

# Smart and Sustainable

Action Plan for Air Transport in the Netherlands: 35% less CO<sub>2</sub> by 2030





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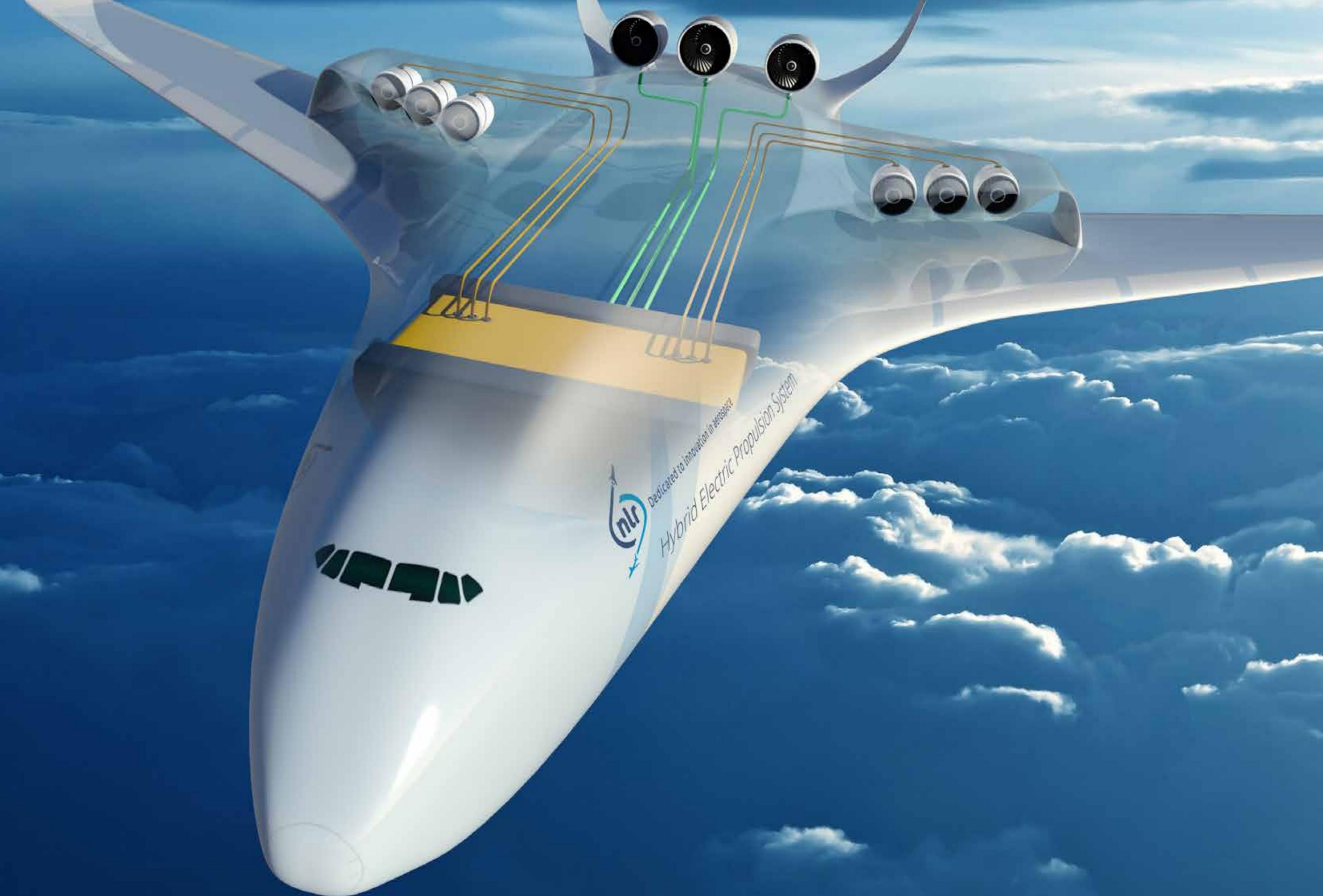
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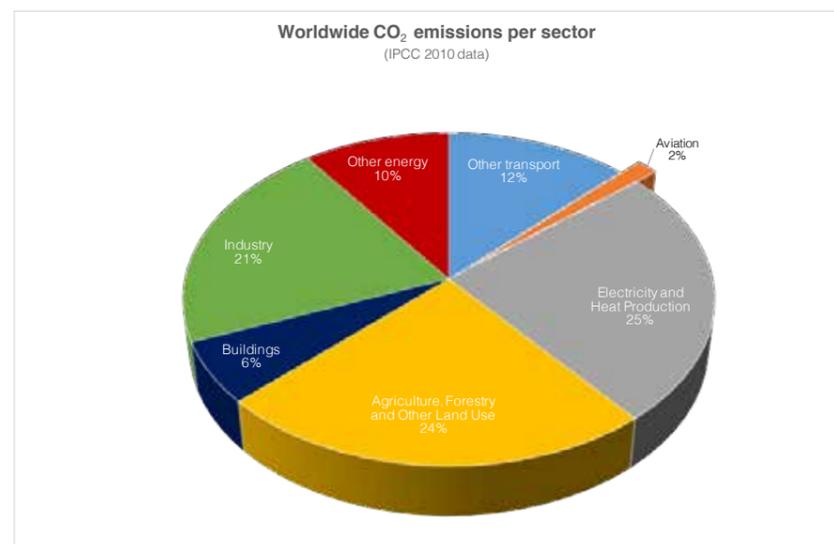
# Contents

Introduction	page 6
Theme 1: Optimising flight paths & procedures	page 9
Theme 2: Incentivising investment in cleaner aircraft by way of airport charges	page 11
Theme 3: Greater utilisation of sustainable fuel	page 13
Theme 4: Radical fleet renewal	page 15
Theme 5: Use of railways and other sustainable modes of transport for shorter trips	page 17
Theme 6: Working towards zero emission airports	page 19
Theme 7: A swift, efficient and sustainable “first & last mile”	page 21
Conclusion	page 22

# Introduction

There is a shared ambition among leading air transport businesses and knowledge centres in the Netherlands to become the smartest and most sustainable players in the global air transport sector. These innovative organisations are cooperating closely with other sectors and enterprise centres to achieve this ambition and to ensure international relevance, as the sector also serves international customers, enabling people and trade to make their way across the globe. All this makes the air transport sector an indispensable cornerstone of Dutch prosperity and ensures that the Netherlands remains an attractive target for foreign investment. The sector provides 370,500 jobs<sup>1</sup> and contributes € 27 billion to the gross national product of the Netherlands.

A successful air transport sector of this magnitude does have an impact, however. Air transport accounts for 2%<sup>2</sup> of all CO<sub>2</sub> emissions worldwide.



To reduce this impact, the sector has for decades invested in better processes, infrastructure and research programmes throughout the chain, with a view to ensuring greener airspace utilisation (SESAR) and aircraft (Clean Sky). In addition, the air transport sector contributes to global climate objectives by way of sector-wide, legally-binding initiatives that substantially reduce the level of CO<sub>2</sub> emissions, namely:

## - European Union Emissions Trading Scheme (EU-ETS)

Since 2012, European airlines have been reducing their CO<sub>2</sub> emissions within the European Union through the European Emissions Trading Scheme (EU-ETS).

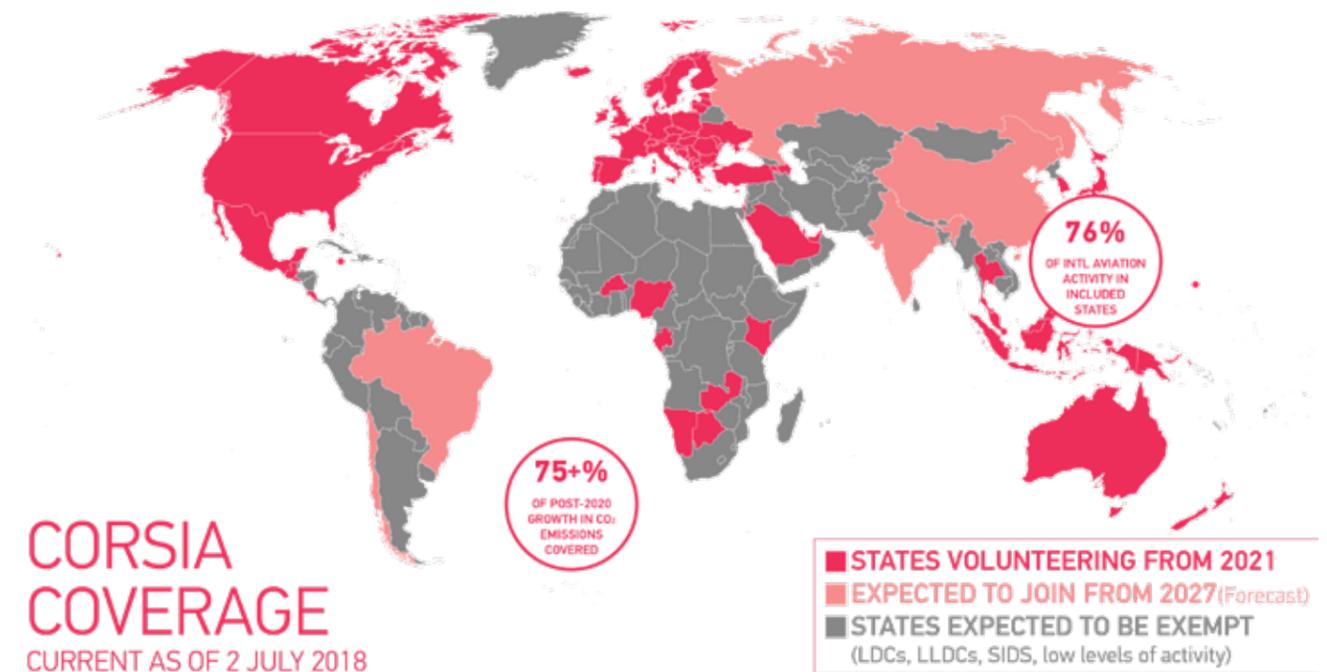
## - Carbon Offsetting and Reduction Scheme for Aviation (CORSIA):

In 2009, the international air transport sector agreed on reduction targets for CO<sub>2</sub> emissions at the Climate Summit in Copenhagen; and in 2016, air transport became the first sector to reach UN-based agreements for concrete global efforts to reduce CO<sub>2</sub> emissions within the International Civil Aviation Organisation (ICAO). Via CORSIA, no fewer than 72<sup>3</sup> countries, including the Netherlands, have committed to ensuring that CO<sub>2</sub> emissions from air transport no longer increase from 2021 onwards. This is how the sector contributes towards achieving the objectives of the Paris Agreement and the United Nations' Sustainable Development Goals for 2030.

On top of that, the International Air Transport Association (IATA) aims to reduce CO<sub>2</sub> emissions by 50% in 2050, compared to total emissions from air transport in 2005.

Leading transport organisations and knowledge centres in the Netherlands have the shared ambition and vision to become the world's smartest and most sustainable air transport sector. This is fully in line with the objectives of the Dutch government coalition agreement.

Research and publications clearly state that it will be a challenge to ensure that CO<sub>2</sub> emissions from air transport do not increase in absolute terms<sup>4</sup> in the coming 10 to 20 years. This plan offers a broadly supported initiative and open invitation to actually achieve a reduction in CO<sub>2</sub> emissions in absolute terms in the Netherlands air transport sector by 2030, and to adequately position ourselves for the subsequent period. We are aware that we collectively face the challenge of keeping the global temperature increase below 2°C. The air transport sector aims to contribute towards this by reducing emissions in its own chain and, where this is not possible, by compensating for emissions in accordance with UN agreements (CORSIA).



Source: ATAG – July 2018

## SMART AND SUSTAINABLE

This action plan revolves around the idea that a combination of Dutch ingenuity, innovation and close cooperation between all stakeholders will boost sustainability in the short, medium and long term. In this regard, it is important to bear in mind that the air transport sector is complex and diverse and that increased sustainability can only be achieved through cooperation throughout the international chain. This presents a bright future for air transport through 2030, with onward projections to 2050, offering an appealing and collective route to achieving these objectives. This is no easy task and it seems logical that all players in the “golden triangle” – government, knowledge centres and businesses – should join forces. The parties that jointly drafted this action plan will ask new partners to get involved in developing the plan, thereby ensuring that knowledge and expertise available in the Netherlands is fully exploited.

To become the smartest and most sustainable air transport sector in the world, we want to accelerate existing developments, remove obstacles and embrace radical solutions. In this document, we have outlined seven themes that will enable us to achieve this ambition. They are as follows:

<sup>1</sup> Report InterVISTAS 2015

<sup>2</sup> IATA Fact Sheet – Climate Change & CORSIA – May 2018

<sup>3</sup> EU ETS data viewer of the European Environment Agency (EEA) – data 30 August 2018

<sup>4</sup> <https://www.icao.int/environmental-protection/CORSIA/Pages/state-pairs.aspx>

<sup>5</sup> PBL - Ontwikkeling Luchtvaart en CO<sub>2</sub> emissies in Nederland - June 2018



The purpose of the first five (blue) themes is to reduce CO<sub>2</sub> emissions caused by air transport based in the Netherlands. The purpose of the last two (brown) items is to reduce CO<sub>2</sub> emissions on the ground. They fall within the scope of a national programme based on the Paris Agreement, which is why we have quantified them separately, on top of our efforts to reduce CO<sub>2</sub> emissions from air transport.

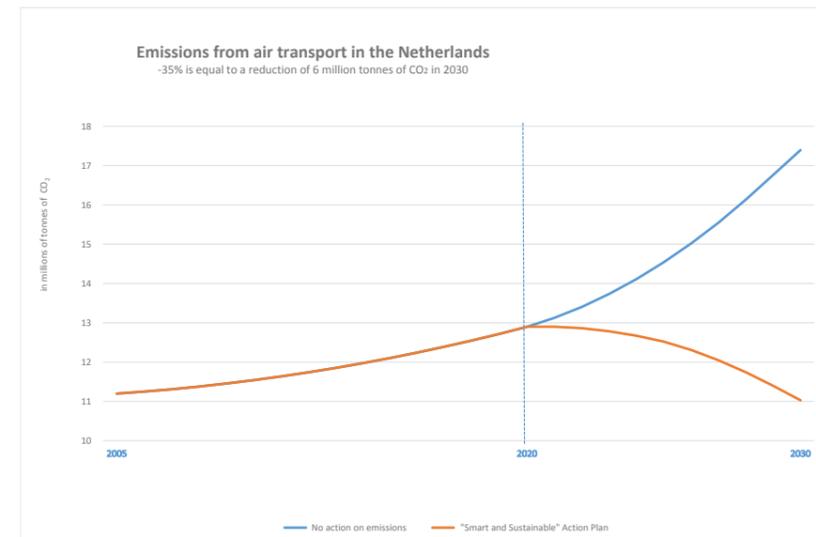
### YIELD

The "Overheidsmaatregelen biokerosine"<sup>5</sup> (Government Measures for Biokerosene) and "Economische- en Duurzaamheidseffecten Vliegbelasting"<sup>6</sup> (Economic and Sustainability Effects of Air Transport Tax) reports published by CE Delft form the basis of our fuel-burn estimates for 2030. We based these estimates on the "WLO Low scenario 2030" for development of the air transport industry, without taking into account the extent to which aircraft and flight paths may become more efficient. CE Delft validated the calculations and guiding principles of this "Smart and Sustainable" action plan.

CE Delft concludes that this action plan is ambitious, but feasible. Based on these figures, the sector will consume 5.5 million tonnes of kerosene in the Netherlands in 2030, if no action is taken, which amounts to 17.3 million tonnes of CO<sub>2</sub>. By pursuing this action plan, CO<sub>2</sub> emissions will be reduced by 6 million tonnes in 2030, which is almost 35% less than the level predicted for 2030 and equal to the CO<sub>2</sub> emissions from homes and

transport<sup>7</sup> of approximately 750,000 households.

In absolute terms, CO<sub>2</sub> emissions from air transport in the Netherlands will then be approximately at the level of 2005.



Owing to the integrated nature of our plans they will also contribute to the welfare and prosperity of the Netherlands in other ways, bringing about an improvement in the human environment at and around airports, as well as the accessibility of airports, while also generating new insight and fostering the development of new markets, such as the production of sustainable fuel. In so doing, we too will contribute towards the energy transition of broader society and towards strengthening the competitive edge of the Netherlands.

This action plan shows that sustainability and economic considerations go hand in hand when it comes to jointly tackling important societal, economic and sectoral themes. If this action plan is to succeed, however, it is necessary to coordinate our efforts, because the process is complex, as none of the parties has influence on all process elements and some of the interests, including financial aspects, may be in conflict with one another. All this demands strong coordination during the development and implementation process, as well as support from Europe and the amendment of existing laws and regulations. We therefore believe the government is an essential partner in this process.

With this document, we hope to join hands with the government in working towards a smarter and more sustainable future.

<sup>6</sup> CE Delft – 4.J8 Overheidsmaatregelen biokerosine – June 2017

<sup>7</sup> CE Delft – 7.R08 Economische- en Duurzaamheidseffecten Vliegbelasting – June 2018

<sup>8</sup> Milieu Centraal – Een gemiddeld huishouden stoot jaarlijks 8 ton CO<sub>2</sub> uit door energieverbruik in huis en vervoer.







# Theme 1: Optimising flight paths & procedures

By reducing fuel consumption we also reduce CO<sub>2</sub> emissions. Fuel consumption is partly determined by the paths that aircraft follow when landing, taking off and flying to their destination. Fuel consumption is lowest when the route is as direct as possible and when landing and takeoff procedures are optimised. Existing flight paths in the Netherlands and elsewhere in European airspace are congested and not always very efficient, leading to extra CO<sub>2</sub> emissions and delays. Optimised airspace would strongly contribute towards making air transport more sustainable.

Dutch airspace is currently being reassessed with the intent to make more efficient use of civilian and military airspace and reducing noise and emissions levels. The improvements will begin to take effect from 2023. European airspace is currently managed by 36 national air traffic control organisations. More efficient use of airspace and further integration of air traffic control systems and organisations will reduce the impact air transport has on the environment. The Single European Sky programme aims to achieve this ambition, but its implementation depends on political decision-making. Because airspace is part of national sovereignty, member states are hesitant to transfer authority to a supranational body.

## IMPACT

According to IATA and ERA, the reconfiguration of airspace, the optimisation of takeoff and landing procedures and better flight planning could reduce noise nuisance Europe-wide and lead to a 10%<sup>1</sup> decline in CO<sub>2</sub>. This percentage is lower for intercontinental routes. CANSO, the international association of air traffic control organisations, has stated that current air traffic control systems<sup>2</sup> worldwide could be made 6% to 8% more efficient. By combining improvements in European airspace and on intercontinental routes with the optimisation of procedures, the sector has the ambition of reducing CO<sub>2</sub> emissions by 8%. Together with the deployment of more economical aircraft, these measures would reduce CO<sub>2</sub> emissions by 1.15 million tonnes in 2030.

This would also enable air traffic control to focus more on managing traffic flows, rather than individual flights, which would improve the overall punctuality of flights, among other things. Lower CO<sub>2</sub> emissions also mean lower emissions of nitrogen, sulphur and particulate matter.

## PLANNING

- We will be taking various steps through 2025, which includes expanding the planning horizon for flights through Schiphol, developing departure routes with altitude and speed restrictions, setting fixed approach paths with fixed descent profiles, further rolling

out the continuous descent approach, and further implementing flight optimisation by way of collaborative decision making (CDM). We will use capacity management to further reduce the number of delays. The Airspace Reconfiguration Project (Luchtruimherziening) will reassess various parts of airspace, including the routes, access points for Amsterdam Airport Schiphol and flexible utilisation of airspace.

- Between 2021 and 2025, we will be developing CDM processes for decision-making on all factors relating to the planning of an intercontinental flight in the coming 10 to 20 years. The first improvements of the reconfiguration of Dutch airspace will be noticeable. Military air traffic control and Air Traffic Control the Netherlands (LVNL) will be integrated to make more efficient use of Dutch airspace.
- The development of Eindhoven Airport will present an opportunity to run a trial for the development of a smarter and more sustainable, quality-driven air transport sector and airport.

## SECTOR CONTRIBUTION

The Netherlands government, Air Traffic Control the Netherlands (LVNL), the Omgevingsraad Schiphol (Council for the Great Schiphol Area), Maastricht Upper Area Control (MUAC) and Netherlands military air traffic control (part of Royal Netherlands Air Force Command) will take the lead in optimising the structure and use of airspace.

The airlines will play a more supporting role (seeking solutions to issues relating to climate, noise and air quality), as will knowledge centres like the Netherlands Aerospace Centre (NLR) and the Delft University of Technology (scientific verification, simulations and development of solutions).

Airports will focus on ground processes, which they will manage and coordinate.

## GOVERNMENT CONTRIBUTION

The Netherlands government can contribute by adjusting its policy – such as the State Action Plan and research agenda – to prioritise the creation of better flight paths and planning processes. The EU member states have been debating the implementation of the Single European Sky for quite some time. The Netherlands government has a seat at that table and will keep stressing the importance of implementing a Single European Sky and steering other member states towards achieving concrete results.

## Prognosis of kerosene consumption

- WLO Low scenario for 2030: 5.5 million tonnes
- CO<sub>2</sub> emissions by 2030: 17.3 million tonnes

## Potential reduction

8% less fuel on average = 8% fewer CO<sub>2</sub> emissions. Thanks to the fuel-saving initiatives outlined in Themes 2 and 4, fuel consumption will decline by 18%. This fuel efficiency will reduce the actual CO<sub>2</sub> impact of this theme by 18% to 6.6%.

## Envisaged outcome

1,150,000 tonnes of CO<sub>2</sub> = annual CO<sub>2</sub> emissions from energy and transport for all private households in the municipalities of Haarlem and Leiden (source: Milieu Centraal and CBS statline).

<sup>1</sup> IATA, AEA and ERA: A Blueprint for the Single European Sky – February 2013

<sup>2</sup> CANSO & Boeing: Accelerating Air Traffic Management Efficiency: A Call to Industry – 2012





# Theme 2: Incentivising investment in cleaner aircraft by way of airport charges

Airlines pay airport charges to use an airport. Because these are partly based on an aircraft's level of noise production, airlines are stimulated to deploy less noisy aircraft. In May 2018, the Dutch House of Representatives adopted a motion<sup>1</sup>, requesting Schiphol to differentiate airport charges on the basis of climate impact. The airlines and Schiphol looked into the options available for differentiation according to noisy and polluting aircraft so as to bring the pricing structure for airport charges in line with the coalition agreement for the 2019-2022 period.

In the short term, non-home carriers can choose to deploy less noisy and more efficient aircraft – such as the Boeing 787 and 737-MAX or the Airbus A320-NEO and A350 – for flights to and from the Netherlands. Different airlines are either already doing so or plan to do so. We therefore expect a maximum of 30% of all flights to Schiphol and 60% to Eindhoven Airport to be operated using the latest and cleanest aircraft. Home carriers can only do so in sync with fleet renewal, because all their aircraft are stationed in the Netherlands<sup>2</sup>. All future benefits associated with regular fleet renewal on the part of the airlines are addressed under Theme 4.

Airport charges are currently collected in full from the airlines, while they are dependent on third parties for parts of the resultant emission and noise. In part based on government policy, the airports and air traffic control authorities determine which taxi routes, runways and flight paths may be utilised. We would like to investigate reforming the legal framework of airport charges in such a way that all the parties involved are stimulated to restrict the volume of noise and emissions across a level playing field.

## IMPACT

Fuel consumption will be reduced significantly by deploying the latest and most efficient aircraft on flights to and from the Netherlands. In concrete terms, this could lower overall kerosene consumption in the Netherlands by 3%, reducing CO<sub>2</sub> emissions by 525,000 tonnes.

## PLANNING

- The new airport charges for Schiphol from 2019 to 2022 were determined based on the motion of the Dutch House of Representatives and differentiation according to the noisiest and most polluting aircraft as specified in the coalition agreement.
- The study being conducted by the Netherlands Aerospace Centre (NLR) into alternative ways of objectively determining flight sustainability profiles will be rounded off by 2021, enabling this to be taken into account in the pricing structure. We are also asking

other stakeholders how they would tax the noisiest and most polluting aircraft more heavily as envisaged by Rutte Cabinet III.

- We will be introducing a new pricing system with the airport charges for the 2022-2024 period based in part on the findings of the NLR study, noise levels and CO<sub>2</sub> efficiency measured for the flight distance, within the parameters of the law.

## SECTOR CONTRIBUTION

Key parties in this respect play a role in the direction and operation of flights, including airports (determine and settle charges within the parameters of the law), Air Traffic Control the Netherlands (LVNL – determines flight paths and thus to a certain extent noise impact), airlines (operate flights and invest in less noisy and more efficient aircraft) and knowledge centres (develop, test and stimulate new solutions).

## GOVERNMENT CONTRIBUTION

Government must ensure that the measures ultimately put in place do not disrupt the competitive position of the Netherlands. It is important for government to swiftly introduce such an approach within the context of Europe and the International Civil Aviation Organisation (ICAO), to ensure that instead of shifting emissions to other countries, a global reduction in emissions is achieved.

### Prognosis of kerosene consumption

- WLO Low scenario for 2030: 5.5 million tonnes
- CO<sub>2</sub> emissions by 2030: 17.3 million tonnes

### Potential reduction

30% of operations use 10% less fuel = 3% less fuel used = 3% reduction in CO<sub>2</sub> emissions

### Envisaged outcome

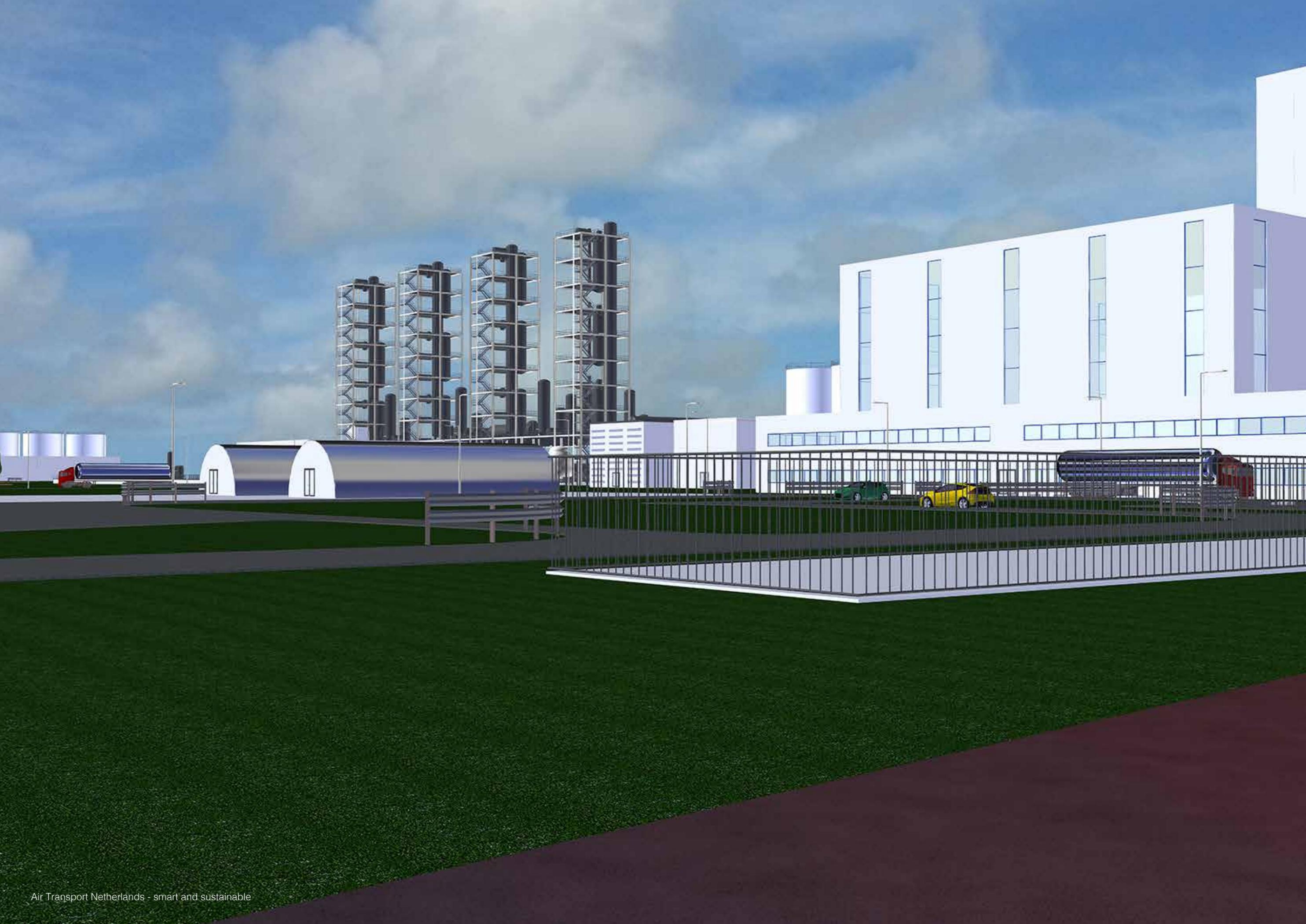
- 525,000 tonnes of CO<sub>2</sub>

### Supplementary information

Because of fleet renewal, only 1% of all flight movements at Schiphol are now carried out using aircraft belonging to the biggest polluter category (i.e. so-called Chapter-3 aircraft). The Dutch House of Representatives has adopted a motion calling on government to urgently focus on refusing Chapter-3 aircraft access to Schiphol.

<sup>1</sup> Paternotte/Bruins motion – reference 29655, no. 325 dd 20 May 2018

<sup>2</sup> To70 – Quick scan of effects of flight tax on fleet renewal – May 2018





## Theme 3: Greater utilisation of sustainable fuel

Given the length of time needed to develop new aircraft and their technical life, kerosene will remain the fuel of choice for the time being. For this reason, sustainable fuel is the most effective way to reduce our CO<sub>2</sub> emissions within a relatively short timeframe. Within the supply chain, kerosene produced from sustainable biomass, waste and/or CO<sub>2</sub> curbs CO<sub>2</sub> emissions by as much as 80% in comparison with the fossil variety. We are aiming to reduce our CO<sub>2</sub> output by around 1.45 million tonnes by 2030 by having 14%<sup>1</sup> of all sustainable jet fuel produced in the Netherlands.

In order to achieve this goal, we have to invest in and innovate throughout a complex value chain. This will involve elements such as newer infrastructure (including 2 to 3 plants that will each require an investment of between € 250 million and € 1 billion), new and approved production technologies and connections to existing distribution channels. The volume of sustainable fuel that can be mixed with fossil kerosene must also be increased.

Additionally, the safety of sustainable fuel must be guaranteed through extensive testing by aircraft manufacturers and aircraft engine producers, before the American Society for Testing and Materials (ASTM) establishes these new fuel specifications.

Finally, the production of raw material must be stable and cannot be at the expense of food supplies for people or animals and/or cause damage to the environment as in the case of deforestation. In order to safeguard this, we support supply chain certification based on strict criteria, namely those of the Round Table on Sustainable Biomaterials (RSB). In so doing, we raise the bar far beyond that prescribed by the European guidelines for sustainable fuel.

Finally, KLM and TUI Group have been actively involved for some years now in developing sustainable kerosene and are recognised as sector leaders in the Dow Jones Sustainability Index.

### IMPACT

As a result of the package of fuel saving initiatives outlined in this action plan, overall kerosene consumption in the Netherlands will decrease from 5.5 million tonnes to 4.1 million tonnes by 2030. Should we succeed in producing 14% sustainable fuel by 2030 (total 573,000 tonnes), CO<sub>2</sub> emissions will be cut by around 1.45 million tonnes. What's more, using sustainable fuel will reduce fuel consumption by 1% to 2%, which has not been included in our calculations. Using sustainable jet fuel will also serve

to reduce the emission of SO<sub>x</sub> and particulate matter and there will be less condensation at a high altitude.

The Netherlands currently trades 50% of all European fossil kerosene and scaling up the energy transition could replace its economic value for the Dutch economy. By responding swiftly to developments in this market, the Netherlands can secure its leading position in the field of sustainable jet fuel.

### PLANNING

- Until 2021, we will be choosing the raw materials and technologies needed to produce sustainable fuel. A national plan for sustainable jet fuel will be drafted and implemented. The first production plant will be opened in the Netherlands, producing 75,000 to 100,000 tonnes of sustainable fuel a year. It will be the first of its type in Europe and the biggest of its type in the world.
- Between 2021 and 2025, new raw materials and technologies will be approved by ASTM, annual production in the Netherlands will be raised to between 200,000 and 250,000 tonnes, the supply chain will have been integrated into existing infrastructure and Europe will be producing a stable flow of high-quality raw materials for sustainable fuel.
- After 2025, the production of sustainable fuel from new sustainable raw materials and technologies will be scaled up. Ultimately, by 2030, 14% of all fuel produced will be sustainable.

### SECTOR CONTRIBUTION

At present, the parties are involved at three levels: the production of ASTM-certified fuels, the development of new production processes, and safeguarding the correct preconditions for introduction. This includes parties such as SkyNRG, airlines, knowledge centres, technology suppliers, aircraft manufacturers, engine manufacturers, port authorities, raw material suppliers and NATO in connection with the distribution opportunities through their European pipelines.

### GOVERNMENT CONTRIBUTION

Government can ensure that sustainable fuel is introduced in an economically viable manner. For example by way of establishing standards, legislation and regulations, and by establishing priorities which boost production and airline purchasing. It is also vital to stimulate the use of sustainable fuel within CORSIA and to ensure that European policy is consistent. The Dutch approach of producing and supplying sustainable jet fuel is also being promoted in other member states by the European Commission.

### Prognosis of kerosene consumption

- WLO Low scenario for 2030: 5.5 million tonnes
- CO<sub>2</sub> emissions by 2030: 17.3 million tonnes

### Potential reduction

For each kilogram of sustainable fuel, CO<sub>2</sub> emissions across the chain decrease by 2.52 kilograms of CO<sub>2</sub>. Based on the fuel saving initiatives outlined in Themes 1, 2, 4 and 5, fuel consumption will decrease to ± 4.1 million tonnes of kerosene. 14% sustainable fuel = 573,000 tonnes generating 80% fewer CO<sub>2</sub> emissions.

### Envisaged outcome

- 1,450,000 tonnes of CO<sub>2</sub>

### Supplementary information

- The first commercial passenger flight in the world powered by biofuel was operated by KLM, which even now operates daily flights using sustainable kerosene from Los Angeles to Amsterdam.
- TUI and KLM are members of the Sustainable Aviation Fuel User Group (SAFUG), an international initiative aiming to develop and produce genuinely sustainable jet fuel. At a national level, they also participate in BioPort Holland.
- TUI supports research conducted by the University of Wageningen into biofuel produced from algae.
- KLM cooperates with other parties to study the possibilities offered by synthetic kerosene made from captured CO<sub>2</sub>.
- As an airline, KLM has launched a customer programme for biofuel.

<sup>1</sup> 2016/0382 (COD) – Compromise text European Parliament and the Council on the Renewable Energy Directive. Transport fuel ambition is 14% by 2030 (Art. 25) – June 2018





# Theme 4: Radical fleet renewal

Airlines in the Netherlands are investing many billions in fleet renewal. Each new aircraft is approximately 15%<sup>1</sup> more economical and quieter than its predecessor thanks to ongoing improvements in engines, aerodynamics and materials. Airlines will continue to renew their fleets, enabling them to achieve significant reductions in carbon emissions over the next decade.

The development of new aircraft or engines using radically new technologies and materials is a lengthy and risky process that costs many billions. Aircraft manufacturers Airbus and Boeing are developing new concepts in aircraft construction but, to some degree, they are dependent on their suppliers. Working alongside scientific institutions and knowledge centres, the Dutch aircraft industry is collaborating with aircraft manufacturers to accelerate the development of ground-breaking aircraft systems and concepts<sup>2</sup>. To that end, the sector aims to strengthen its future role in the aircraft supply chain and contribute towards developments necessary to significantly reducing emissions between 2030 and 2050.

At a domestic level, we can see opportunities for electric and hybrid propulsion, using electric and other engines. The sector also sees room for change in the aerodynamic model (including different shapes and internal structures), stronger and lighter materials, and more economical systems on board. Our sector will create radical innovation and modernisation in new-generation aircraft and market them in partnership with companies such as Boeing and Airbus. We can use the knowledge from these developments to improve the current fleet through a process of modification of and retrofitting so that existing aircraft also continue to improve and become considerably more efficient. This will strengthen the Netherlands' position as a supplier to the aerospace industry and enable Dutch knowledge centres and universities to retain their leading position in aerospace research.

## IMPACT

We will take major steps to reduce our impact on the climate by introducing radically new aircraft concepts and fully electrically powered aircraft. To enable Dutch industry to play an important role, it will be necessary to draw up a specific research agenda beyond the existing step-by-step innovations so that we can focus on the development and demonstration of radically new systems and concepts. The European Clean Sky partnership believes that, by introducing radically new systems and concepts over short and medium distances, we can reduce fuel consumption by 40%, thereby reducing carbon and nitrogen emissions<sup>3</sup>. In the short and medium term, we will achieve a considerable reduction in carbon dioxide emissions through a process of fleet modification and replacement.

By 2030, we will have reduced carbon emissions by about 15% by replacing older aircraft with the latest generation of aircraft. This corresponds to 2.6 million tonnes of carbon dioxide.

## PLANNING

- Between now and 2021 we will develop new aerodynamic designs and structures and develop a hybrid electric powertrain. We are also working with the energy sector on new energy carriers.
- Between 2021 and 2025 we will integrate the aerodynamic design and hybrid electric powertrain into large scale models. We will test them and investigate how the components of a hybrid powertrain affect the operation of other aircraft and cockpit systems.
- After 2025, we will integrate the latest energy carriers into large scale models and develop a prototype powertrain.
- Airlines will continue their fleet replacement programmes and accelerate them where possible.

## SECTOR CONTRIBUTION

To realise our plans of action, various parties will have to join forces. Umbrella organisation the Lucht- en Ruimtevaart Nederland (Netherlands Aviation and Aerospace Foundation–LRN) brings together parties that can develop new materials, constructions and powertrains. The Delft University of Technology can design new aerodynamic models, electric and hybrid systems, materials, structures, and on-board systems. Fokker GKN Aerospace is already working on an electric powertrain and will be involved in the initiative through the LRN. The Netherlands Aerospace Centre (NLR) will contribute towards the aerodynamics and the powertrain. It will engage a Dutch consortium dedicated to developing new materials such as intelligent thermoplastics. Airlines will support the development of radically new aircraft concepts and, where possible, replace or modify their existing fleets.

## GOVERNMENT CONTRIBUTION

The Netherlands is not the only country focusing on the new type of aircraft, so this is a golden opportunity to gain a knowledge advantage. However, the government must support the initiative. Furthermore, cooperation with innovative parties such as Wright Electric or Pipistrel is essential and the government should provide support in obtaining European subsidies for international projects.

## Fuel consumption prognosis

- WLO Low scenario for 2030: 5.5 million tonnes
- CO<sub>2</sub> emissions by 2030: 17.3 million tonnes

## Savings potential

Airlines have estimated the effects of fleet renewal and modification in 2030, and are assuming a 15% fuel saving resulting from fleet renewal = 15% fewer CO<sub>2</sub> emissions.

## Envisaged outcome

- 2,600,000 tonnes of CO<sub>2</sub>

## Supplementary information

- The NLR is exploring future applications for the Pipistrel Alpha Electric, which it recently added to its fleet of test equipment.
- EasyJet is supporting Wright Electric, an American start-up, which aims to develop an electric aircraft for commercial flights with a range of 540 kilometres over the next decade.
- The Boeing 737 MAX is 40% quieter and 14% lower in emissions and fuel consumption compared to the previous generation of B737s.
- On average, the Boeing 777-300 uses 15% less fuel than the B747-400, which is increasingly being phased out.
- The Boeing 787-800 is 20% more fuel efficient on average than the B767-300ER.
- The Embraer E-190 consumes about 10% less fuel than the Fokker 100, which Dutch airlines no longer use.
- The International Civil Aviation Organisation (ICAO) has set global carbon emission standards. Aircraft that do not meet these standards may no longer be produced as of 2028.

<sup>1</sup> IATA Technology Roadmap Fact Sheet – Environment – May 2018

<sup>2</sup> Topsector HTSM Roadmap Aeronautics 2018-2025 – March 2018, Lucht- en Ruimtevaart Nederland

<sup>3</sup> <http://www.cleansky.eu/technology-evaluator>





# Theme 5: Use of railways and other sustainable modes of transport for shorter trips

Dutch consumers and companies benefit from a customer-oriented, integrated, fast and sustainable transport system, both domestic and international. On some routes, trains can provide an excellent alternative to air travel up to a distance of 700 kilometres. The success of the Eurostar and Thalys proves this is possible and that, along short distances, it is better for the environment and the economy. There are sustainable alternatives other than the train that can be further developed for routes with smaller passenger volumes.

But there is still much to be done. Existing train connections to Brussels, Paris, London, Dusseldorf, Frankfurt, Berlin and other locations are more expensive and time consuming than air travel to numerous destinations. To make train travel truly attractive, we will need faster trains, it must be easier to buy integrated AirRail tickets, and there must be seamless connections to and from Schiphol. Building on the existing Air-Rail offering, more train seats can be offered as part of the central distribution systems, possibly transporting hold baggage in a protected, secured compartment. Our ambition is to create a seamless transfer enabling train passengers to enter the airport's secure area.

To further develop Schiphol into a multimodal hub, we will look at extending the North-South metro line using an aboveground route and developing Schiphol's train station. This will create more capacity for international trains in the Schiphol Tunnel. It is also necessary to make regions outside Amsterdam more accessible by public transport. There are opportunities for Eindhoven Airport, for example, which, at this time, is mostly accessible by car. A direct connection to the railway network would enable travellers currently travelling by car to use the train. Eindhoven's Brainport region would benefit both from a reduction in carbon dioxide emissions and the burden on its roads. If we want to offer Dutch and European travellers unlimited opportunities to travel by train, we will have to create cooperation between the rail, airline and governmental sectors.

The developments needed to link air and rail travel must also be initiated for other sustainable alternatives. Improving connections, accelerating travel time, and increasing frequencies will increase the chance that passengers will opt for other modes of transport.

## IMPACT

The choice of trains over aircraft on distances of up to 700 kilometres will serve to reduce carbon dioxide emissions. The table illustrates average emissions per flight and annual totals for selected routes emitting a total of 227,500 tonnes of carbon dioxide.

Passengers using airports in the Netherlands generate 260,000 tonnes of carbon dioxide<sup>1</sup> on their journeys to and from the airport. We also want to make these routes more sustainable and will explain this in greater detail under Theme 7.

## PLANNING

- Between now and 2025, we will increase frequency, shorten travel times, and provide greater comfort on train connections to cities such as London, Berlin, Paris, and Dusseldorf.
- After 2025, we will expand the network of high-speed train connections.
- We will continue to investigate the development of alternative sustainable modes of transport, such as the Hyperloop.

## SECTOR CONTRIBUTION

Numerous parties are collaborating on the development agenda, investments and exploitation models. Dutch Railways (NS) are contributing to "Smart and Sustainable" and to the Dutch airline industry's ambitions by providing – and, where possible, enlarging – the international train network as a possible alternative to short-haul flights within Europe, up to a distance of 700 kilometres. The company operating the train stations is developing the train terminals at the airports. Furthermore, airlines are encouraging the sale of integrated AirRail tickets.

## GOVERNMENT CONTRIBUTION

The further development of high-speed train connections between the Netherlands and various European metropolitan areas requires coordination between the countries concerned and the EU in terms of timetables, investments, regulations and technical standardisation, such as security systems. The Netherlands can lead the way by helping to invest in cross-border infrastructure and, together with the airline industry and rail sector, by providing European support and means for converting the separate national train networks into a single European network.

## Savings potential

Exact calculation of carbon dioxide emissions per KLM route over 2017 has been extrapolated to Dutch carbon dioxide volumes. It is assumed that KLM accounts for 70% of the volume

	CO <sub>2</sub> per flight	CO <sub>2</sub> per year
Brussels	3.2 tonnes	15.500 tonnes
Paris	7.6 tonnes	44.000 tonnes
Frankfurt	5.4 tonnes	30.500 tonnes
London	6.9 tonnes	69.500 tonnes
Berlin	8.3 tonnes	50.500 tonnes
Düsseldorf	3.6 tonnes	17.500 tonnes
Total		227.500 tonnes

## Envisaged outcome

- 227,500 million tonnes of CO<sub>2</sub>

## Supplementary information

- In 2010, about 10,000 AirRail tickets were sold, with a major increase in the last five years in the number of AirRail passengers. In 2017, about 85,000 AirRail tickets were sold, enough to fill 965 Embraer 175 aircraft.
- In 2017, 20% of KLM's passengers from Belgium used AirRail tickets.

<sup>1</sup> Source: Schiphol Group, 2016 data





# Theme 6: Working towards zero emission airports

In addition to our ambition to drastically reduce flight operations emissions, we also aim to ensure climate-neutral terminals, offices and ground operations at all airports in the Netherlands by 2030. Schiphol Group is already well on its way, using only wind-generated electricity, promoting the use of sustainable biofuel and pursuing efforts to increase energy efficiency (e.g. by using LED lighting).

Schiphol Group is also phasing out the use of gas (the terminal at Lelystad Airport no longer has gas facilities and is increasingly using heat storage) and striving to reduce commuter traffic. The remainder of the group's activities are rendered climate-neutral by way of off-setting measures. Amsterdam Airport Schiphol and Eindhoven Airport both have the highest possible score on the Airport Council International's Airport Carbon Accreditation benchmark<sup>1</sup>.

The users of airports also play an important part in making them climate neutral. Various companies that are active at the airport have, in recent years, invested substantially in making their ground operations more sustainable. The companies at and around the airport use renewable electricity and sustainable gas where necessary. Transport at the airport is increasingly operated using electric vehicles; electric vehicles and the electrification of wheeled equipment is being rolled out gradually. In instances where electrification is not yet an option, fuels from waste flows or other sustainable sources are used. To achieve this as efficiently as possible, we operate as a single ecosystem at and around airports. And finally, we are also reducing emissions from commuter traffic, in keeping with measures outlined in the next chapter.

## IMPACT

The aforementioned measures will see Schiphol Group reducing its 2018 emissions from 100,000 to 20,000 tonnes. These emissions come from using gas and fuel for its own vehicles and they will be further reduced. In addition, air transport businesses operating at Schiphol can reduce their CO<sub>2</sub> emissions by 121,000 tonnes, while emissions generated by commuter traffic could be reduced by 103,000 tonnes.

Similar initiatives are being taken at regional airports in the Netherlands. The exact emission reduction potential has not yet been ascertained, but electrification of the vehicle fleet and ground equipment will reduce emissions of nitrogen, sulphur, soot and particulate matter to zero, as well as reduce noise.

We also expect to be able to market the knowledge and technology we develop. This presents an opportunity to not only export Dutch technology and expertise, but also to make other international airports more sustainable.

## PLANNING

- In the period up to 2021, more solar panels and heat/cold storage will be installed, while the energy labels A and gas-free will become the standard for all new facilities and modernisation. We will also demonstrate a locally-developed, emission-free taxiing concept for smaller aircraft.
- Between 2021 and 2025, airports will use as much self-generated electricity as possible. The electric taxiing concept will be scaled up and we will assess whether it is suitable for wide-body aircraft. We will also introduce electric alternatives for heavy equipment at Cargo, and ensure that ground equipment is electric wherever possible.
- After 2025, all motorised equipment will be electric, while all electricity supplied to the airport will be fully renewable and partly self-generated. We will also be using more green gas in areas where gas has not yet been phased out. Eindhoven Airport will achieve this milestone in 2030.
- In 2030, all aircraft parked at connected gates at Schiphol will be supplied with sustainably generated electricity and conditioned air.

## SECTOR CONTRIBUTION

Five parties are involved in making Schiphol, Eindhoven and the regional airports sustainable. Firstly, the airport operator, who manages and develops the concessions and terminals. Secondly, the airlines and handling, cleaning and catering companies, who are developing and deploying sustainable alternatives. Thirdly, the suppliers of motorised equipment, who are producing electric options. Fourthly, the energy sector, which is producing renewable energy in partnership with the other parties mentioned above. And, finally, the knowledge centres that are developing new, smart and sustainable solutions in partnership with all the aforementioned parties.

## GOVERNMENT CONTRIBUTION

The Dutch Government will have to encourage energy projects in and around the airports to produce the maximum amount of energy possible, and not just sufficient for their own needs. The continued existence of a feed-in tariff, which compensates for the unprofitable portion of sustainable energy production, will be an important instrument here. There is also an opportunity for the state to work with the airports to stimulate using airports as experimental sites for sustainable development. A lot of creativity will be needed on the part of all parties to create opportunities that comply with current legislation and/or regulations and licencing procedures. And there will have to be enough leeway for existing laws and regulations to be adapted.

- At Schiphol, 74 permanent aircraft stands are fitted with ground power units (400 Hz) and pre-conditioned air units. Every time the use of an APU is avoided, CO<sub>2</sub> emissions are cut by up to 1.3 tonnes per hour\*.
- 35 electric buses airside reduce CO<sub>2</sub> emissions by 1,260 tonnes over 2½ years. This is equivalent to the emissions of 63 households over the same period.
- For 15 years, Eneco has been supplying Royal Schiphol Group with 200 GWh of green electricity, which is entirely sourced from Dutch-built windfarms. This reduces CO<sub>2</sub> emissions by 88,000 tonnes a year.
- Following on from Schiphol's B, E and F Piers, G Pier was connected to a thermal storage system at the end of 2017. This has cut gas consumption at Schiphol considerably. The expected reduction at G Pier is 84% (168,000m<sup>3</sup> natural gas), equivalent to a 300-tonne reduction in CO<sub>2</sub> emissions per year.
- The new pier, currently under construction, is the most sustainable at Schiphol due in part to the use of biomaterials, double glazing and recycled plastics and marble grit. The pier will be fitted with 5,000m<sup>2</sup> of solar panels and rain water will be used to flush the toilets.

## Supplementary information

Schiphol uses electric buses to transport passengers between the terminal and aircraft that are not parked at a gate. There are currently 35 of these fully electric buses in use. This has cut CO<sub>2</sub> emissions by almost 1.3 million kilogram over 2½ years (source: Schiphol Group).

\* Unique (Flughafen Zürich AG): 2005\_ZRH\_APU-EmisCalcMeth.pdf

<sup>1</sup> See [www.Airportcarbonaccreditation.org](http://www.Airportcarbonaccreditation.org) for more detail





## Theme 7: A swift, efficient and sustainable “first & last mile”

The journey to and from the airport – the so-called “first & last mile” – costs time, is sometimes unnecessarily complicated, causes traffic jams and contributes to CO<sub>2</sub> emissions. Passengers currently choose to travel by car or public transport, but we think it should be possible to develop alternatives that are more customer-oriented, integrated, energy efficient and intermodal. Such solutions should also be available for workers in the sector to make commuting more sustainable.

In order to achieve this, airports need to work more closely with other transport companies. Passengers should have access to reliable and efficient transfers and there should be more ways to get cargo and baggage from door to door. Solutions such as electric car share and fast public transport to and from the airports are needed. At Schiphol, this could be achieved by extending the North-South metro line aboveground to Hoofddorp and timetabling very frequent sprinter trains to connect Amsterdam to Schiphol. Investment in the quality and capacity of the train station at Schiphol would significantly improve public transport access to the airport.

Under consideration for Eindhoven Airport is the option of building a train station in the immediate vicinity of the airport to connect it directly to the national rail network. Other public transport solutions and efficient parking are also being researched. Express bus connections between train stations and the airports Lelystad Airport and Rotterdam The Hague Airport are crucial.

To improve the comfort of passengers, the airlines will work to develop the “front port concept”, which will facilitate checking in and dropping off baggage outside of the airport as well.

Inside the airport, all the parties in the chain at Schiphol are working as one to process cargo faster and more efficiently. The Schiphol Smart Cargo Mainport Programme (SCMP) coordinates different projects dealing with digitisation, uniform supply chain agreements and information exchange, which are aimed at optimising cargo activities at Schiphol. This leads to faster transit times, less waiting time, higher load factors and, hence, lower CO<sub>2</sub> emissions.

### IMPACT

Annually, around 260,000 tonnes of CO<sub>2</sub> are generated by passengers travelling to and from the airports and the cargo passing through the airports. The sector is committed to eliminating these emissions by making passenger friendly, sustainable solutions available. Besides cutting CO<sub>2</sub> emissions, this will also help to reduce road traffic emissions around the airport and improve traffic flow. These measures will make travelling quicker and easier.

### PLANNING

- In the period up to 2021, we will further develop the “front port concept”, including connections to the Mainport; reach agreements with the regional governments and road authorities; create an investment and exploitation plan; and introduce an intermodal travel ticket.
- Between 2021 and 2025, we will demonstrate the “front port concept” and realise sustainable first & last mile solutions. Schiphol’s accessibility would be improved by extending the North-South metro line aboveground and providing frequent train connections between Hoofddorp and Schiphol.
- The “front port concept” will be rolled out after 2025.

### SECTOR CONTRIBUTION

Different players will work together on the development agenda and investment and exploitation models. The Dutch Railways (NS) and other public transport providers will be responsible for providing a sound network of sustainable connections to and from airports. The train stations’ operator will be involved in developing front port and first & last mile solutions. The hub operators will develop the terminals and ensure that there are good facilities at the terminals where passengers, with or without baggage, can transfer. Private companies will be invited to develop additional transportation options. Air Cargo Netherlands and evofenedex will work with airlines, handlers and loaders to develop and implement innovative and efficient cargo concepts.

### GOVERNMENT CONTRIBUTION

Besides local and regional adjustments, national government can also contribute by investing in regional infrastructure, including the North-South metro line, and by making firm policy decisions. These will provide the certainty that is needed in order to ensure the necessary level and rate of investment.

- Connexxion began operating 100 electric buses on its Schiphol Snetnet routes at the end of March 2018. These buses run between the municipalities around Schiphol and the airport.
- Electric taxis have been operating at Schiphol airport since 2014. With more than 300 electric vehicles, this is the largest Tesla fleet in the world.
- Every car park at Schiphol is equipped with charging stations for electric cars.
- NS trains in the Netherlands are fueled by green electricity.
- Travel company Tui works with Taxi Electric.
- KLM offers its passengers free bus and train connections to and from Schiphol on a number of routes.

### Supplementary information

- The Air Cargo Netherlands (ACN) Milk Run project has led to a 30% reduction in CO<sub>2</sub> emissions among participating cargo companies by increasing load factors on the lorries that drive between shippers and ground handlers at Schiphol.
- KLM Cargo, Swissport, Jan de Rijk, Kuehne+Nagel and Cargonaut have developed smarter supply chains through the European Green Fastlanes project. This has increased lorry load factors and reduced congestion and CO<sub>2</sub> emissions.

# -35% EQUALS 6 MILLION TONNES LESS CO<sub>2</sub> IN 2030

● flight ● ground



SUSTAINABLE FUEL  
**-1.450.000**  
TONNES CO<sub>2</sub>



FLEET RENEWAL  
**-2.600.000**  
TONNES CO<sub>2</sub>



OPTIMISING FLIGHT  
PATHS &  
PROCEDURES  
**-1.150.000**  
TONNES CO<sub>2</sub>



UTILISING SUSTAINABLE FLEET  
**-525.000** TONNES CO<sub>2</sub>



EMISSION-FREE MAINPORT  
**-224.000** TONNES CO<sub>2</sub>



TRAIN REPLACES FLIGHT  
**-227.500** TONNES CO<sub>2</sub>



SUSTAINABLE LAST MILE  
**-260.000** TONNES CO<sub>2</sub>

# Conclusion

The five flight-related themes together lead to a 35% cut in CO<sub>2</sub> emissions compared with the WLO Low scenario for 2030. The reduction of almost 6 million tonnes of CO<sub>2</sub> is equivalent to the annual emissions produced by all the households in the provinces of Utrecht and Zeeland<sup>1</sup> for their domestic and transport fuel consumption<sup>2</sup>.

<b>Flight-related emissions within the scope of ICAO</b>	<b>CO<sub>2</sub> in tonnes</b>	<b>Percentage of CO<sub>2</sub> reduction</b>
Radical fleet renewal (Theme 4)	- 2.600.000	43,7%
Greater utilisation of sustainable fuel (Theme 3)	- 1.450.000	24,4%
Optimising flight paths & procedures (Theme 1)	- 1.150.000	19,3%
Incentivising investment in cleaner aircraft by way of airport charges (Theme 2)	- 525.000	8,8%
Use of railways and other sustainable modes of transport for short trips (Theme 5)	- 227.500	3,8%
<b>Total</b>	<b>- 5.952.500</b>	<b>100%</b>
<b>Ground-related emissions within scope of Paris Agreement</b>		
Working towards zero emission airports (Theme 6)	- 224.000	
A swift, efficient and sustainable "first & last mile" (Theme 7)	- 260.000	

These seven themes provide the foundations for increasing the sustainability of air transport in the Netherlands in the lead up to 2030. In addition, Dutch industry and knowledge centres are preparing for the radical innovations that will be needed to continue to cut CO<sub>2</sub> emissions beyond 2030. The parties involved have all worked together on this action plan, which has reinforced our conviction that we are strong and complementary partners for each other. The Dutch government is a very important link in the chain if our objectives are to be achieved. We look forward to working out our ideas in greater detail with national and local governments and partners. New parties, who are able to contribute towards the development and realisation of the action plan, will also be involved in its implementation.

These ideas correspond in part to the many existing initiatives and activities in the area of innovation and sustainability. These include national initiatives, such as the Knowledge & Development Centre (KDC) and Samenwerking Innovatieve Mainport (SIM – partnership for an innovative Mainport) and, on a European scale, the Advisory Council for Aviation Research and Innovation in Europe (ACARE), CleanSky and SESAR (air traffic management research).

We need to do more than coordinate to implement our action plan, however. Alongside vision and ambition, we also need the courage to make choices and the insight that there is no time to lose. Equally, it is important that we are open to experimentation and, with famous Dutch mercantile spirit, see opportunities where others see obstacles. The sector is willing to face up to the challenge by taking concrete steps to start new initiatives. With a shared future and the will to act, we are bound to succeed in making air transport in the Netherlands smarter and more sustainable.

<sup>1</sup> CBS Statline data "Huishoudens; samenstelling, grootte, regio, 1 januari" for 2018

<sup>2</sup> Milieu Centraal. An average household emits on average 8 tonnes of CO<sub>2</sub> through domestic and travel fuel consumption.





