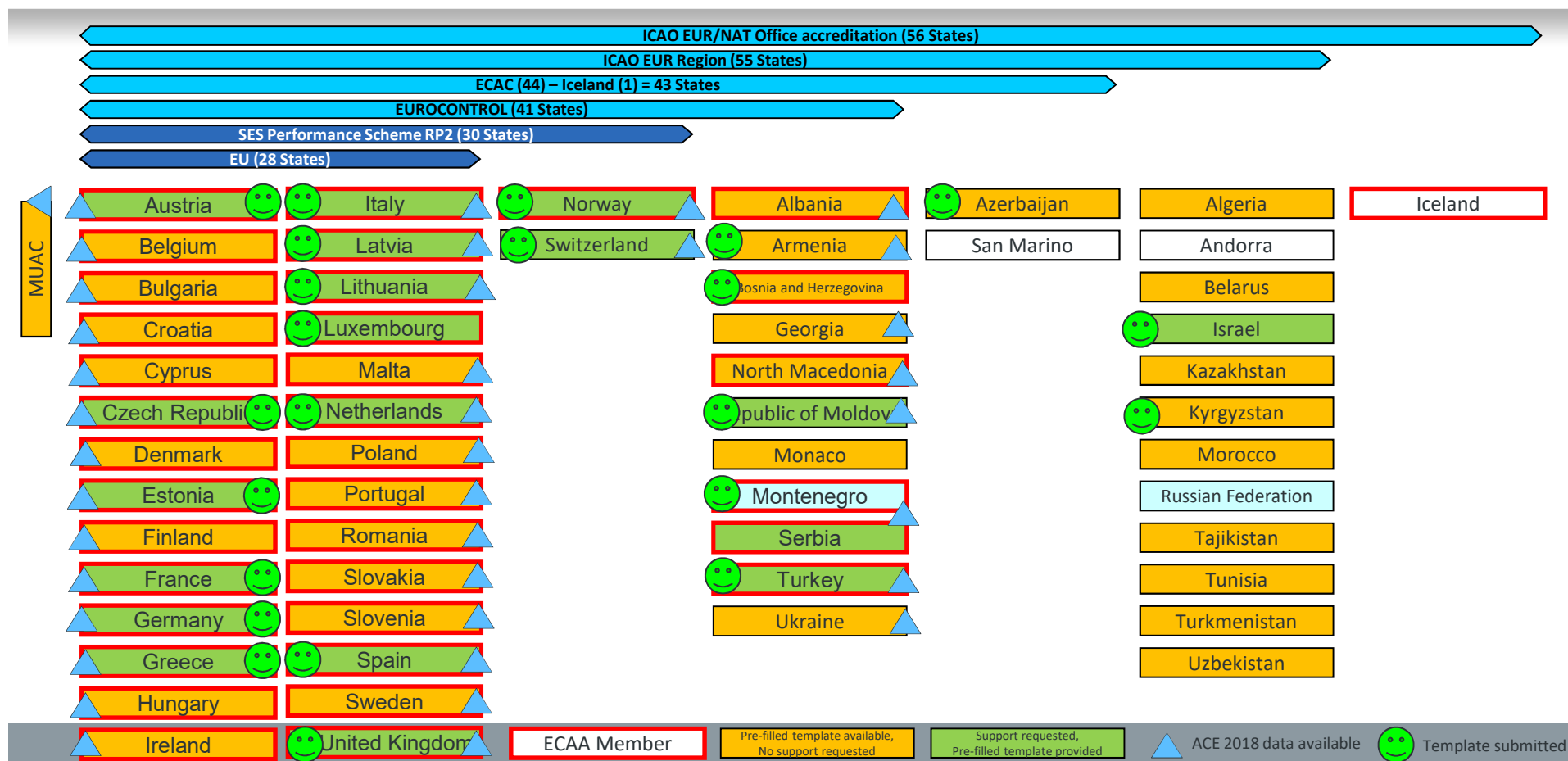


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Status on 18-11-2020







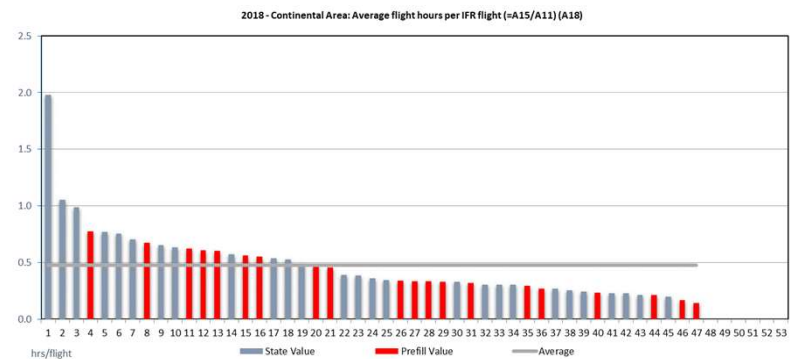
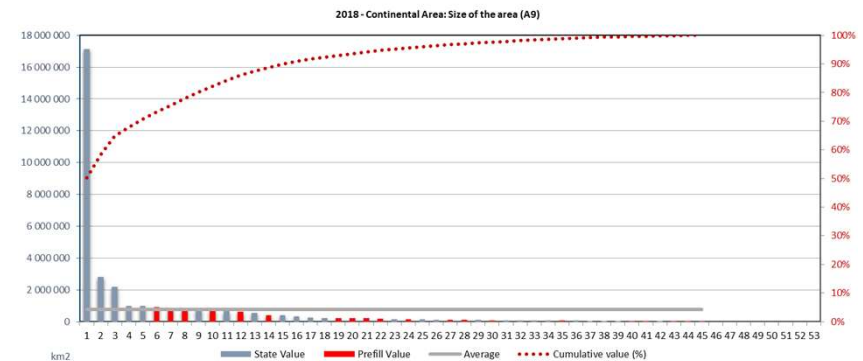
Processing and presentation of results

- Data is collected in one Excel reporting template per State
- Data of individual States is collated into a single data set
 - Basis for graphical representation of results
 - Combination of prefilled and submitted data
 - Grey bars: data as submitted by the State
 - Red bars: prefilled data where available, for States which did not submit a template
 - In some cases the number of States in the graphs is smaller than the number of pre-filled + submitted templates. Reason: for some States the template is only partially filled.
 - Results are anonymised
 - But each State can see where it stands in comparison to all States in the Region
 - Each State knows its own values and can therefore position itself in the graphs



Explanation of graphs

- **Title**
 - Identifies the data: year, scope (geographical and/or KPA), name of the data item, identifier code in the template
- **X-axis**
 - The list of anonymised States for the State- and ANSP-based data items (MUAC included as an ANSP), and the list of anonymised airports for the airport-based data items (\pm 180 airports). Note that the labels are ranking numbers, not State/airport identifiers: in principle the mapping between numbers and States/airports is different for each graph.
- **Left y-axis**
 - The value of the data item, with the measurement units in the bottom left corner (blank means it is simply a count).
- **Grey line**
 - The average value (arithmetic mean), based on the number of States/ANSPs for which results are available for this data item (the length of the line indicates for how many States/ANSPs data is available). This value is a proxy for the regional average: it will change as data for more States/ANSPs is available.
- **A series of grey and/or red bars**
 - The profile of individual State/ANSP/airport values in descending order. This provides a good picture of the differences within the region. The bars do not show the difference between a reported value of zero and the value not being reported, but this can be deduced from the brown line (absence of a bar below the grey line means value zero or a value too small to be visible in the graph).
- **A red dotted line**
 - For data items which are aggregatable over States/ANSPs/airports: the cumulative profile of the blue bars in percent (see right-hand axis).





Contextual data (Table A)





Data items

Continental Area		
	Airspace	
A8	Number of FIRs	Number
A9	Size of the area	km ²
A10	Radar Surveillance Coverage at FL 290	km ²
	Traffic	
A11	Total number of IFR flights controlled (=A12+A13+A14)	Flights/year
A12	Number of domestic IFR flights controlled	Flights/year
A13	Number of international IFR flights controlled	Flights/year
A14	Number of IFR overflights controlled	Flights/year
A11b	Total number of IFR flights controlled (use only if A12+A13+A14 not available)	Flights/year
A15	Number of IFR flight-hours controlled	hrs/year
A16	Number of IFR airport movements controlled (departures+arrivals)	Mov/year
A17	Number of VFR airport movements controlled (departures+arrivals)	Mov/year
A18	Average flight hours per IFR flight (=A15/A11)	hrs/flight
A19	Average IFR traffic density (=A15/A9)	hrs/km ² /year
	ATC facilities	
A20	Number of ACCs	Number
A21	Number of co-located ACC/Approach Facilities	Number
A22	Number of Approach Control Facilities	Number
A23	Number of co-located Tower/Approach Facilities	Number
A24	Number of stand-alone Towers	Number
A25	Number of co-located ACC/Tower/Approach Facilities	Number
	ATCOs in operations	
A26	Number of ATCOs in operations at ACCs	FTE
A27	Number of ATCOs in operations at Terminal Facilities (APP+TWRs)	FTE

Oceanic Area (for States having an Oceanic Area)		
	Airspace	
A28	Number of FIRs	Number
A29	Size of the area	km ²
A30	Radar Surveillance Coverage at FL 290	km ²
	Traffic	
A31	Number of IFR flights controlled (=A32+A33+A34)	Flights/year
A32	Number of domestic IFR flights controlled	Flights/year
A33	Number of international IFR flights controlled	Flights/year
A34	Number of IFR overflights controlled	Flights/year
A31b	Number of IFR flights controlled (use only if A32+A33+A34 not available)	Flights/year
A35	Number of IFR flight-hours controlled	hrs/year
A36	Average flight hours per IFR flight (=A35/A31)	hrs/flight
A37	Average IFR traffic density (=A35/A29)	hrs/km ² /year
	ATC facilities	
A38	Number of OACs	Number
	ATCOs in operations	
A39	Number of ATCOs in operations at OACs	FTE

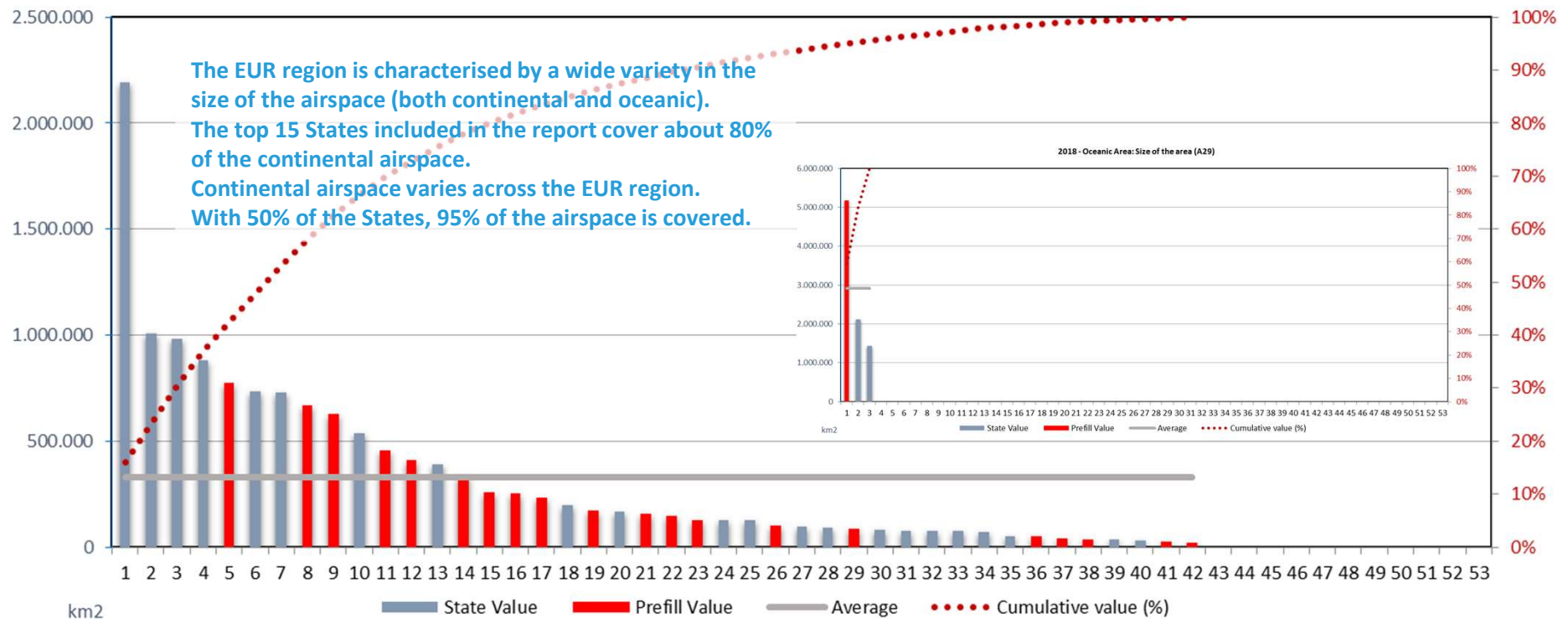


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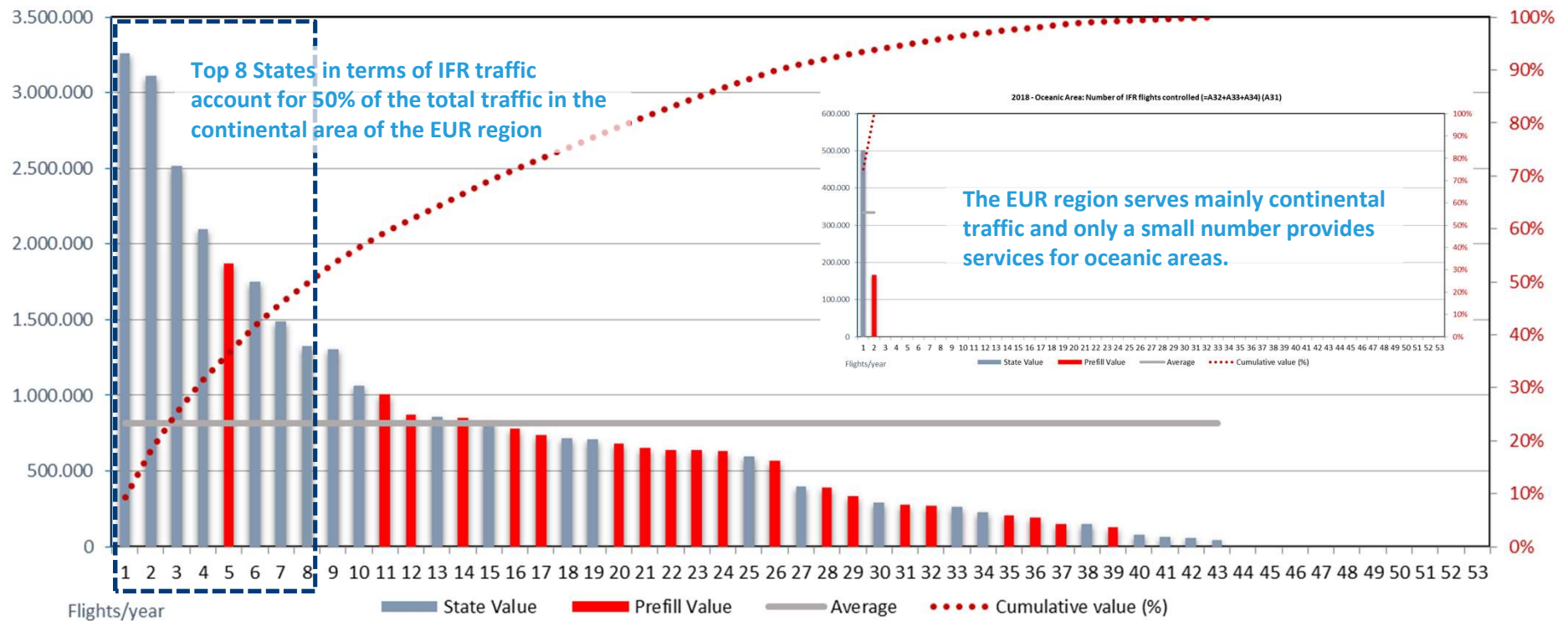
Data items A9 & 29

2018 - Continental Area: Size of the area (A9)



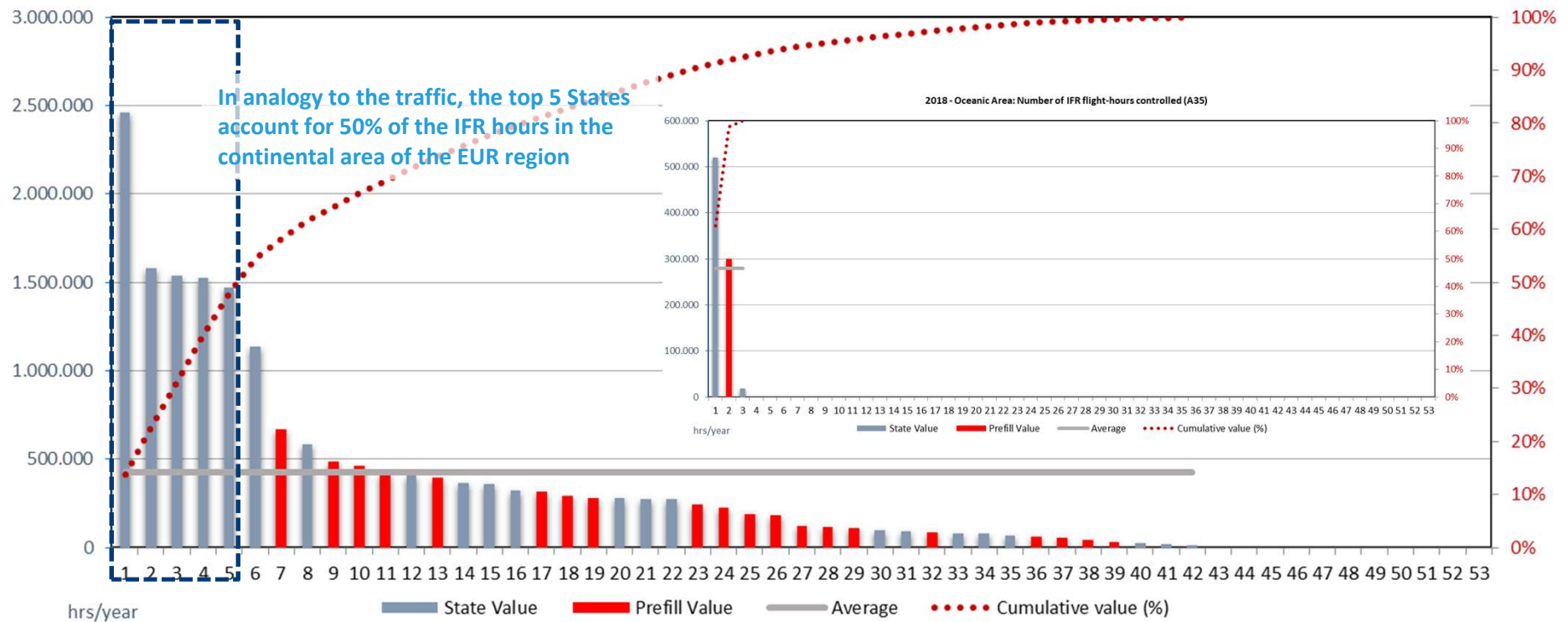


2018 - Continental Area: Total number of IFR flights controlled (=A12+A13+A14) (A11)



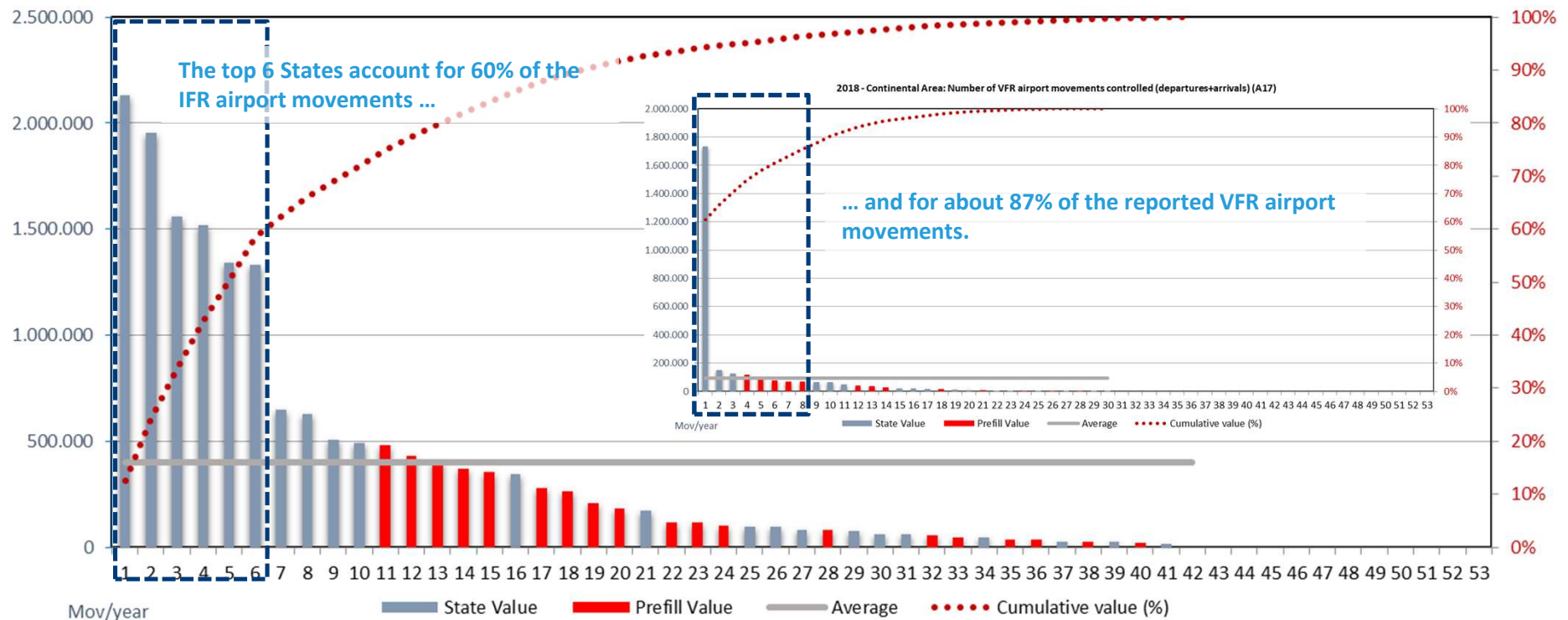


2018 - Continental Area: Number of IFR flight-hours controlled (A15)



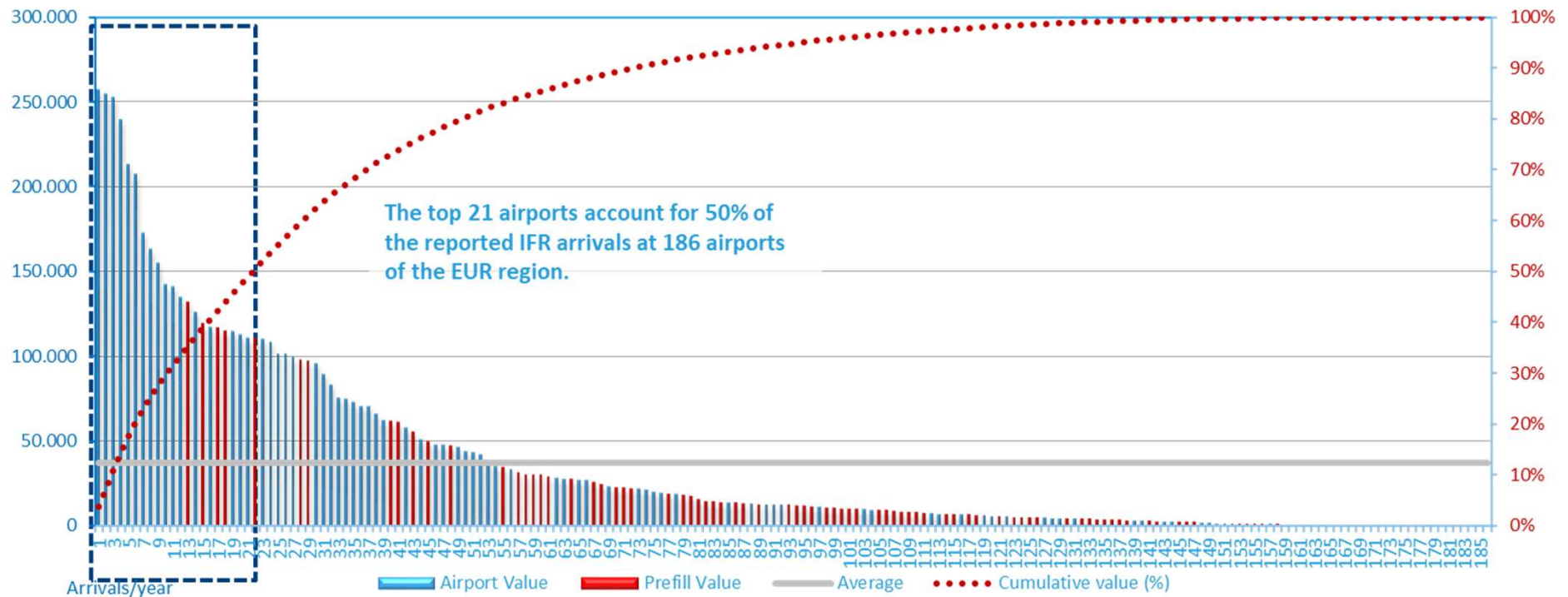


2018 - Continental Area: Number of IFR airport movements controlled (departures+arrivals) (A16)



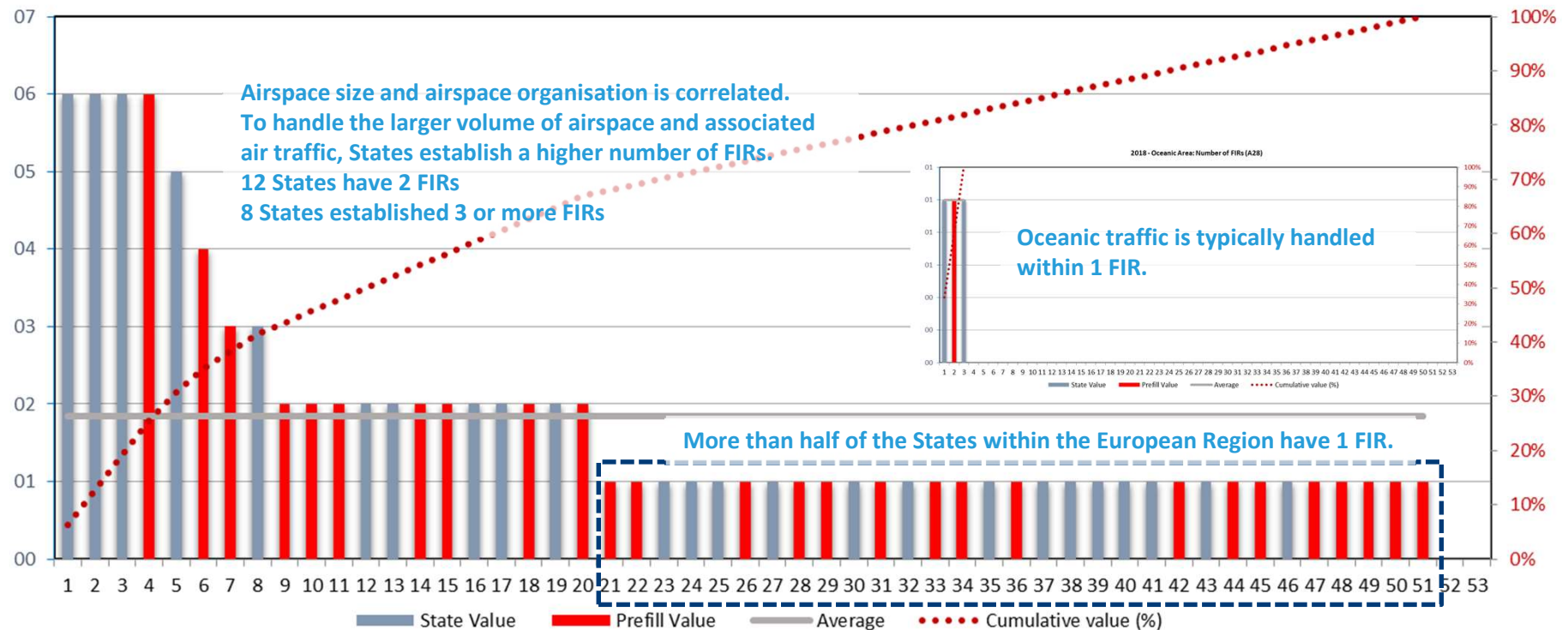


2019 - Total number of IFR arrivals at the airport (B41)



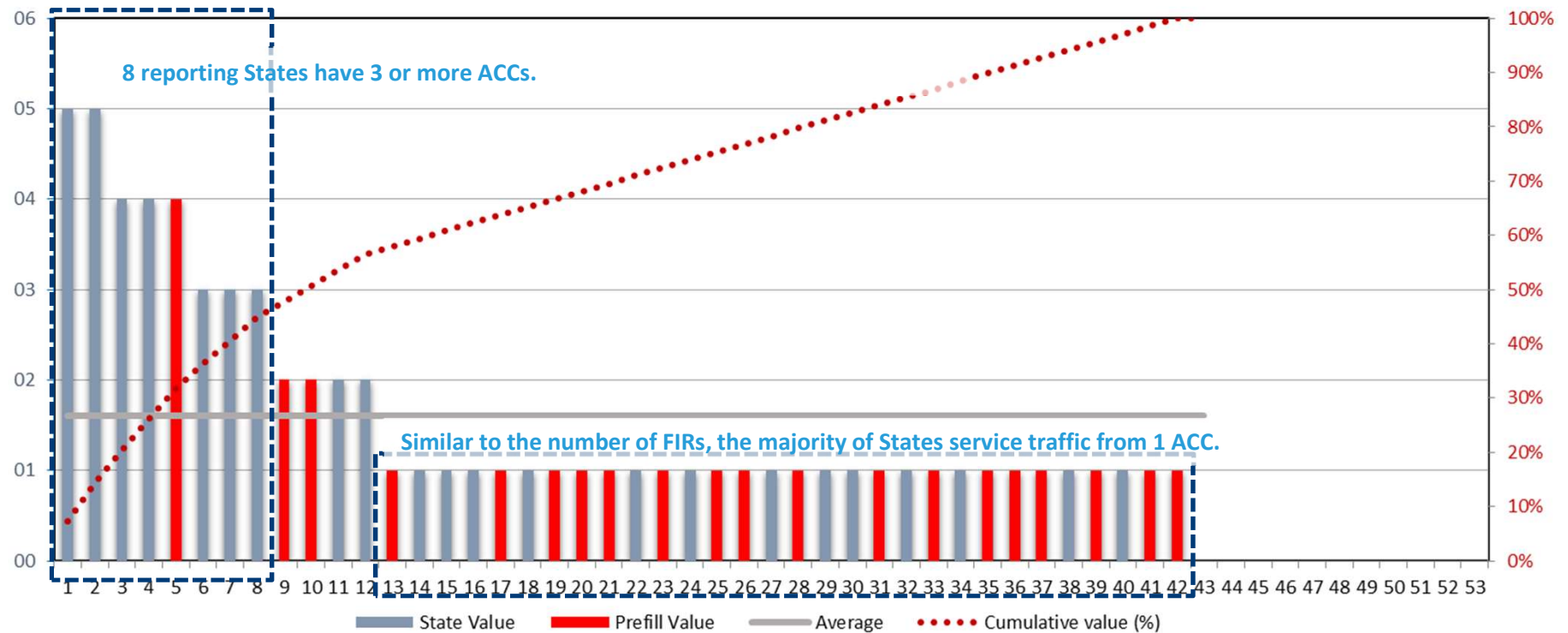


2018 - Continental Area: Number of FIRs (A8)



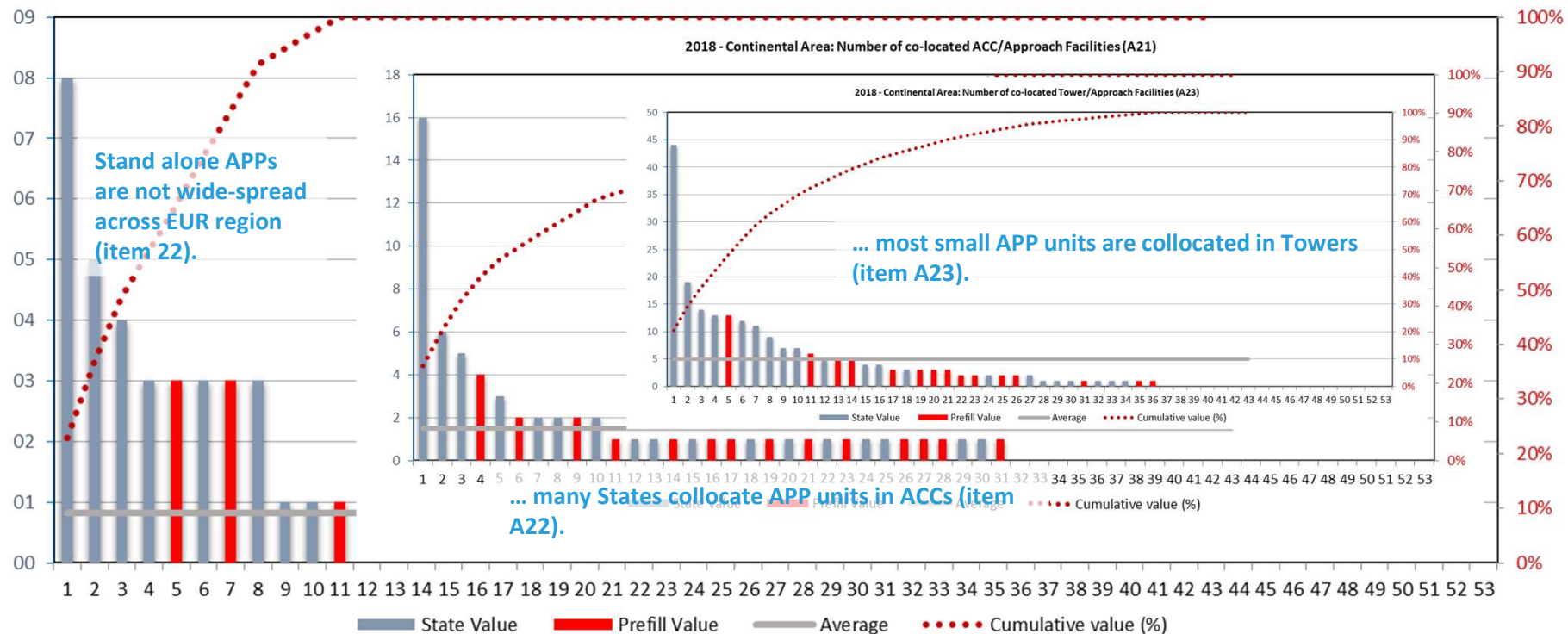


2018 - Continental Area: Number of ACCs (A20)



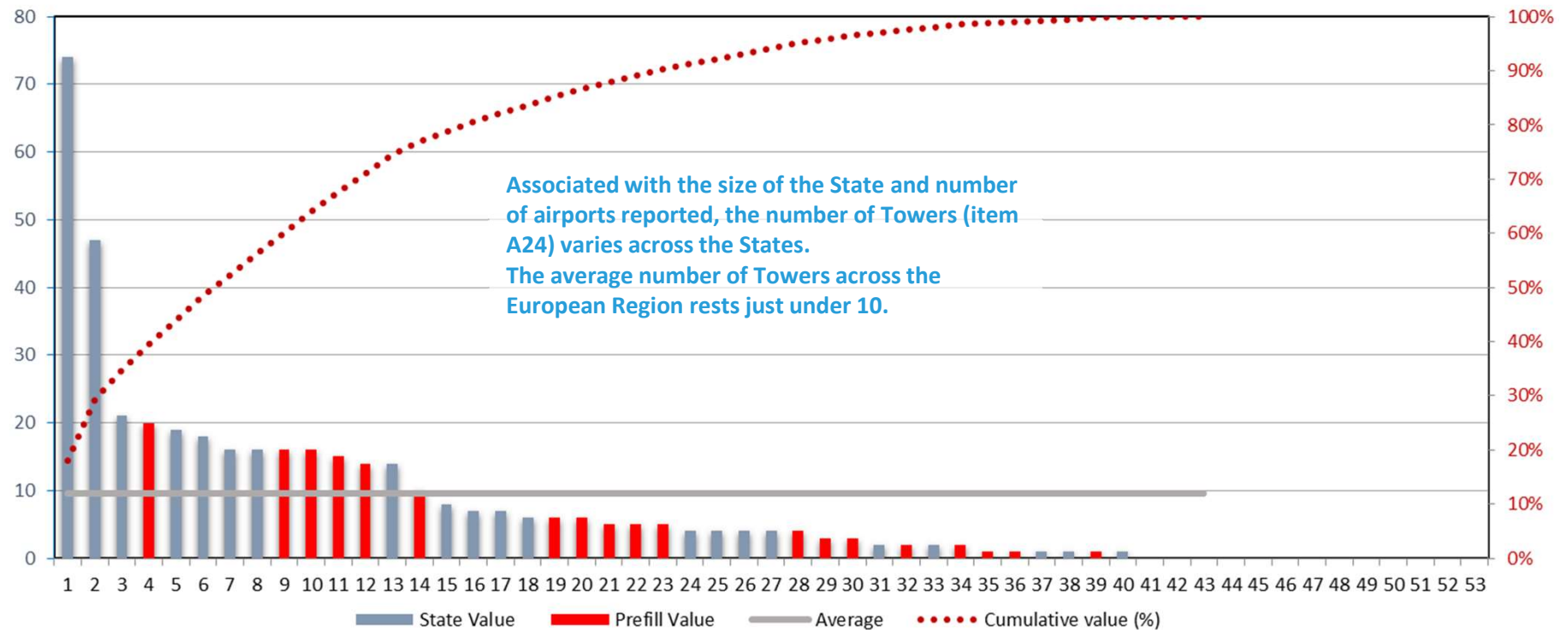


2018 - Continental Area: Number of Approach Control Facilities (A22)





2018 - Continental Area: Number of stand-alone Towers (A24)



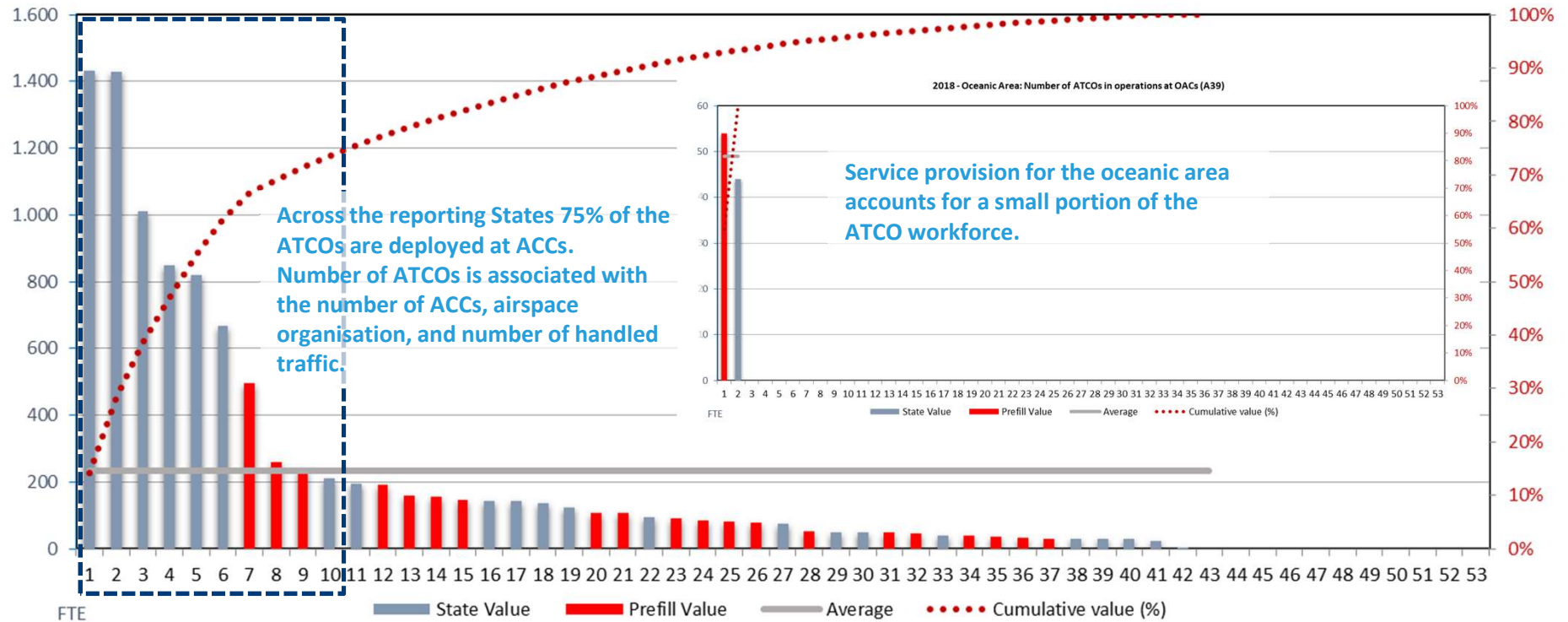


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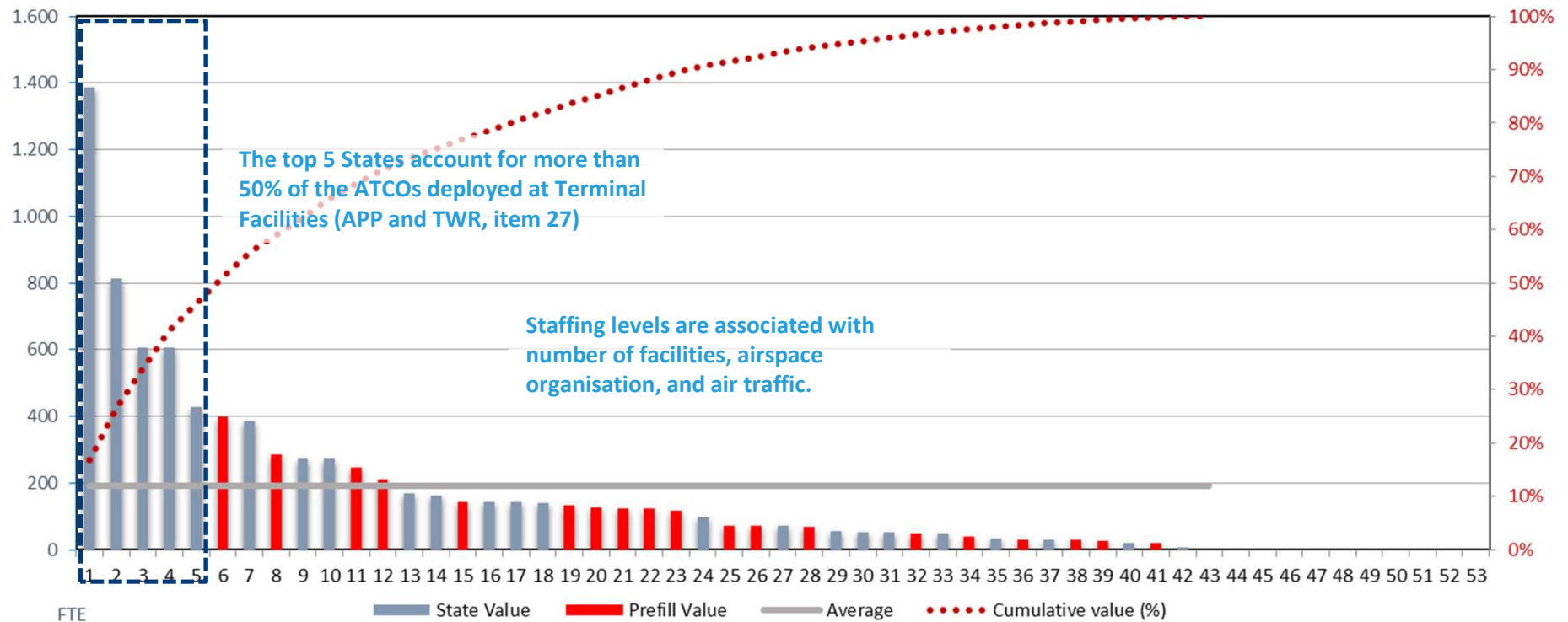
Data items A26 & A39

2018 - Continental Area: Number of ATCOs in operations at ACCs (A26)





2018 - Continental Area: Number of ATCOs in operations at Terminal Facilities (APP+TWRs) (A27)





Performance data (Table B)





- For the 2020 reporting cycle and in light of the harmonisation of the reporting/monitoring across the EUR Region, the Safety monitoring has been put dormant.
- Part B comprises therefore performance measures of
 - Capacity
 - Flight Efficiency
 - Cost Effectiveness



KPA	Capacity
Objective	Ensure that Air Navigation Service capacity meets demand in en-route airspace and at airports
Indicators	<ul style="list-style-type: none">- Average ATFM delay per flight generated by the airspace volume (en-route)- Average ATFM delay per flight in the main airports (to be identified by States in advance and based on the regional relevance)



Please note

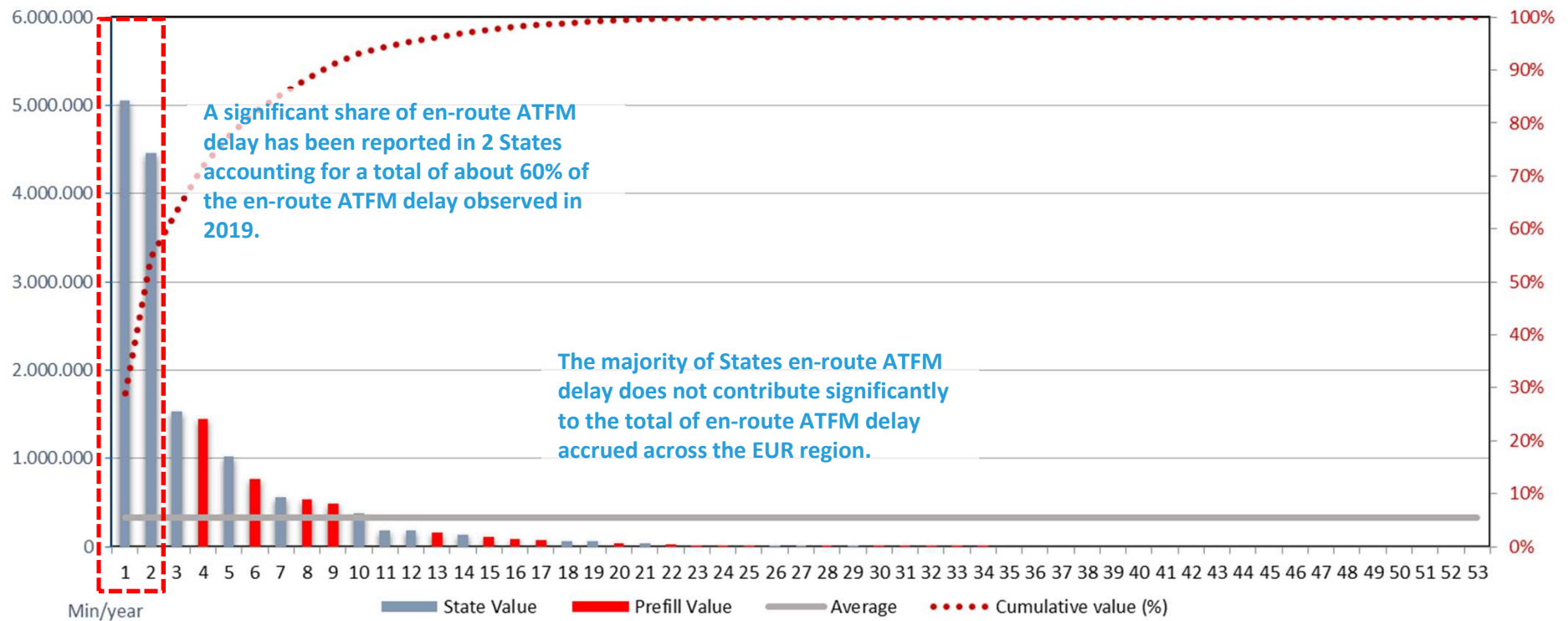
- **Indicators measure**
 - The location where the problem (capacity bottleneck) is, not where the delay is taken (departure airport)
 - Performance of airspace volumes and airports, not flights
 - Despite the expression as a value “per flight”
 - **Within the Capacity KPA**
 - Demand/capacity imbalance
 - Not capacity itself
- **Limitations**
 - Not designed to measure excess capacity
 - No data if airspace or airport does not participate in a centralised ATFM process



Capacity		
En-route ATFM delays (continental airspace)		
B35	Total en-route ATFM delay generated in the State (all causes) (=B37+B38+B39+B40)	Min/year
B36	Average ATFM delay per flight (=B35/A11)	Min/flight
B37	En-route ATFM delay generated in the State (ATC capacity causes)	Min/year
B38	En-route ATFM delay generated in the State (ATC other causes)	Min/year
B39	En-route ATFM delay generated in the State (Weather causes)	Min/year
B40	En-route ATFM delay generated in the State (All other causes)	Min/year
B35b	En-route ATFM delay generated in the State (Cause unknown, use only if B37, B38, B39 & B40 not available)	Min/year
Airport ATFM delays		
	Airport identifier	ICAO code
B41	Total number of IFR arrivals at the airport	Arrivals/year
B42	Total airport ATFM delay generated by the airport (all causes) (=B44+B45+B46+B47)	Min/year
B43	Average ATFM delay per arrival (=B42/B41)	Min/arrival
B44	Airport ATFM delay generated by the airport (ATC & aerodrome capacity causes)	Min/year
B45	Airport ATFM delay generated by the airport (ATC other causes)	Min/year
B46	Airport ATFM delay generated by the airport (Weather causes)	Min/year
B47	Airport ATFM delay generated by the airport (All other causes)	Min/year
B42b	Airport ATFM delay generated by the airport (Cause unknown, use only if B44, B45, B46 & B47 not available)	Min/year

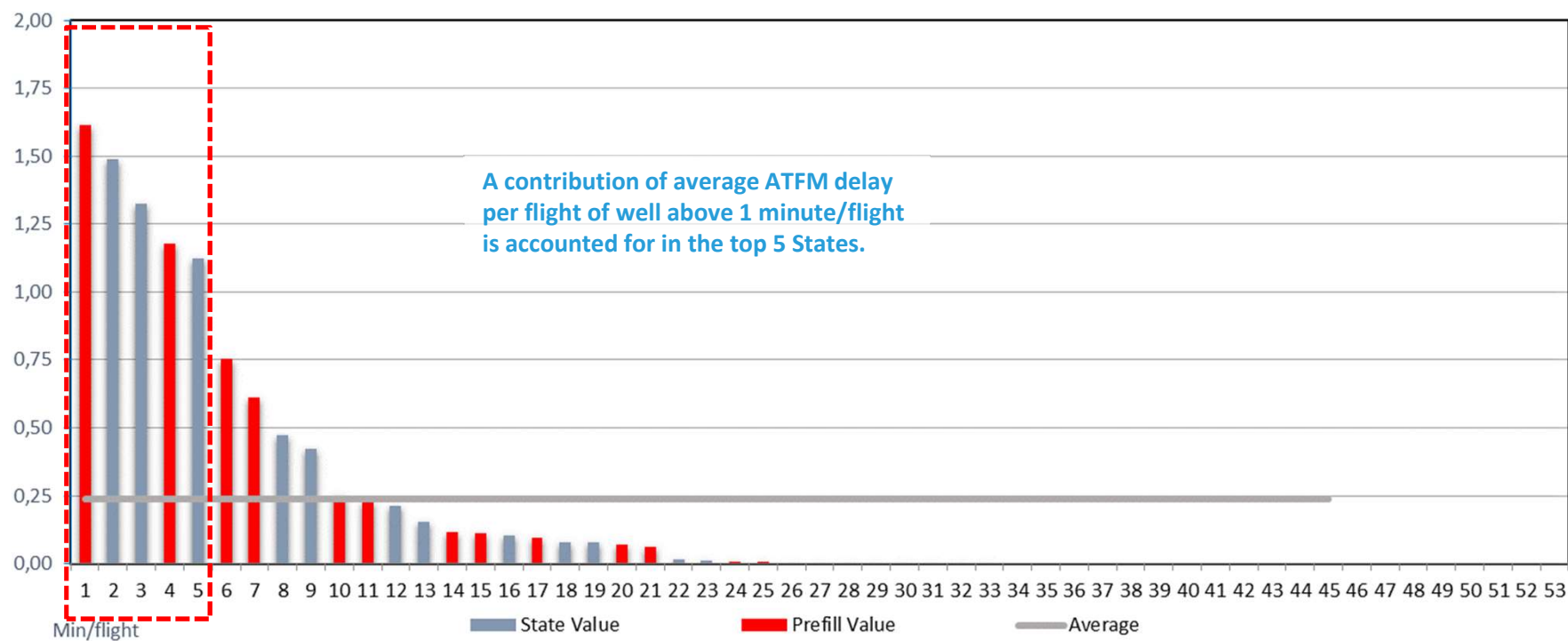


2019 - Continental Area: Total en-route ATFM delay generated in the State (all causes) (=B37+B38+B39+B40) (B35)



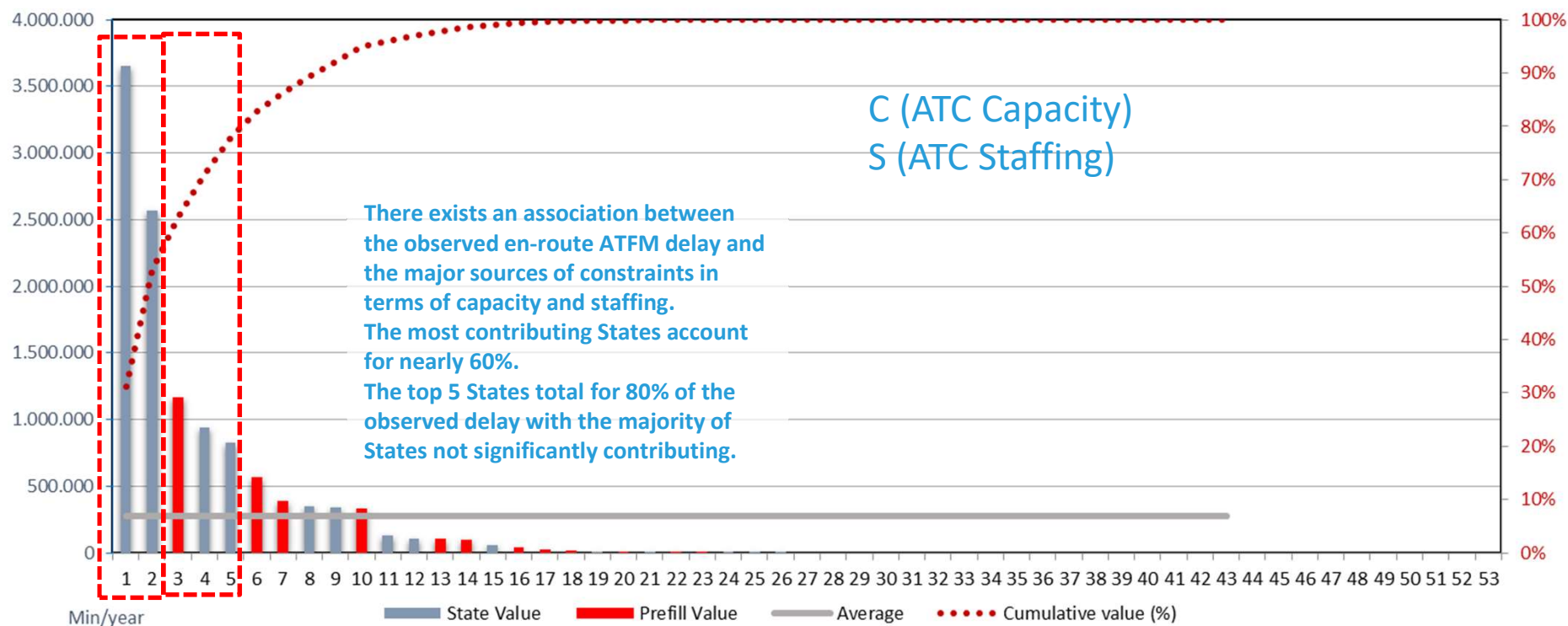


2019 - Continental Area: Average ATFM delay per flight (=B35/A11) (B36)





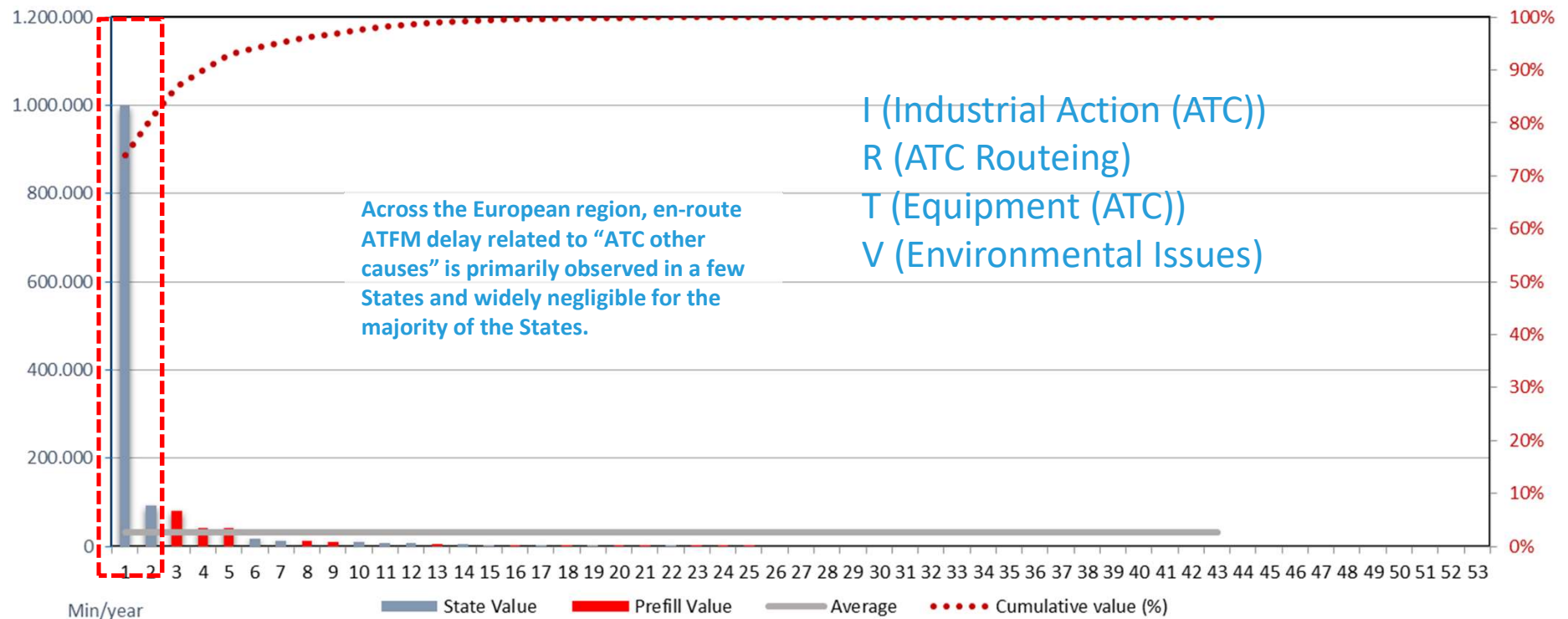
2019 - Continental Area: En-route ATFM delay generated in the State (ATC capacity causes) (B37)



Demand/capacity mismatch in en-route airspace due to ATC capacity problems occurred in a limited number of States. 1 State causes 30% of all such delay, and 2 States cause nearly 60% of all such delay.



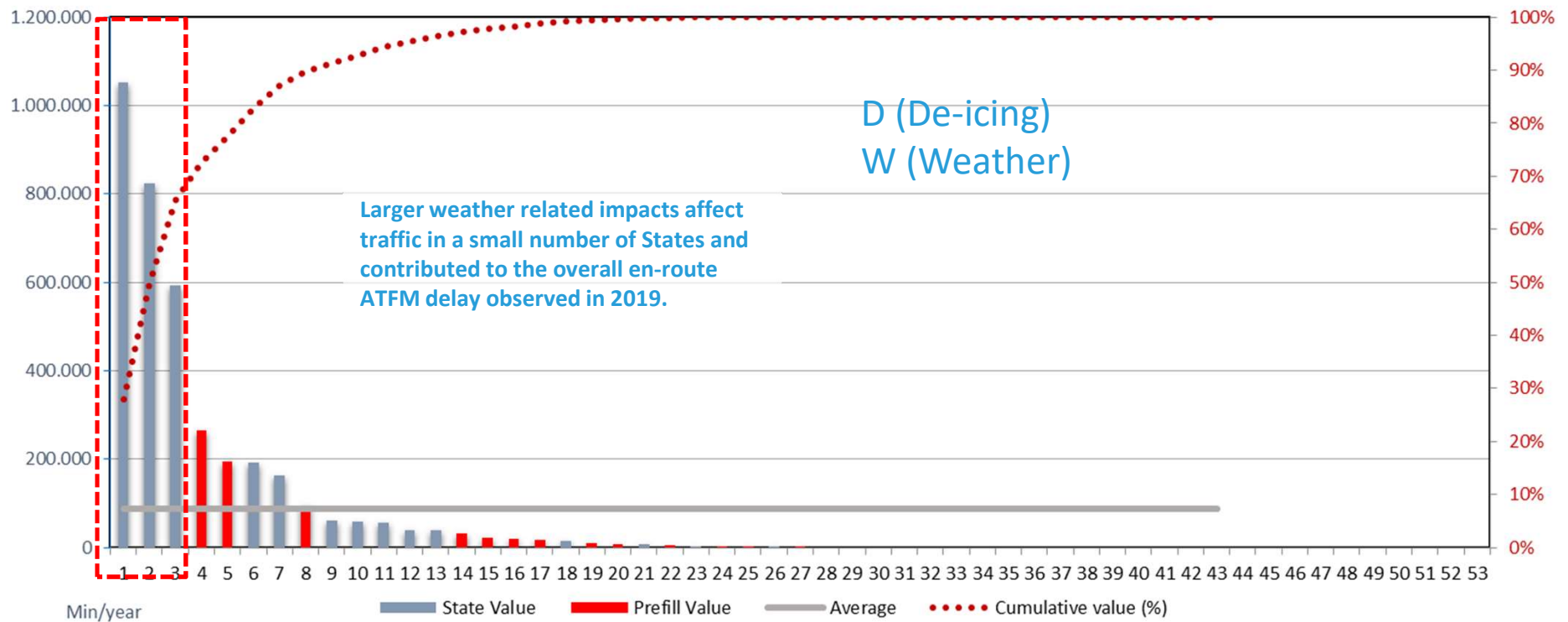
2019 - Continental Area: En-route ATFM delay generated in the State (ATC other causes) (B38)



Demand/capacity mismatch in en-route airspace due to "ATC other causes" is a phenomenon taking place in only 2 States.

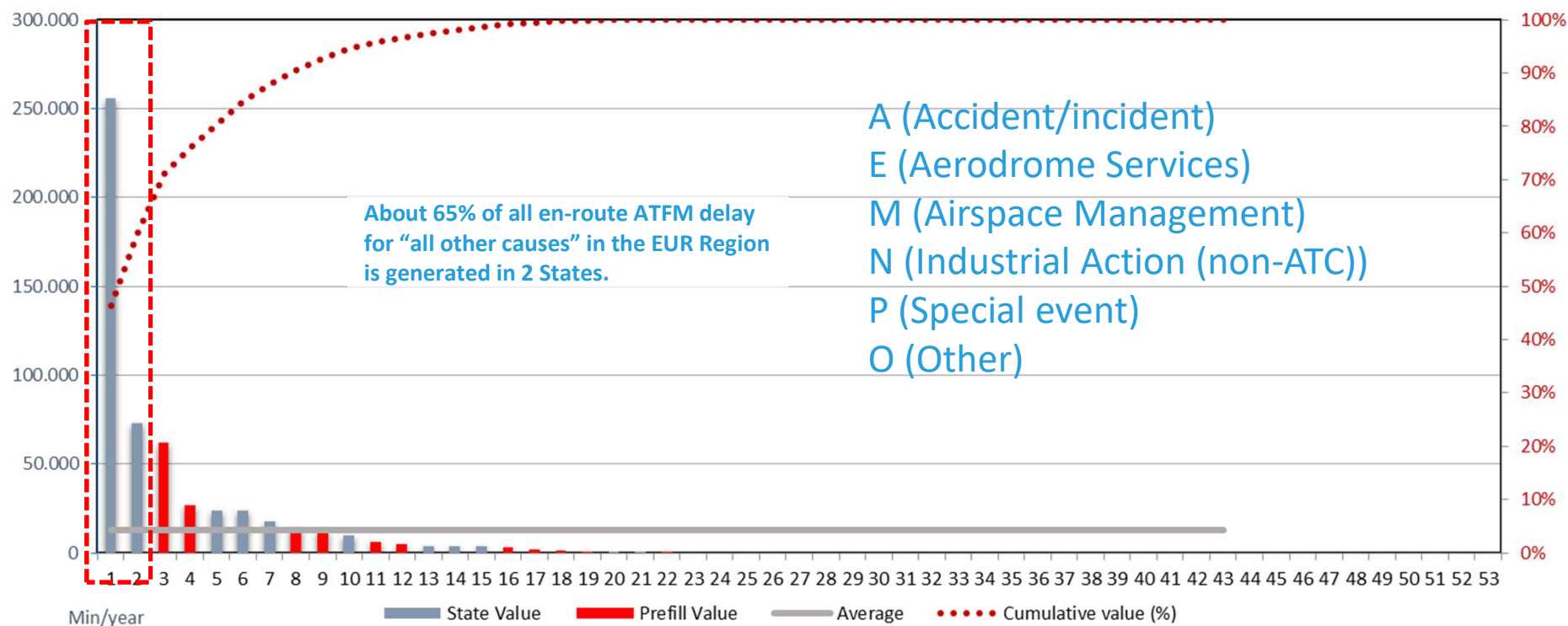


2019 - Continental Area: En-route ATFM delay generated in the State (Weather causes) (B39)



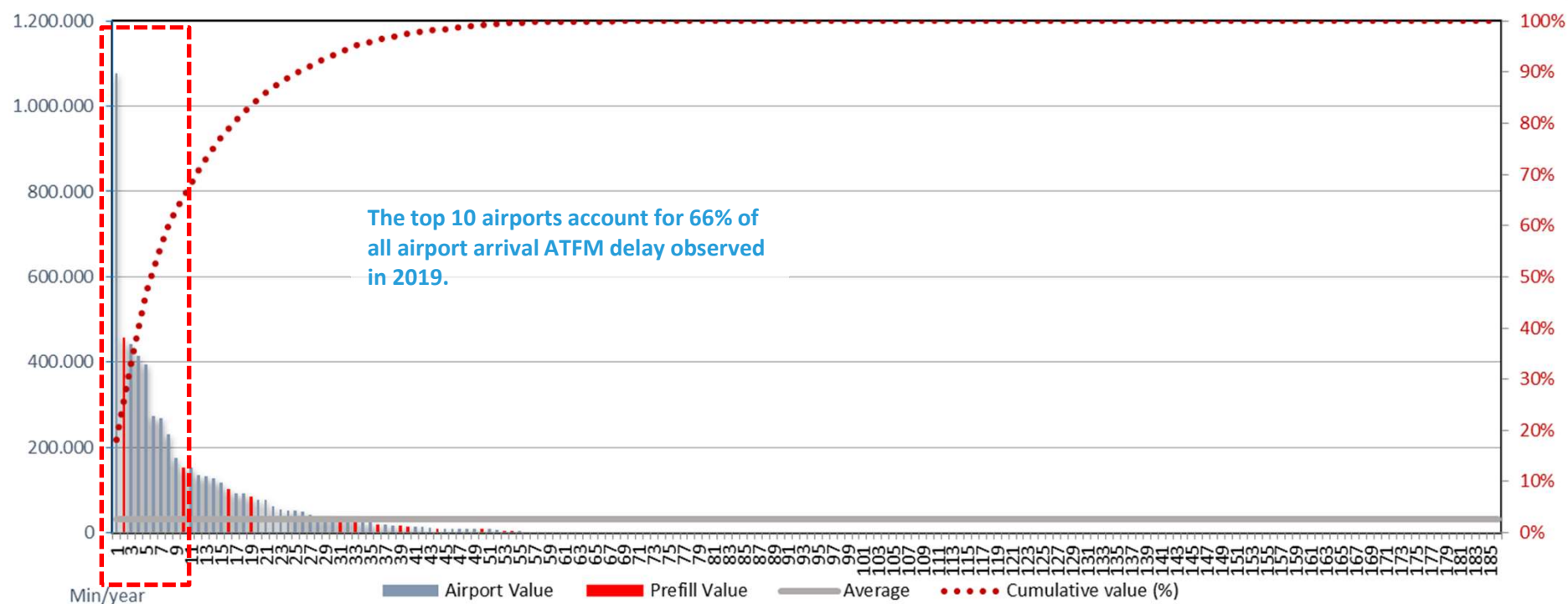


2019 - Continental Area: En-route ATFM delay generated in the State (All other causes) (B40)





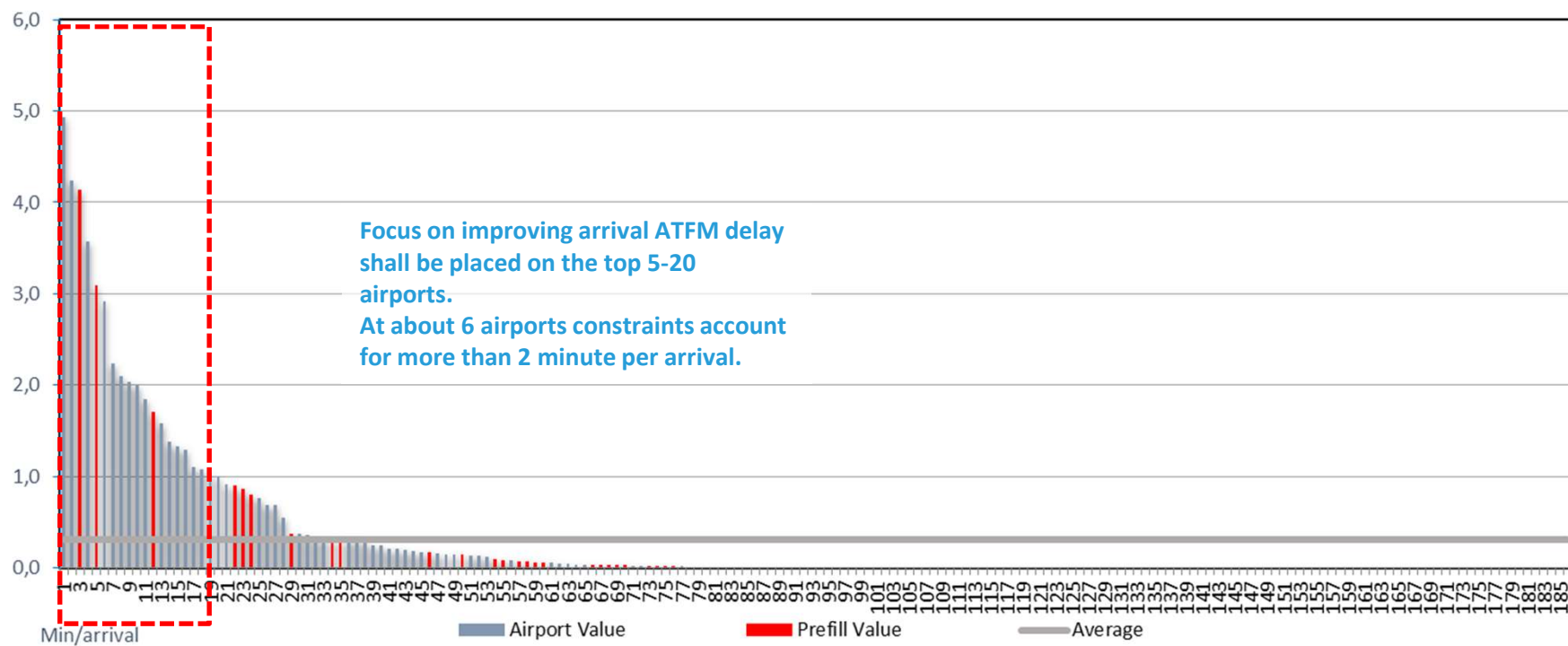
2019 - Total airport ATFM delay generated by the airport (all causes) (=B44+B45+B46+B47) (B42)



6 airports are causing 50% of all airport ATFM delay in the EUR Region.

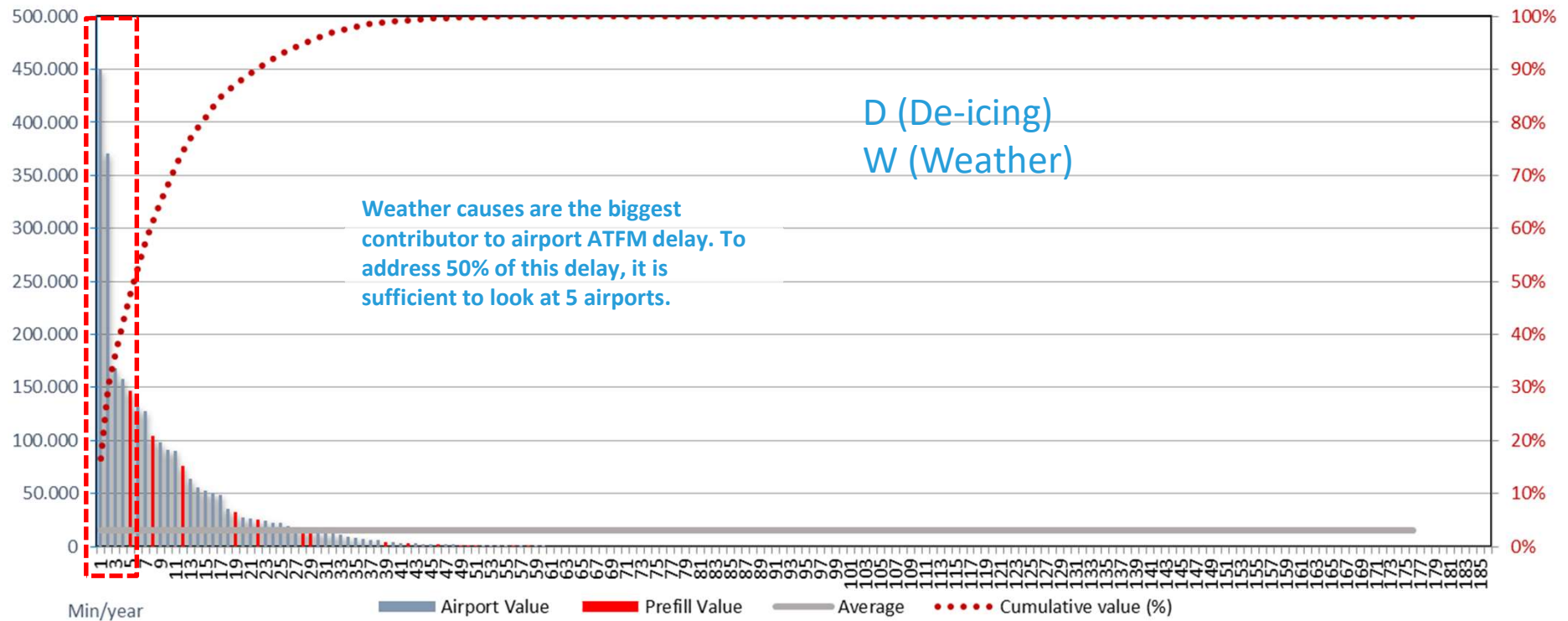


2019 - Average ATFM delay per arrival (=B42/B41) (B43)



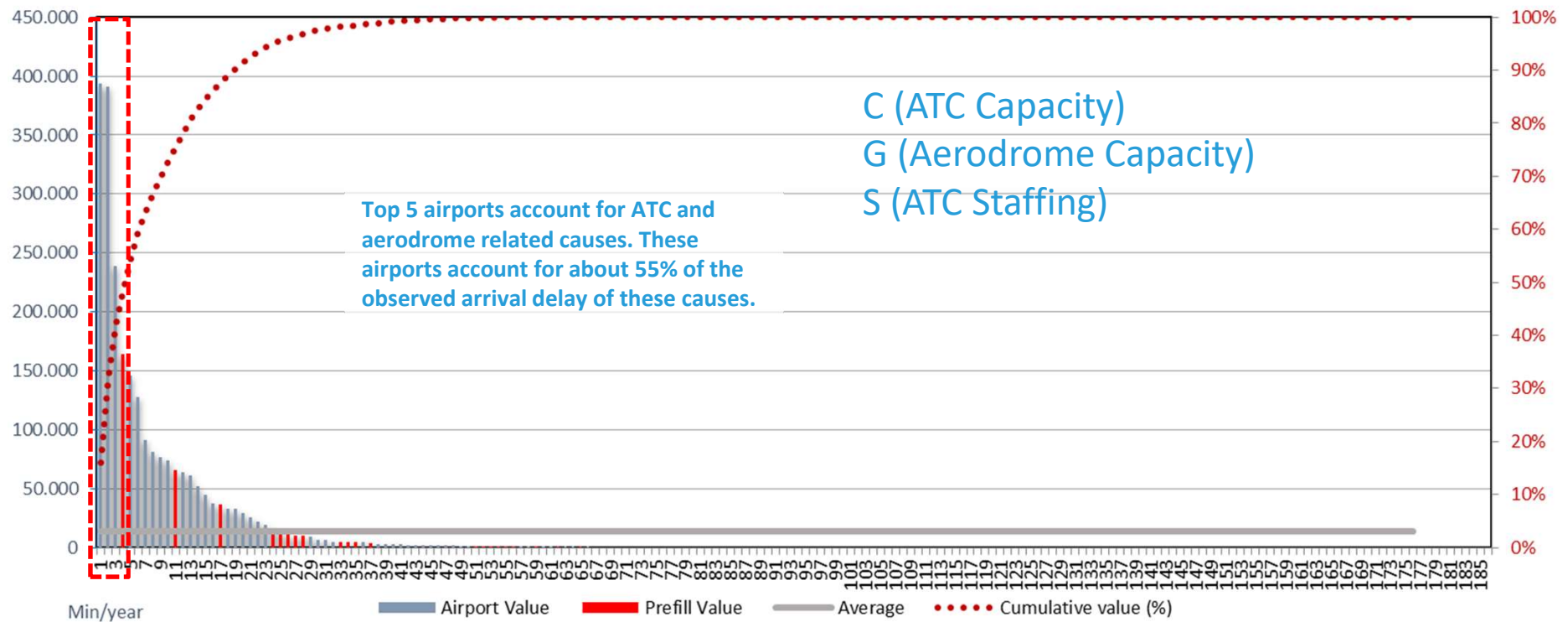


2019 - Airport ATFM delay generated by the airport (Weather causes) (B46)





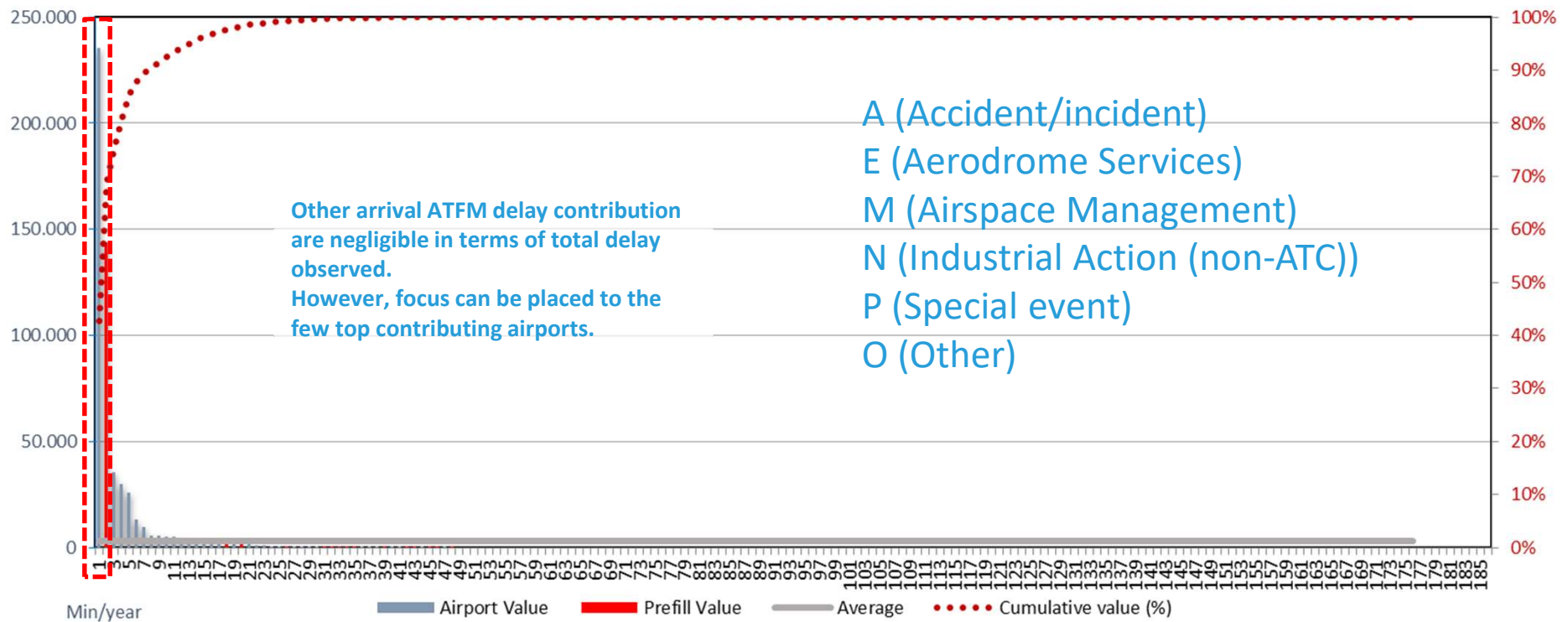
2019 - Airport ATFM delay generated by the airport (ATC & aerodrome capacity causes) (B44)



ATC & aerodrome capacity causes are the second biggest contributor to airport ATFM delay. 4 airports need to be looked at as a matter of priority.

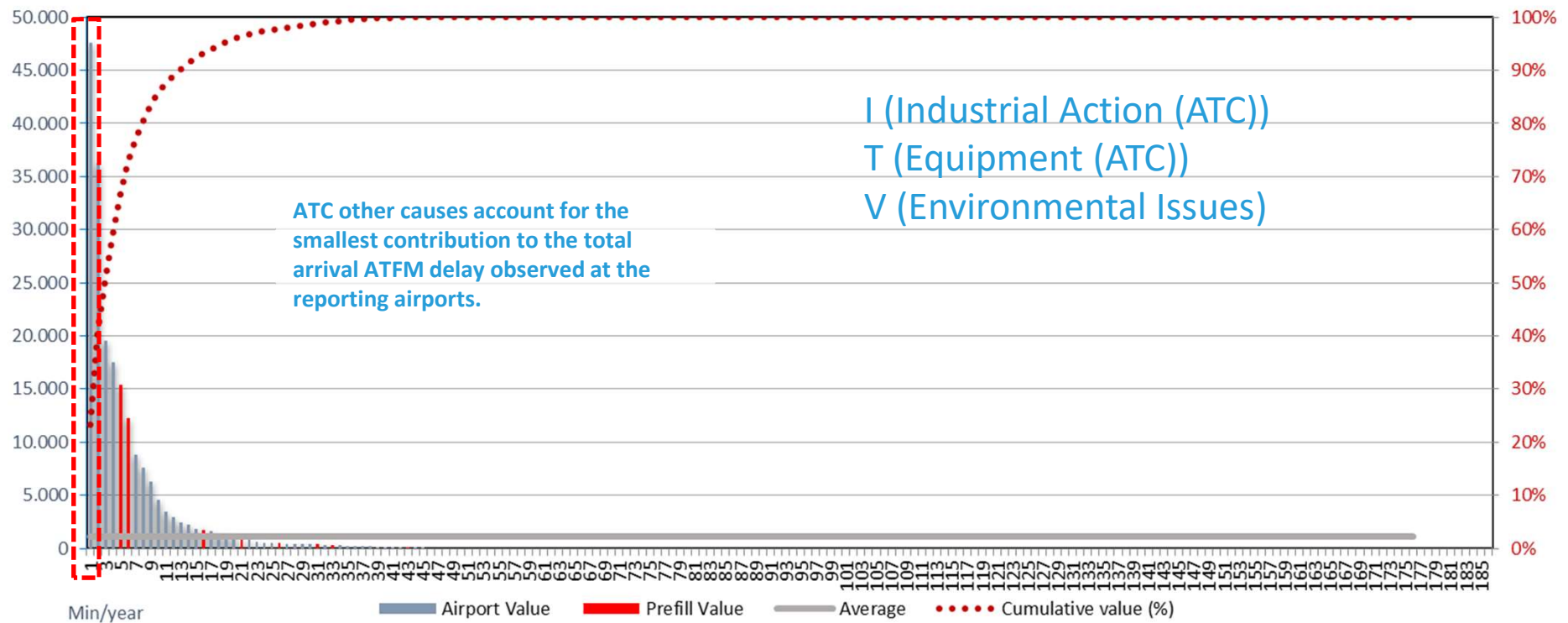


2019 - Airport ATFM delay generated by the airport (All other causes) (B47)





2019 - Airport ATFM delay generated by the airport (ATC other causes) (B45)



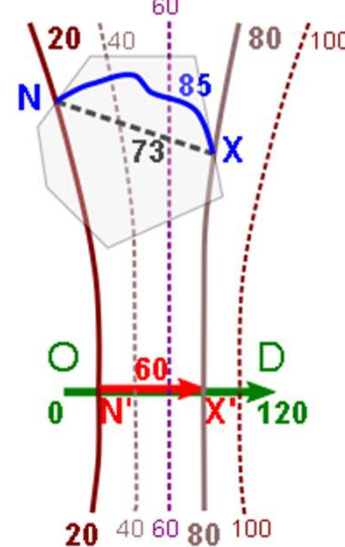


KPA	Efficiency
Objective	Ensure that users [can?] use the most efficient routes – focussing on the horizontal flight-efficiency
Indicator	Average horizontal en route flight efficiency, defined as the difference between the length of the en route part of the actual trajectory (where available) or last flight planned route and the great circle.

Notion of “Achieved Distance”

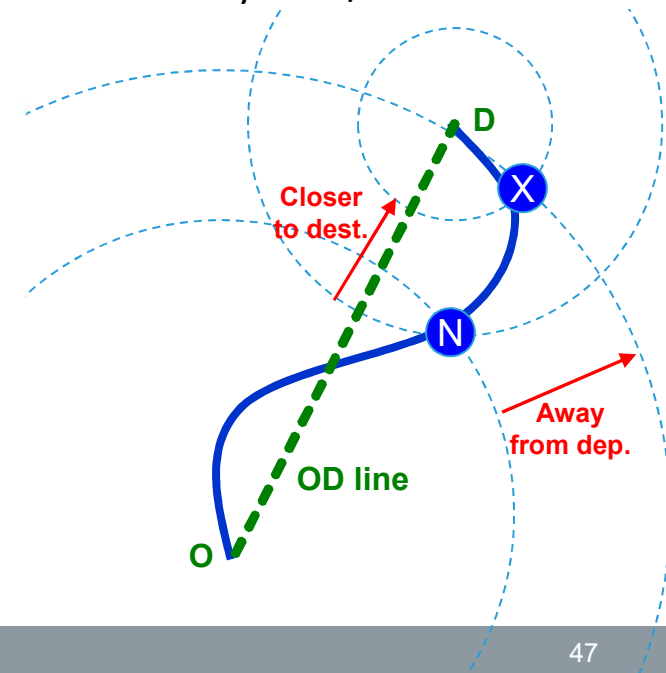
- O, D, N, X: **O**rigin, **D**estination, **N**try, **X**it
- “Corresponding portion of the great circle distance OD” = **achieved distance N’X’** (needed to calculate the indicator at State level)
- Calculation of **achieved distance N’X’** for flight segment NX:
(distance-closer-to-destination + distance-away-from-departure)/2
- Important properties
 - Sum of achieved distances of flight segments is always equal to total direct (great circle) distance from O to D
 - Actual, achieved and excess distances for flight segments are aggregatable (bottom-up from State level to regional level)

Iso-achieved-distance lines



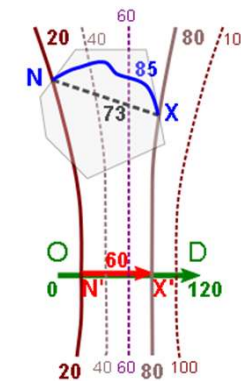
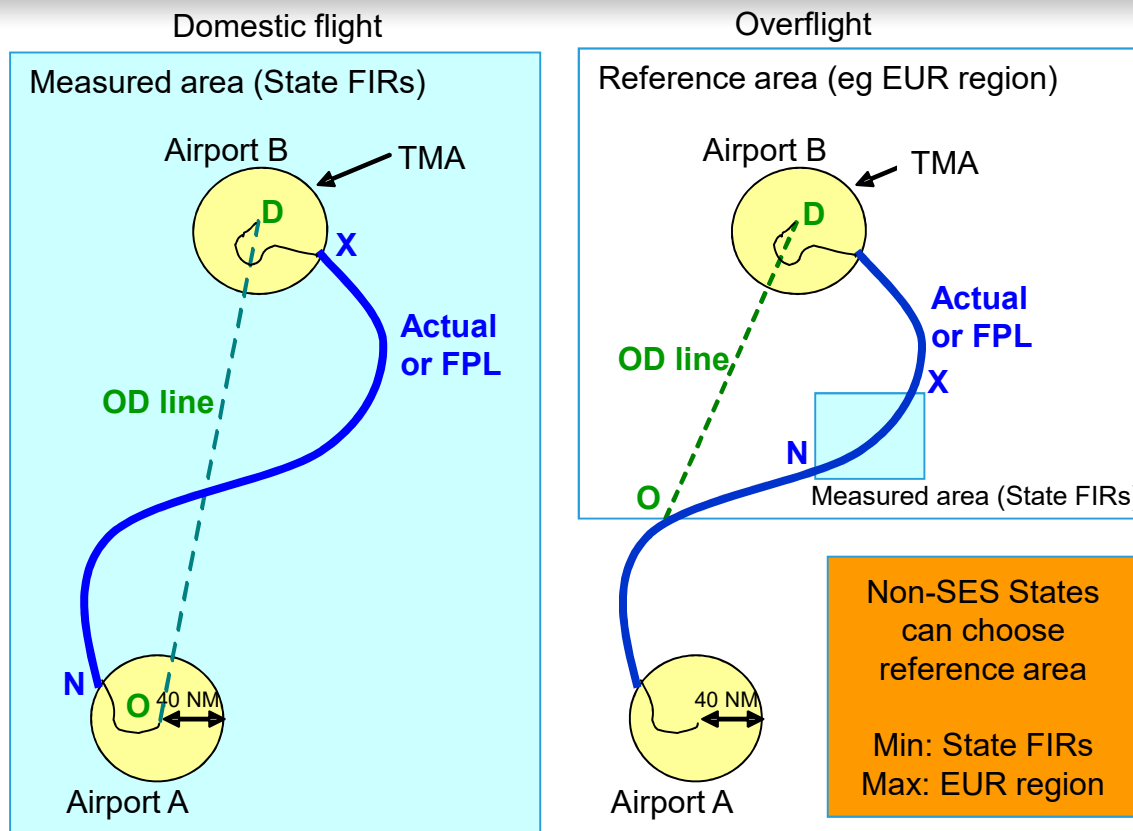
In the example to the left:

Extra distance: $85 - 60 = 25$

$$\text{Inefficiency} = 25 / 60 = 0.42 = 42\%$$




Processing of domestic flights and overflights



- Required inputs: Trajectory and the coordinates of points O, D, N, X (Origin, Destination, eNtry, eXit)
- Computed: Trajectory distance (NX), achieved distance (N'X')
- For the NX parts of all trajectories of IFR flights domestic, departing, arriving, or overflying IFR flights

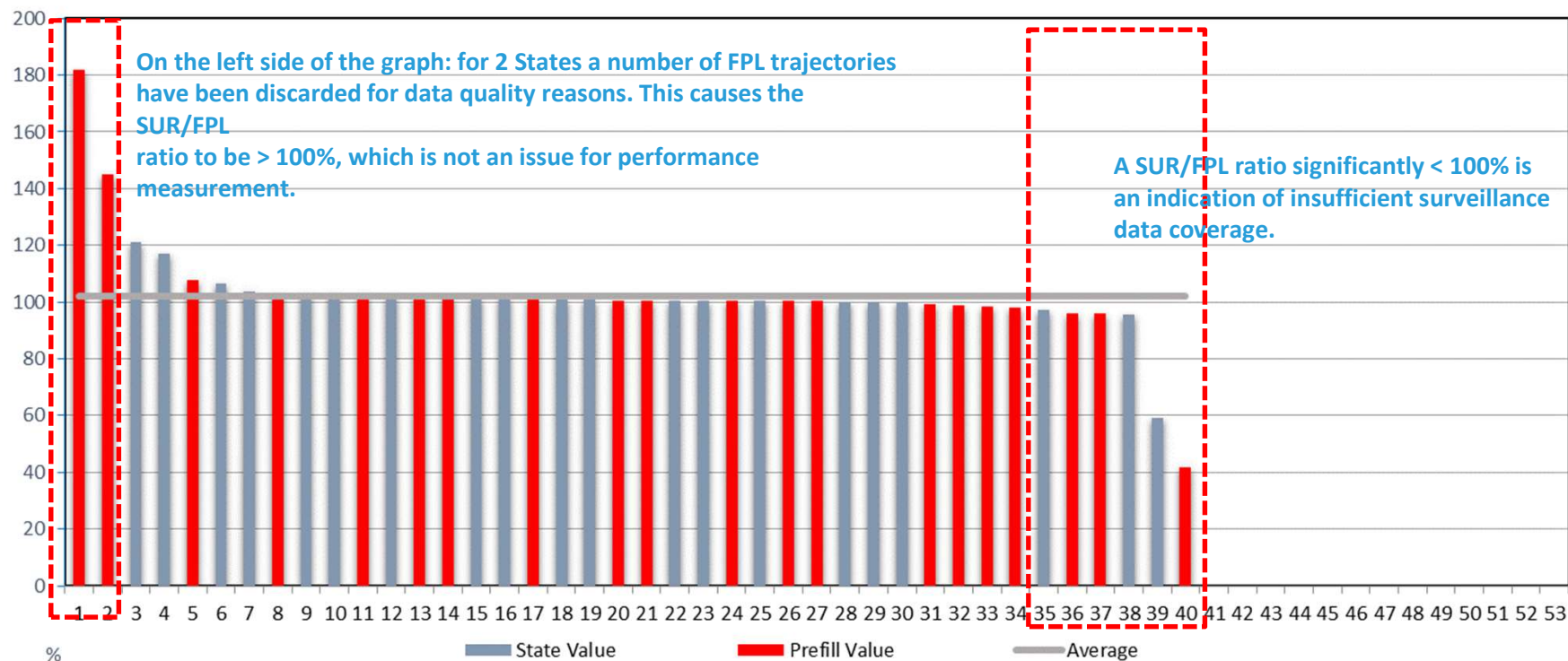


Flight Efficiency		
	Horizontal en-route flight efficiency	
B48	Name of selected reference area (provide list of FIRs in annex)	Text
B50fpl	Total planned IFR distance (flight plan)	km/year
B51fpl	Total achieved IFR distance (flight plan)	km/year
B50sur	Total actual IFR distance (surveillance data)	km/year
B51sur	Total achieved IFR distance (surveillance data)	km/year
B49	Data source for B50 - B53 (surveillance data or flight plan)	SUR or FPL
B49b	SUR/FPL achieved distance ratio (<95% = incomplete coverage)	%
B50	Total flown IFR distance	km/year
B51	Total achieved IFR distance	km/year
B52	Total extra IFR distance (=B50 – B51)	km/year
B53	Horizontal en-route flight efficiency (=B52/B51)	%



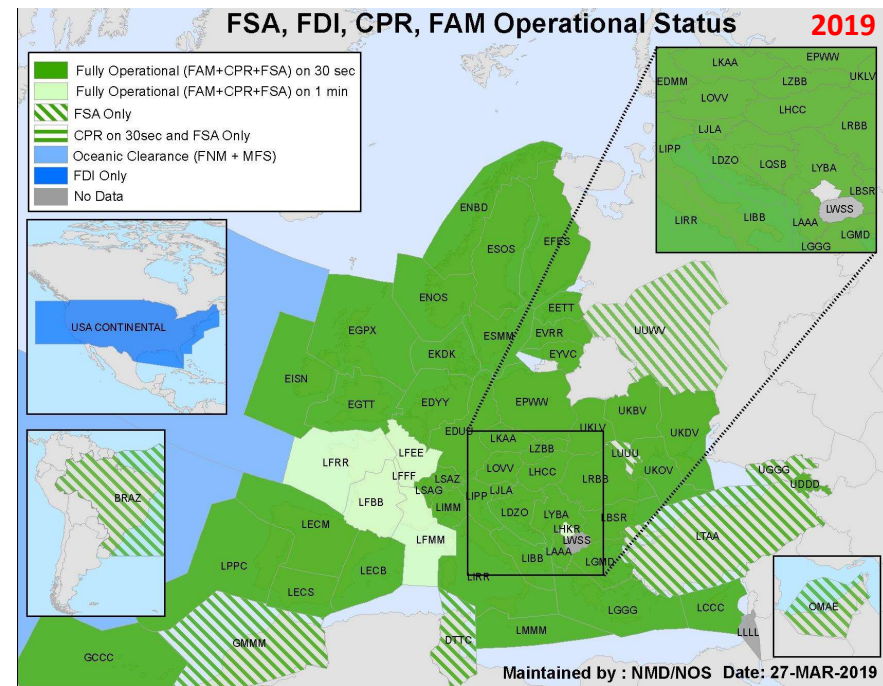
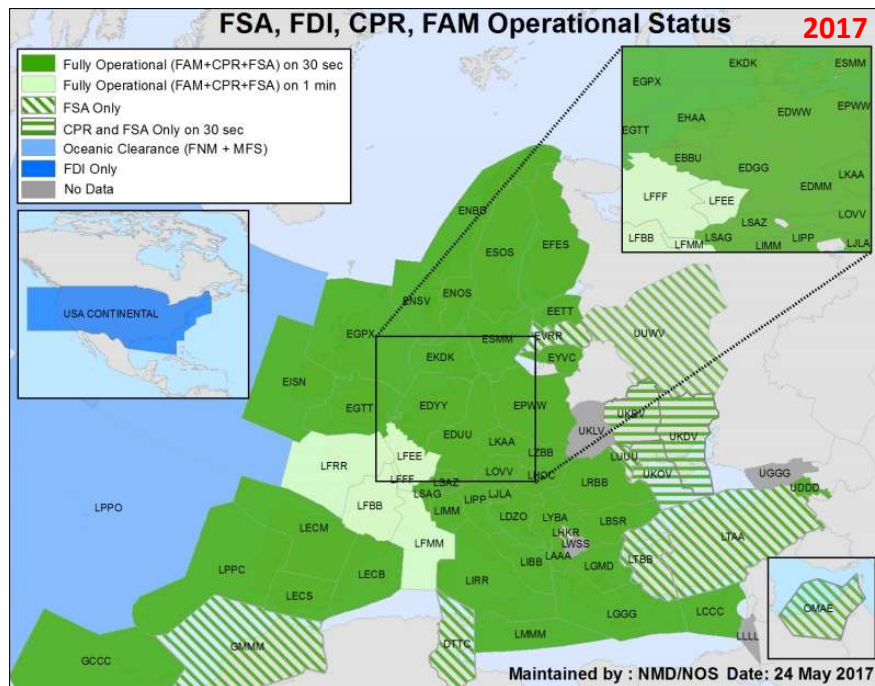


2019 - SUR/FPL achieved distance ratio (<95% = incomplete coverage) (B49b)



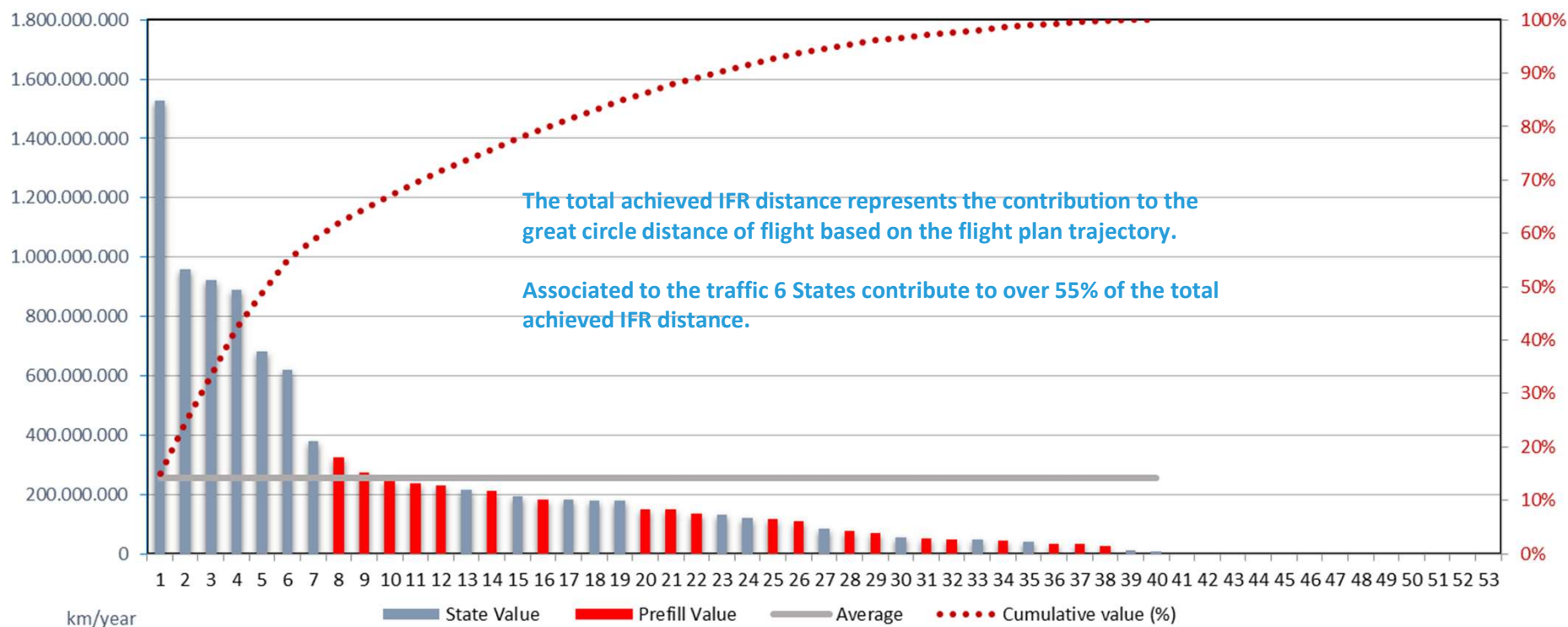


Surveillance data (CPR) coverage





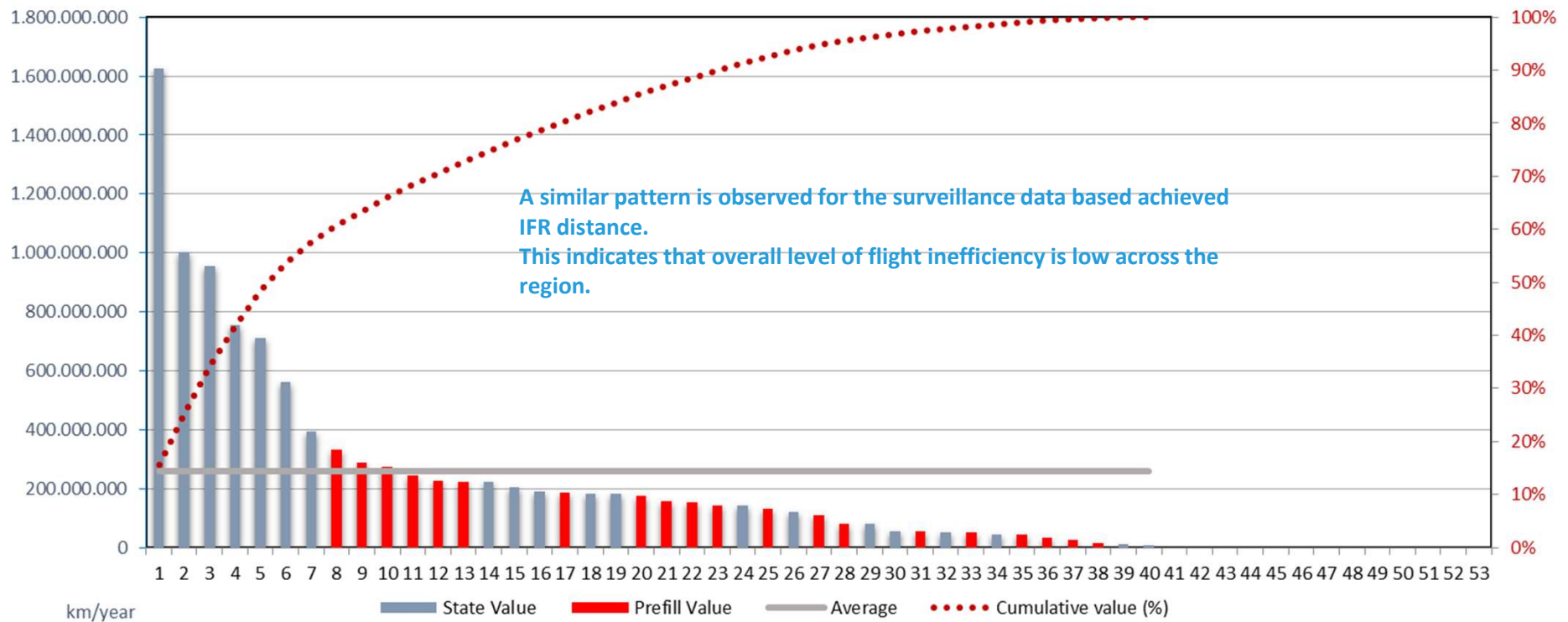
2019 - Flt. Efficiency: Total achieved IFR distance (flight plan) (B51fpl)



Total achieved IFR distance (in other words: contribution to the great circle distance of the flights) according to FPL trajectories.



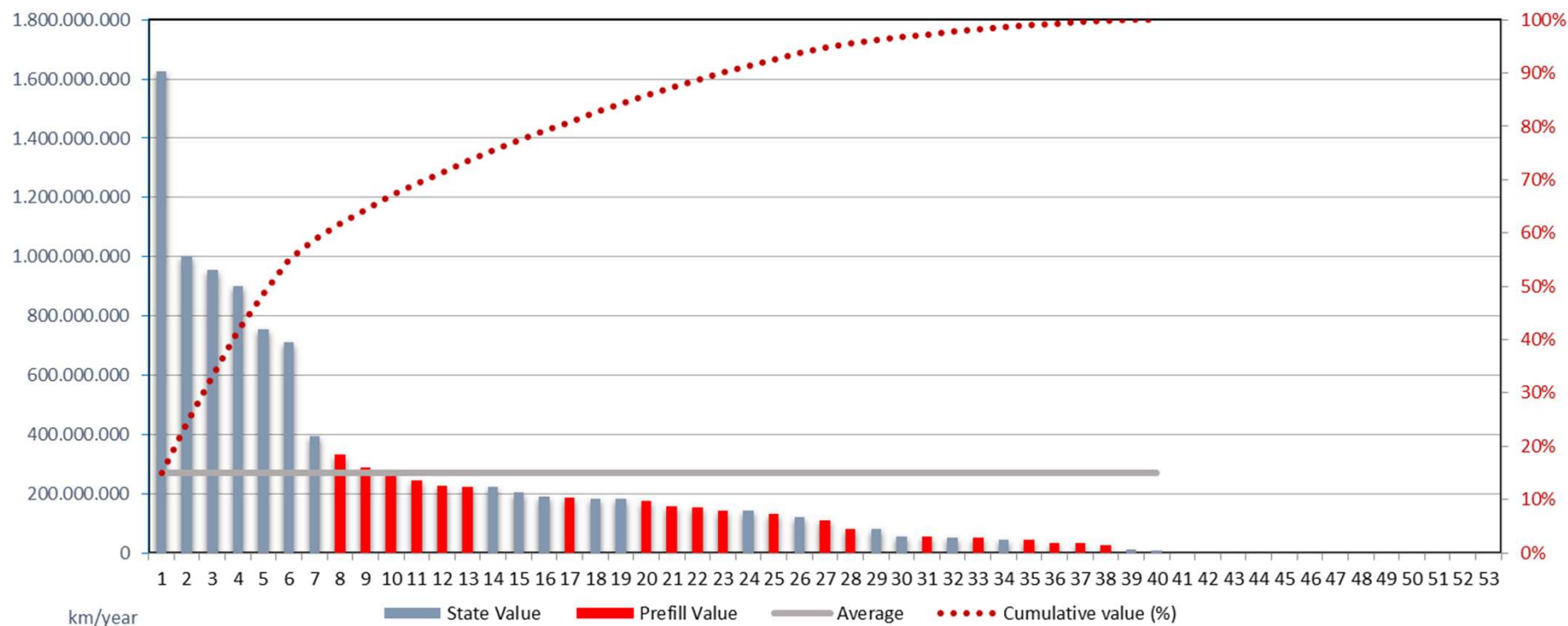
2019 - Flt. Efficiency: Total actual IFR distance (surveillance data) (B50sur)



Total achieved IFR distance (in other words: contribution to the great circle distance of the flights) according to surveillance data trajectories.



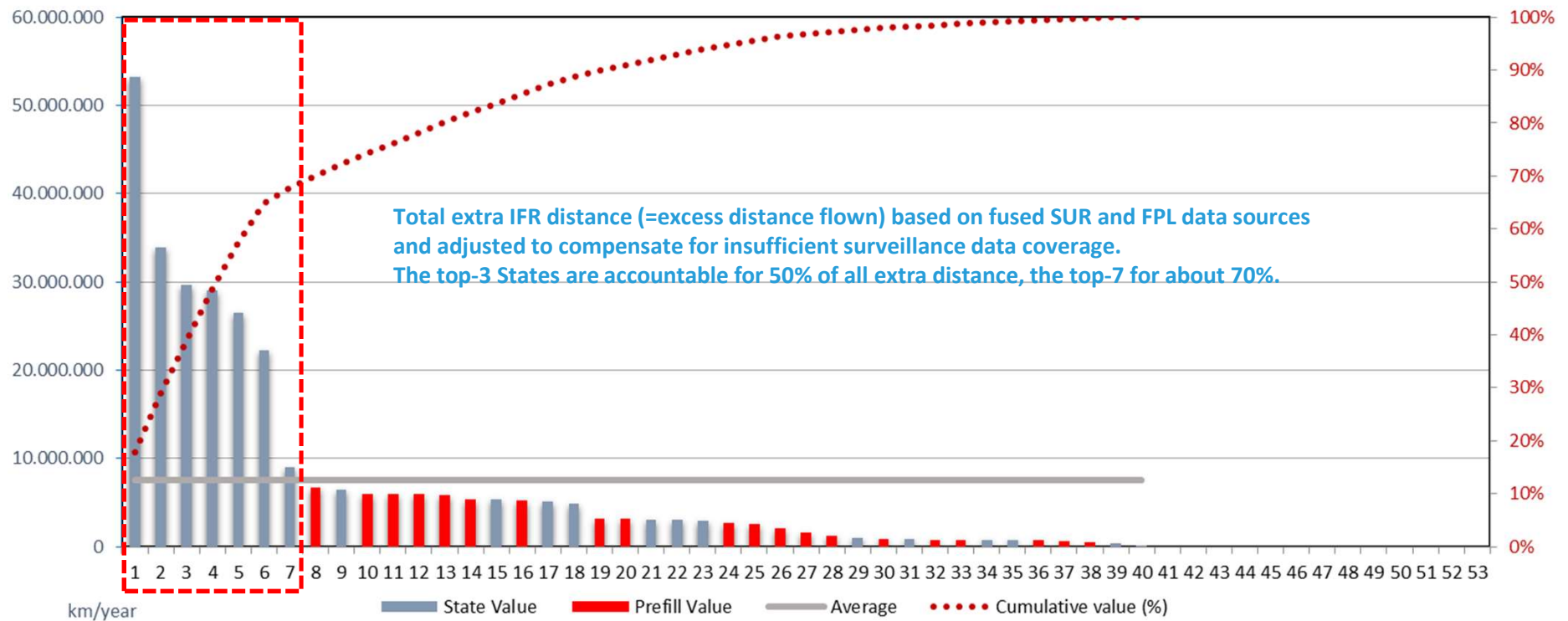
2019 - Flt. Efficiency: Total flown IFR distance (B50)



Total flown IFR distance (=actual distance) fused from SUR and FPL data sources and adjusted to compensate for insufficient surveillance data coverage.

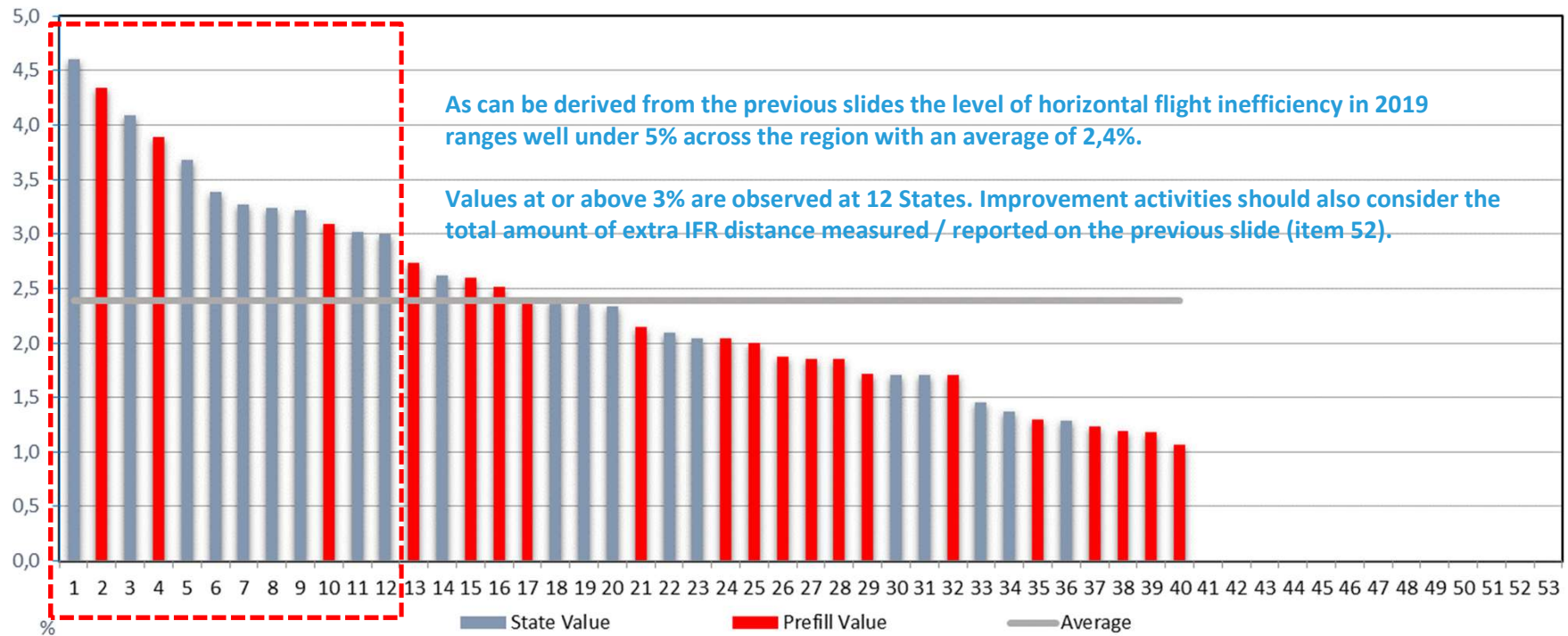


2019 - Flt. Efficiency: Total extra IFR distance (=B50 – B51) (B52)





2019 - Horizontal en-route flight efficiency (=B52/B51) (B53)

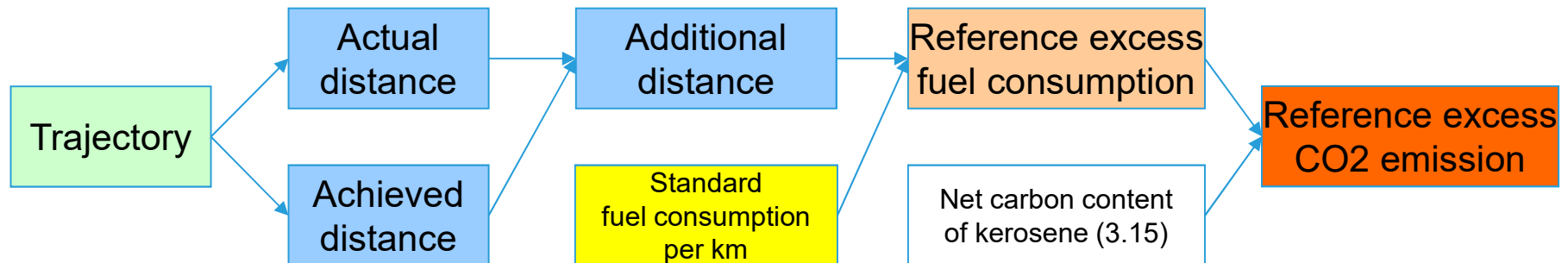




KPA	Environment
Objective	Contribute to the protection of the environment – focussing on fuel savings and CO2 emission reductions
Indicator	CO2 emissions deriving from inefficiencies in flight efficiency (conversion of additional distance into CO2 emissions based on standard values formula)

Definition of indicator

- Reference excess fuel consumption:
Total additional distance flown in the airspace volume (i.e. State) multiplied by a standard fuel consumption factor (value chosen by each State)
- Reference excess CO₂ emission:
Reference excess fuel consumption multiplied by 3.15 (net carbon content of kerosene)





Remarks

- Indicator
 - Has low data requirements and is therefore easy to implement
 - Because mostly based on “additional distance” already computed
 - Publishes an approximation of excess CO2 emission, resulting from horizontal flight inefficiency
 - The optimum indicator value is not equal to zero
 - Value is influenced by many different factors (including traffic volume, fleet characteristics etc.)
 - Indicator does not cover everything (missing: vertical flight efficiency, TMA inefficiencies, surface movement inefficiencies)
 - Hence the absolute value of the indicator should not be interpreted as representing the CO2 emissions caused by ANS.
 - Indicator to be used for “general purpose” and trend analysis only



Environment		
	CO ₂ emissions deriving from inefficiencies in flight efficiency	
B54	Average en-route fuel consumption factor for the State (provide source and computation method in annex)	kg/km
B55	Average en-route CO ₂ emission factor for the State (=B54 * 3.15)	kg/km
B56	Theoretical CO ₂ emissions deriving from inefficiencies in horizontal en-route flight efficiency (=B52 * B55 / 1000)	Tonnes/year



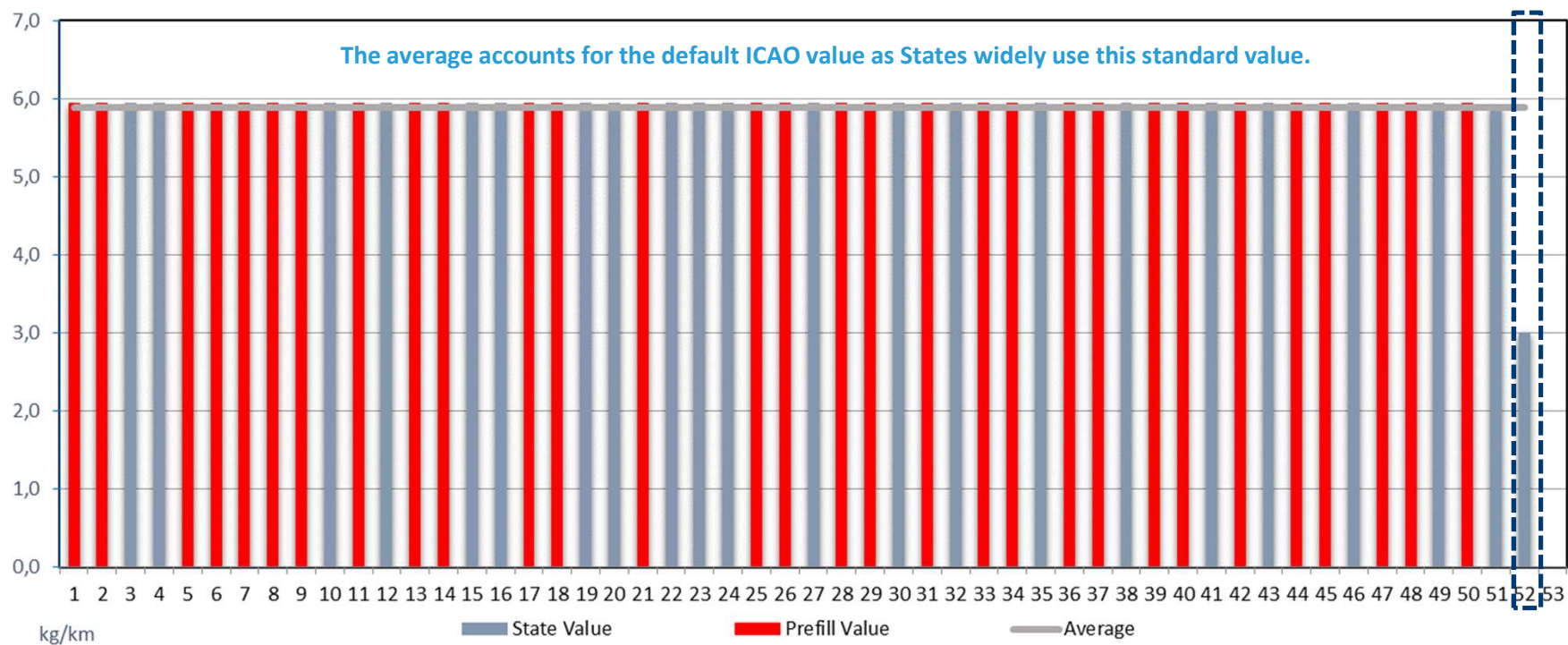


B54 – Average en-route fuel consumption factor

- State can choose method/value
 - Global standard value from ICAO
 - Average fuel burn per nautical mile (NM) of flight = 11 kg/NM = 5.9 kg/km
 - Source: Doc 9750 3rd ed. page App H-8
 - Used for the prefiling of the template
 - State-specific standard value: the standard kerosene consumption per kilometer of a typical jet aircraft type
 - States can select their own “typical aircraft type”, reflecting the composition of traffic in their airspace
 - State-specific measured value: a calibrated average fuel consumption per kilometre flown,
 - computed from the State’s average annual traffic composition in terms of aircraft types, vertical traffic distribution and distance flown
 - using the ICAO Fuel Savings Estimation Tool (IFSET)
 - or any other modeling tool, if available
 - recalibration needed every couple of years to take into account changes in traffic composition



2019 - Average en-route fuel consumption factor for the State (provide source and computation method in annex) (B54)

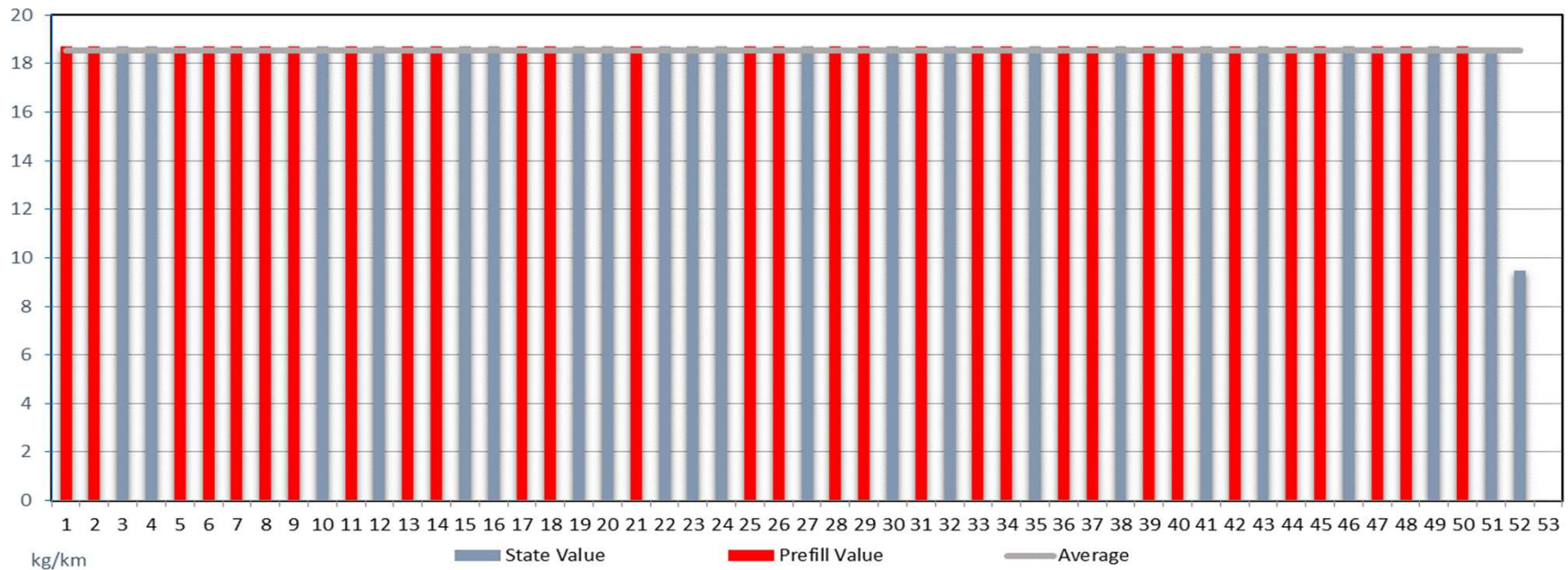


1 State has submitted its own computation of the average en-route fuel consumption. All others use the default ICAO value provided in the prefilled tables (5.87 kg/km).
Note that since mid-2018 we know (as a result of detailed modelling) that the average gate-to-gate (not en-route) fuel consumption factor for the ECAC area is 20% less: 4.72 kg/km.



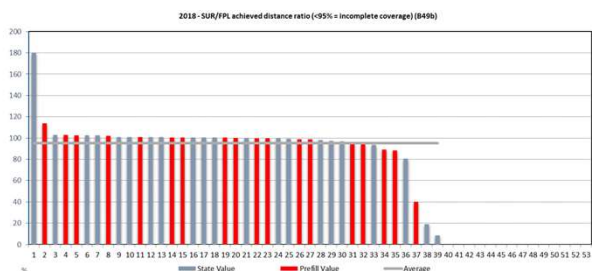
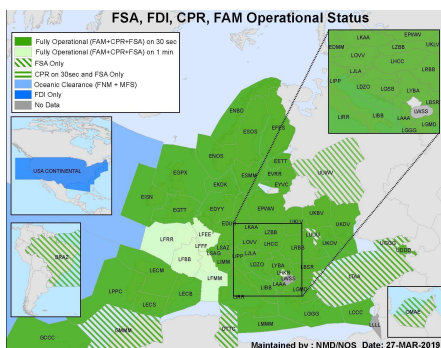
The reported average en-route CO₂ emission factor is based on the aforementioned widely used standard value.

2019 - Average en-route CO₂ emission factor for the State (=B54 * 3.15) (B55)



This is the States' CO₂ emission factor assuming that all used fuel is Jet fuel.

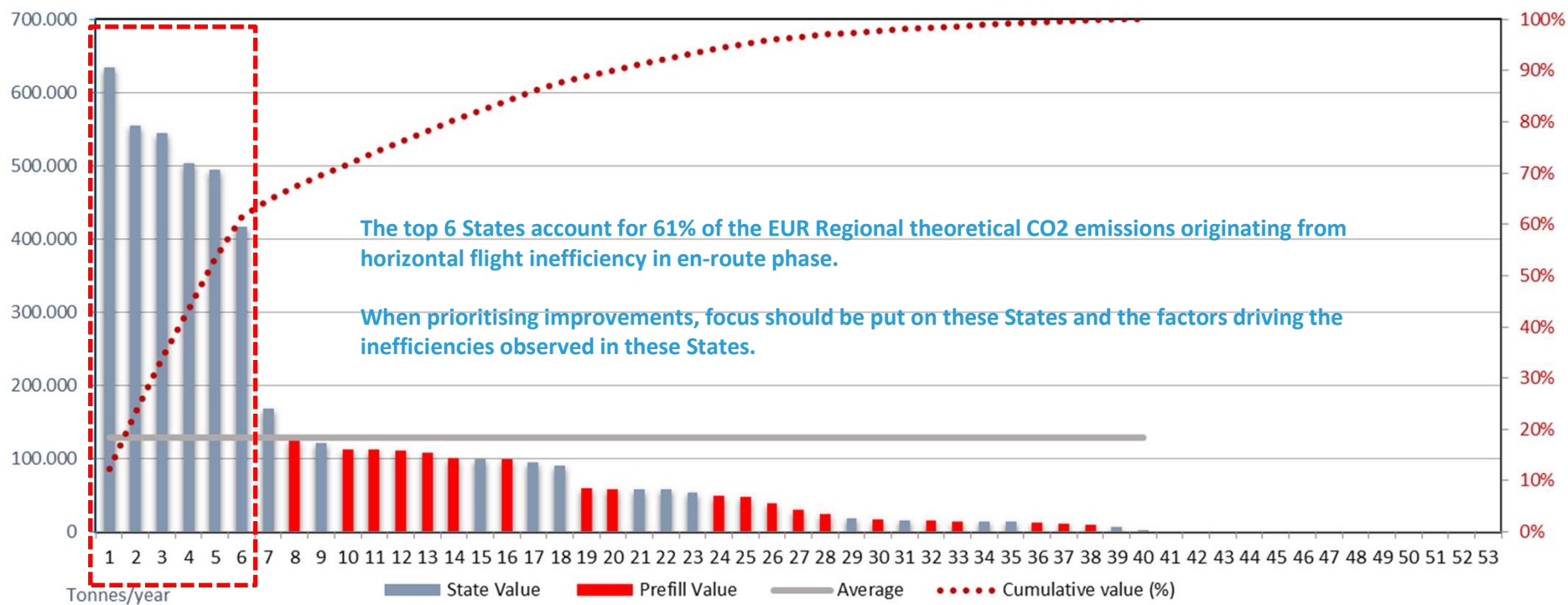
Addressing coverage issues



- Indicator is an absolute value
 - Susceptible to coverage issues
 - Geographical, time, flight category filtering
- Coverage checks & corrections
 - SUR data available
 - Sufficient match with FPL data (achieved distance comparison >95%)
 - Use additional distance from SUR data as is
 - Insufficient match with FPL data
 - Upscale additional distance from SUR data to 95% of additional distance from FPL data
 - SUR data not available
 - Use additional distance from FPL data



2019 - Theoretical CO2 emissions deriving from inefficiencies in horizontal en-route flight efficiency (=B52 * B55 / 1000) (B56)



The top-6 States are accountable for 65% of the EUR Region theoretical CO2 emissions originating from a lack of horizontal flight efficiency. When prioritising improvements, the focus should be on these States.



KPA	Cost effectiveness
Objective	Contribute to optimize the cost for air navigation services
Indicators	<ul style="list-style-type: none">- IFR flights (en-route) per ATCO hour on duty- IFR flight hours (en-route) per ATCO hour on duty- IFR movements (airport) per ATCO hour on duty



Remarks

- Indicators
 - Focus on an important component of ANSP costs
 - However with the limitation that working hours per ATCO, employment cost per ATCO, and support cost are not covered
 - Reuse data reporting already in place for many States
 - Also reuse existing data definitions and terminology
 - EUROCONTROL Specification for Economic Information Disclosure (SEID)
 - Have relatively simple reporting requirements
 - Only traffic volume and ATCO hours on duty
 - Avoid entering into financial information disclosure issues for the initial implementation of the framework

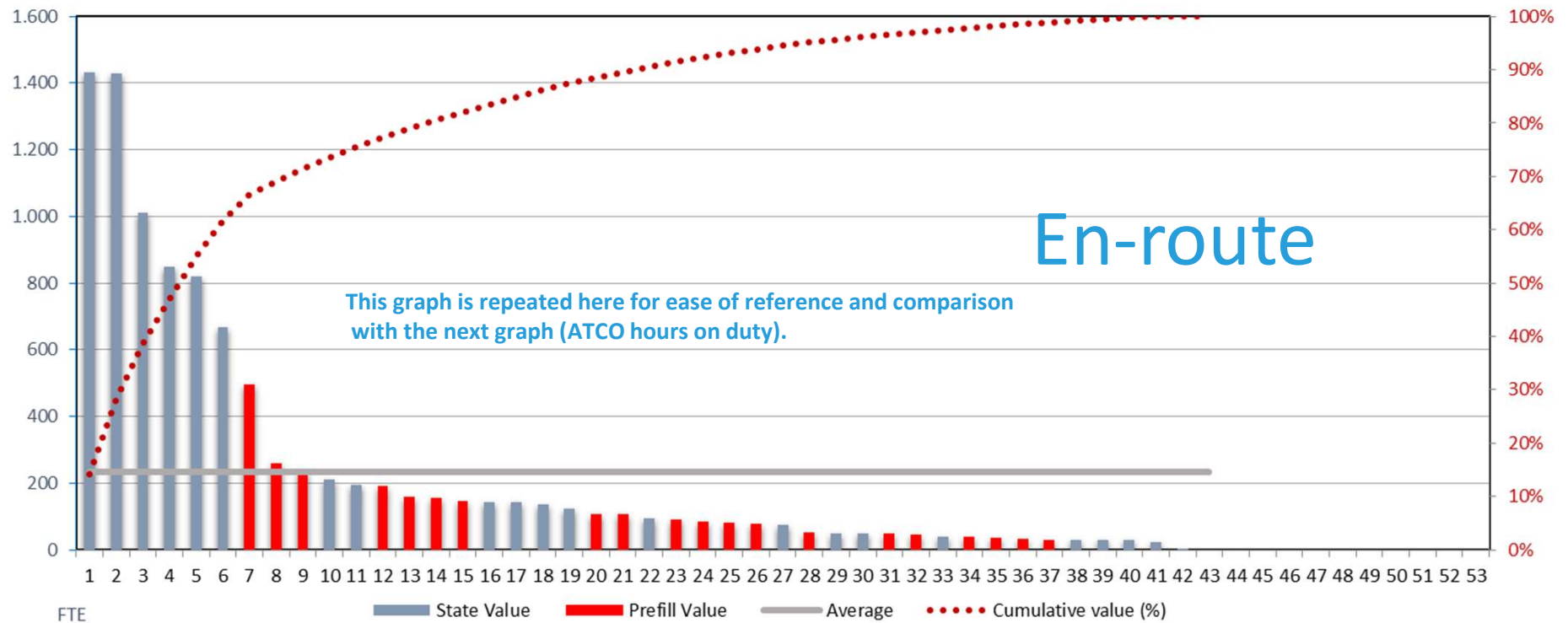


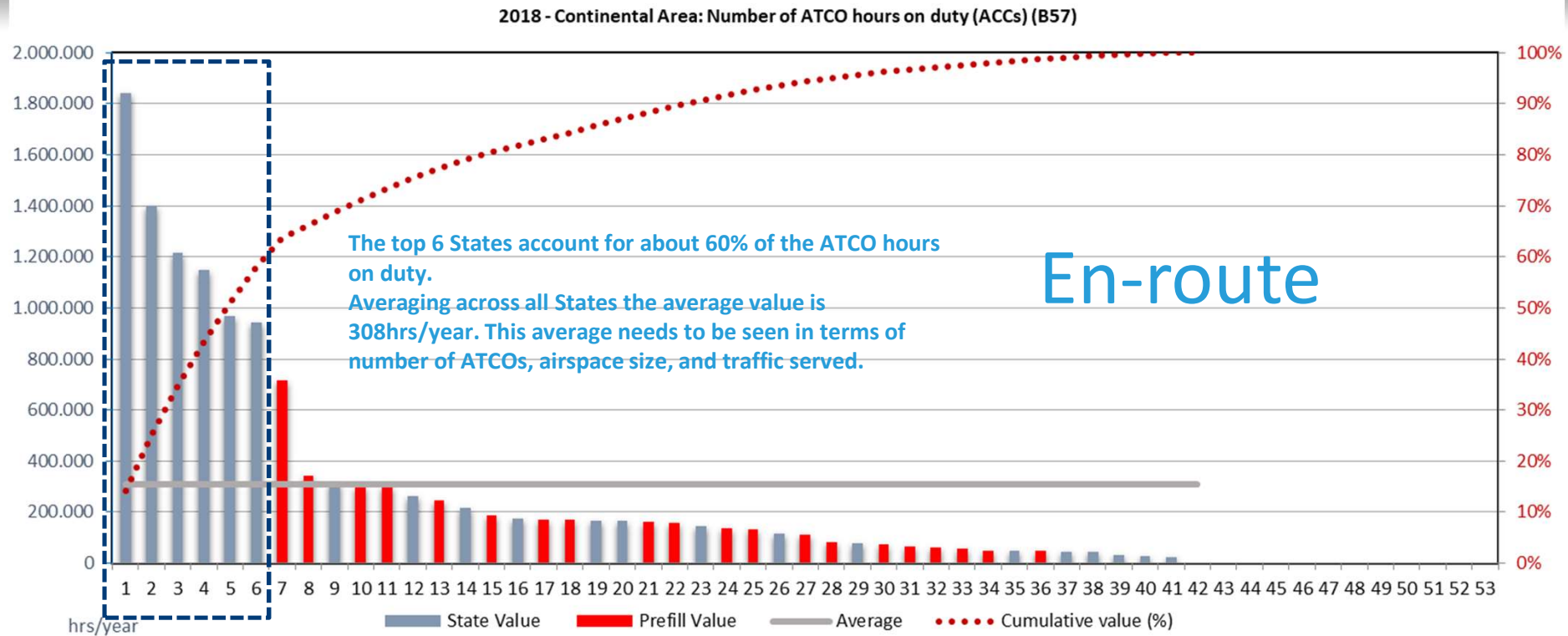
Cost effectiveness		
	ATCO productivity (Continental Area)	
B57	Number of ATCO hours on duty (ACCs)	hrs/year
B58	Number of ATCO hours on duty (APP+TWRs)	hrs/year
B59	IFR flights (en-route) per ATCO hour on duty (ACCs) (=A11/B57)	Flights/hr
B60	IFR flight hours per ATCO hour on duty (ACCs) (=A15/B57)	hrs/hr
B61	IFR movements (airport) per ATCO hour on duty (APP+TWRs) (=A16/B58)	Mov/hr





2018 - Continental Area: Number of ATCOs in operations at ACCs (A26)

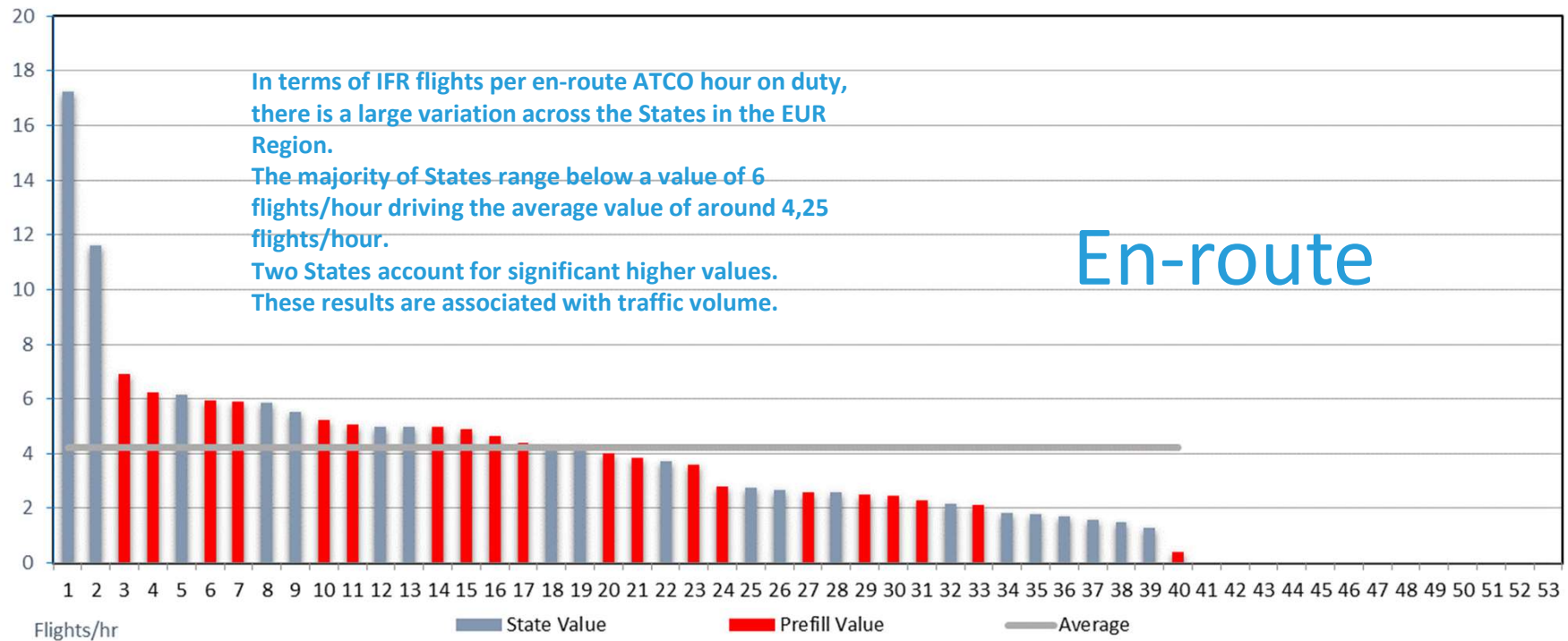




4 States are accountable for more than 50% of all en-route ATCO hours on duty in the EUR Region.



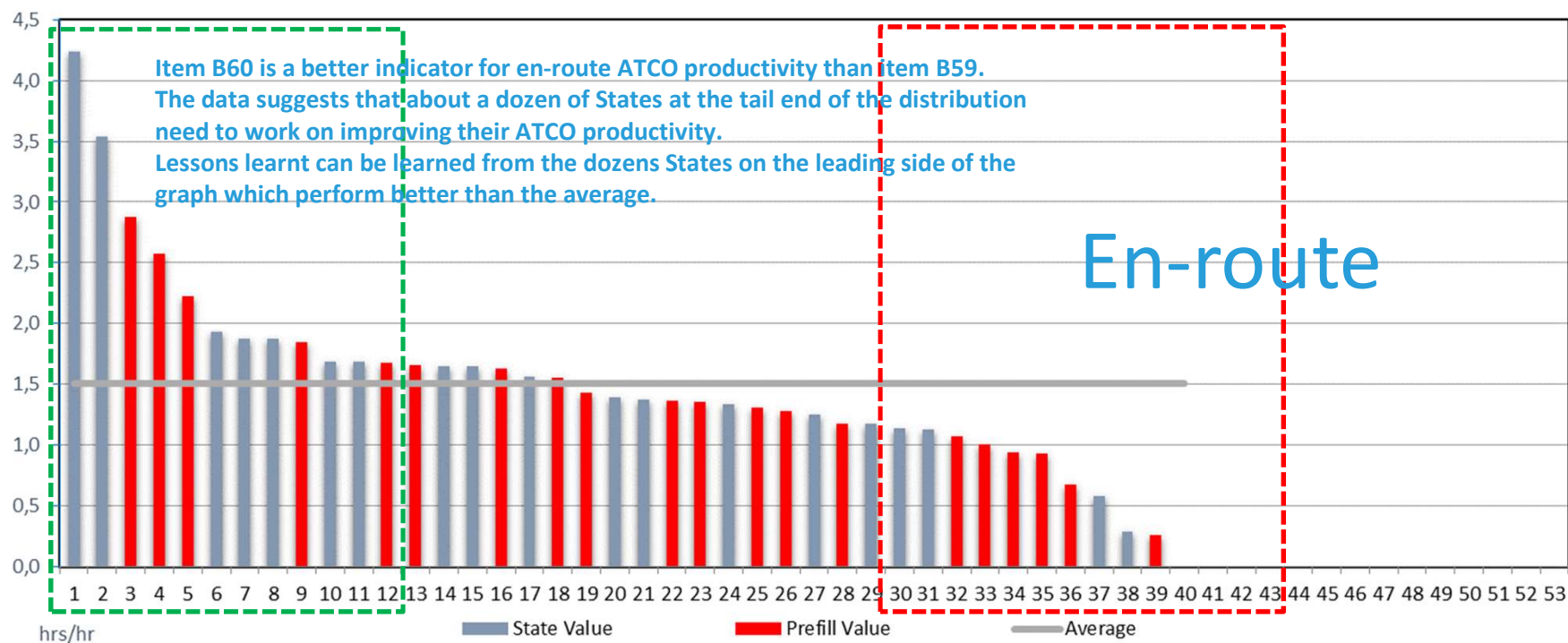
2018 - Continental Area: IFR flights (en-route) per ATCO hour on duty (ACCs) (=A11/B57) (B59)



In terms of number of movements handled per en-route ATCO hour on duty, there is a large variation but this does not take into account the average flight duration in the State.

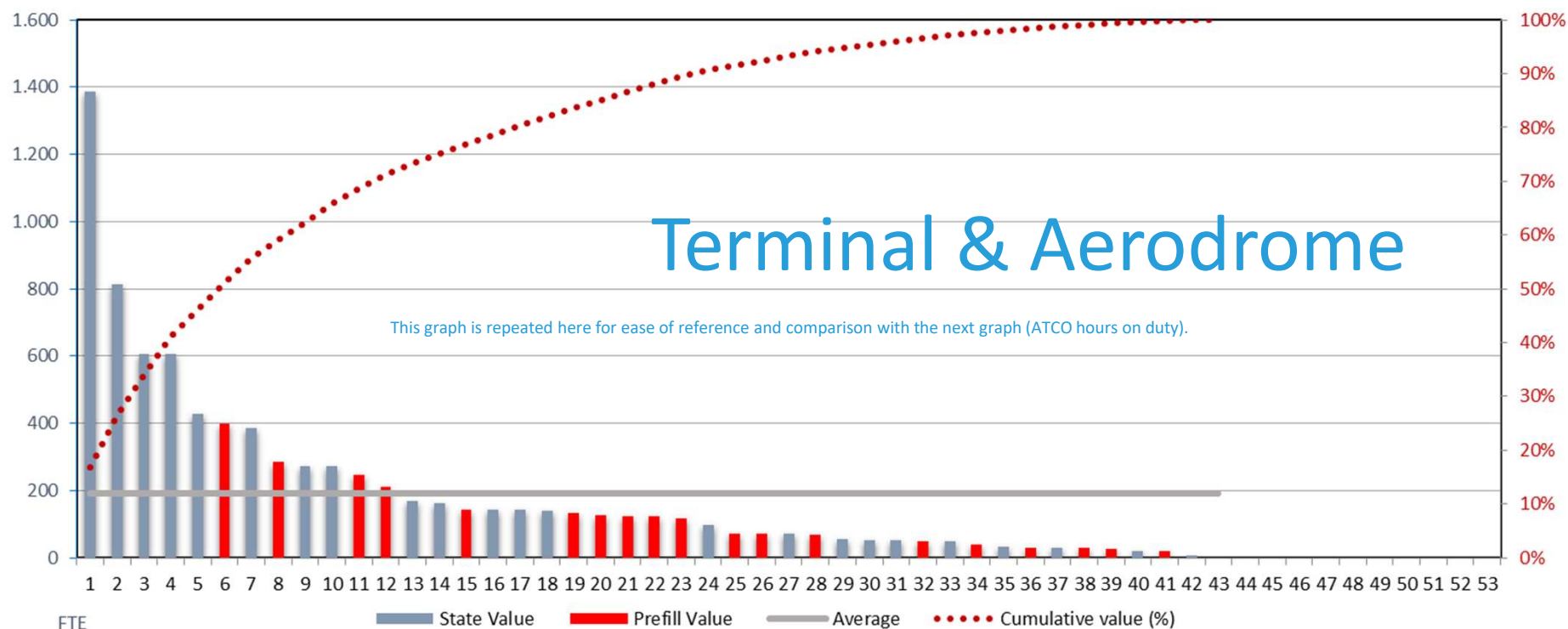


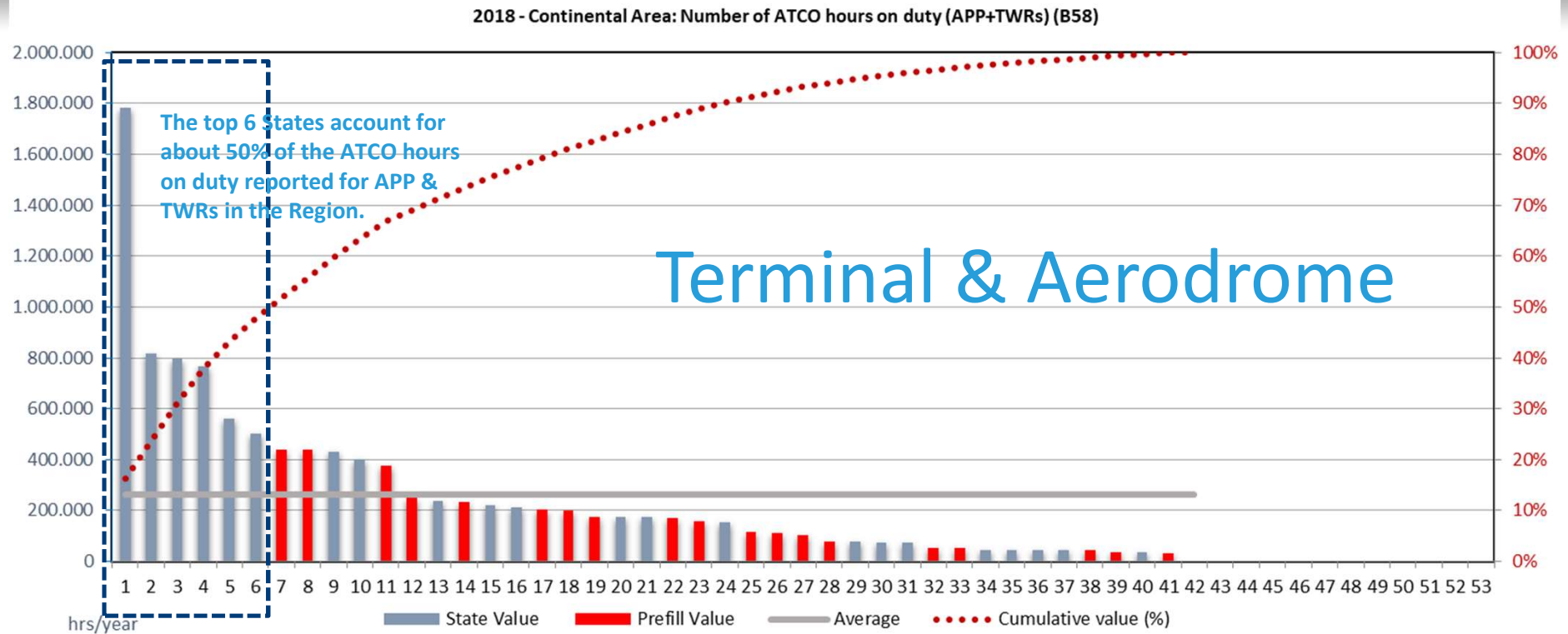
2018 - Continental Area: IFR flight hours per ATCO hour on duty (ACCs) (=A15/B57) (B60)





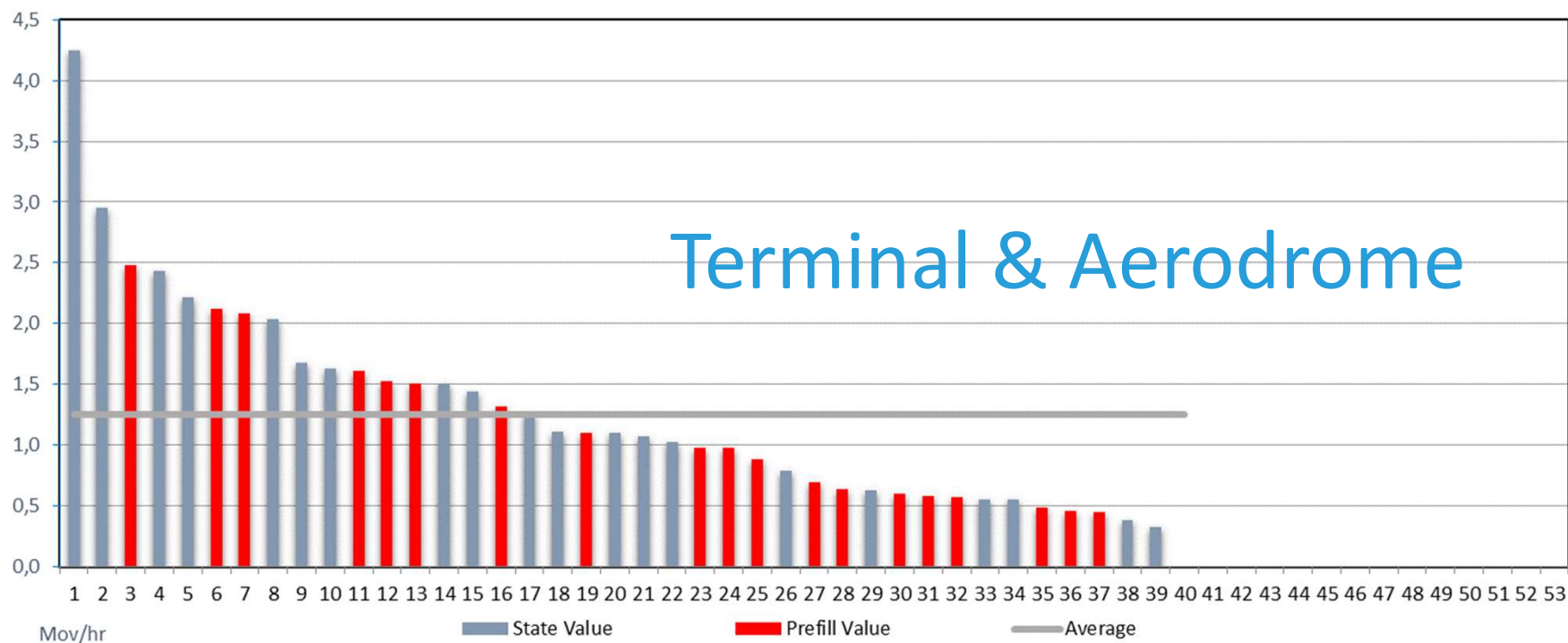
2018 - Continental Area: Number of ATCOs in operations at Terminal Facilities (APP+TWRs) (A27)







2018 - Continental Area: IFR movements (airport) per ATCO hour on duty (APP+TWRs) (=A16/B58) (B61)



This indicator is considered less than ideal because it only relates the terminal & aerodrome ATCO hours on duty to the number of IFR airport movements. However certain States report a significant number of VFR airport movements (item A17), and obviously these ATCOs control the total number of airport movements. When aggregating to State level, this includes airports with a mix of IFR and VFR traffic, as well as airports predominantly used by VFR or IFR traffic. In particular the ATCO hours on duty include those at smaller (regional or local) controlled airports with a high proportion of VFR traffic.



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THANK YOU