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6

Dear chairman,

All eyes are on electric driving. With many others, the government considers electric driving to be a very promising option for ensuring the sustainability of our future automobility, for strengthening our energy position and for giving our economy a system-rooted impulse. As was posited in its mobility approach (House of Representatives, 2008-2009 parliamentary year, 31305, n° 80), the government opts for sustainability as starting point for the mobility system. The Netherlands is prosperous, densely populated, energy intensive and technologically very developed. In times of economic decline it is particularly important for the government to do all it can to keep the Dutch economy growing and keep the country on the move. It can only do that when economic and social interests unite with environmental and climate interests. The Netherlands can set the international tone by forging an innovative link among these. Although the Netherlands does not have a large automobile industry, it does have a major components industry and supplier potential. In the government's opinion, the development of electric driving and (albeit small-scale) preparation for introducing this in our country offers a good chance of our being the world leader par excellence.

At home and abroad we see many initiatives for electric passenger and goods transport. Energy companies, automobile manufacturers and local and regional authorities (and partnerships they join) and others that want to get started with electric cars regularly approach the government. The government wants to utilise that momentum by supporting promising market ventures and so to accelerate the introduction of electric cars on the market. In this early stage with its various hurdles and uncertainties, parties willing to take risks deserve the government's support. The introduction of electric driving is promising, but can only succeed when market players, social organisations, research and educational institutions, local and regional authorities and the central government all work together. With this letter and its annexes, we offer you, on behalf of the (Ministry of Public Housing, Spatial Planning and the Environment (=VROM)) and the State Secretary for Finance, a practical action plan that gives shape and content to the central government's supporting role.

Ambition and Essence

The central ambition of this plan is to make **the Netherlands the guide** *and* **international laboratory for electric driving** *in 2009-2011 so that later, based on the framework created and learning experience undergone, we can scale up and grow toward a large-scale market introduction*.

This plan contains the **central government's contribution** *to this ambition of up to* **€65 million**. *The central government supports all efforts by market parties, social organisations and local and regional authorities. That means that the* **national investment** *in this ambition is many times larger. The government expects that the aforesaid contribution will stimulate around* **€500 million** *in expenditures from others for electric driving.*

The central government's contribution consists of three main ingredients:

1. *The establishment of a* **Formula E team**, *with robust and authoritative chairperson and members from all industries indispensable for the successful introduction and roll-out of electric driving. The team's primary task is to spur market development and remove obstacles.*
2. **The central government will take practical measures** *in 2009-2011 on the following fronts: (a) Practical testing and demonstration projects, (b) launching customership, (c) recharging, energy and other infrastructure, (d) research, development and production of electric vehicles and/or parts for them, (e) formation of consortiums and coalitions and (f) ancillary policy.*
3. *A market introduction facilitated, coordinated and phased in by the formula E team. That means* **programmatic work**, *based on the central government's action plan and that of other pertinent studies and action plans*[1] [2] [3] [4] [5].

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This government plan also responds to the Vendrik – De Krom resolution that requested the government to formulate its ambitions for the accelerated introduction of electronic cars in the Netherlands in an action plan (House of Representatives, parliamentary year, 2008-2009, 31700 XII, n°. 37). It also responds to the Halsema – Hamer resolution that requested the government to foresee extra funding for electric cars in the spring interim budget memorandum (House of Representatives, parliamentary year, 2008-2009, 31070, n°. 32). Finally, it answers the questions posed by Representatives Cramer and Wiegeman-Van Meppelen Scheppink (House of Representatives, parliamentary year, 2008-2009, question n°. 2009ZO4476).

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[1] Netherlands Environmental Assessment Agency, *Elektrisch autorijden – Evaluatie op basis van systeemopties*, Bilthoven, January 2009.
[2] Energy Research Centre of the Netherlands, *Duurzame innovatie in het wegverkeer – een evaluatie van vier transitiepaden voor het thema Duurzame Mobiliteit*, January 2009. http://www.ecn.nl/docs/library/report/2008/e08076.pdf
[3] The Netherlands Society for Nature and Environment and C,mm,n 2.0, *Actieplan elektrisch rijden – Op weg naar één miljoen elektrische auto's in 2020*, Utrecht, March 2009. http://www.cmmn.org/fileadmin/klanten/cmmn/documents/090323_Actieplan_Elektrisch_rijden_cmmn_def.pdf
[4] Dutch Automotive Federation *Naar een snelle en grootschalige introductie van de elektrische auto in Nederland – Hoofdlijnen voor een nationaal programma elektrische voertuigen*, Zoetermeer, 10 April 2009.
[5] Plan for network companies to set up 10,000 replenishment outlets.

This plan treats electric cars, but we make sure that we do not lose track of other opportunity-rich developments. This includes electric scooters and bicycles and other types of electric transport. These ease the way for accepting electric cars and driving on other types of fuels: hydrogen, biogas and higher biofuel blends. This will be necessary because while electric cars are certainly promising, they will not acquire such a large market share in the coming decades that traffic-related environmental problems will be solved. We will have to use all our options for reducing traffic emissions if we are to attain the objectives set in the government's Clean and Thrifty programme.

For hydrogen, biogas and higher biofuel blends, the government wants to start by providing financial support for practical tests and demonstration projects. This also implies the production of sustainable biofuels. We already have, and are developing, grant programmes for this comparable to the grant programme included in this action plan for practical testing and demonstration projects for electric cars. These developments are closely related to electric driving. The hydrogen car is an electric car in which a fuel cell, not the electricity grid, charges the battery. In addition, biofuels can make a major contribution to CO_2 reduction, certainly when combined with next generation hybrid cars.

The follow up to this letter will treat: electric cars, the opportunities that their accelerated introduction offers, market ventures, hurdles to be taken and uncertainties and the central government's contribution to the accelerated introduction of electric cars in 2009-2011.

Definition of electric cars

The first hybrid passenger vehicle with a combined drive from an electric motor and a conventional internal combustion engine dates from 1997/1998. Over the past two years, hybrid passenger cars have broken into the market, aided by a reduction in purchase tax on passenger cars (BMP) and motorcycles (MRB) and above all by the reduction of the nominal addition to taxable income (*IB-bijtelling*) for very thrifty cars from 25% to 14%. In the first half year after introduction of the 14% rate for nominal addition to income tax for cars with a low CO_2 emission (first half of 2008), the sale of hybrids quadrupled. The mounting line has continued ever since. A growing number of car manufacturers have included a hybrid in their gamma. And the traditional manufacturers of hybrids will be expanding the number of hybrid models soon. Hybrid technology has proven itself. Manufacturers are now perfecting this technology, which can go a long way toward sharply reducing the average CO_2 emission per vehicle in the coming years. There are no major hurdles to take. If we keep on the way we are going, the share of hybrid passenger vehicles in the fleet will grow beyond its present 2%.

Matters are different for plug-in hybrids and fully electric cars that are charged via the power supply network and that, when compared to normal hybrids, can operate for longer periods purely on electricity (and without any local emission): 15 tot 50 kilometres (plug-in) or 100 kilometres and more (fully electric) compared to a few kilometres (normal hybrid). Unless otherwise stated, this plan means plug-in hybrids and fully electric cars when it speaks of electric cars or electric driving.

Opportunities that an accelerated introduction of electric cars offers our country

Electric driving is of strategic importance for the preservation of our automobility and energy supply and for strengthening our economy. In practice, electric driving can contribute greatly to several issues that confront the Netherlands with regard to this strategic interest.

First, it affects our *energy position*. Electric driving helps reduce our dependency on the finite supply of fossil fuels and on oil producing countries. This can increase the security of supply, whereas now the Netherlands' automobility is completely dependent on fossil fuels. This is also beneficial for our trade balance because it will reduce oil imports. Electric driving also offers opportunities to bring energy supply and demand into better balance. If cars are charged mainly at night, they can be a storage reservoir and adjustment potential for power companies.

Second, it affects our *economy*. Internationally, auto manufacturers and new entrants are sharply accelerating the development and production of electric cars; large-scale production is in preparation. The Netherlands has no (sizable) automobile industry, but does have many widely respected component suppliers and centres of expertise and research. Electric driving offers these parties new opportunities because new and other components will be needed. As innovation, electric driving also offers opportunities for new players in the auto industry, such as (joint ventures with) companies with specific knowledge about batteries and for new auto manufacturers like Dutch DuraCar. Cluster formation and a new production chain are taking shape. High Tech Automotive Systems (HTAS) and d-INCERT are projects that illustrate this. Electric driving can strengthen our economy and is beneficial for attracting businesses, for our international competitive position and for employment. A growing market for electric cars is thus one instrument for combating the economic crisis. As Annex 1 shows, there is strong international development in the field of electric cars. It is important that the Netherlands joins in. This offers opportunities for companies supplying component parts. The Government Road Transport Agency (RDW) plays an important role as pre-eminent and highly appreciated admitting authority for European acceptance specifications (ETG) for vehicles. RDW stands out internationally for the fastest approvals procedure, testing and admissions under one roof, its own test track and advanced knowledge about electric driving. There is a reason why RDW provided the first European type approval for an electric car.

Third, it affects the *environmental issues* relating to climate, air quality and noise. Annex 2 elaborates on and quantifies electric driving's contribution to this. Annex 2 also looks briefly at the sustainability of electric cars at the waste disposal stage. The following is a summary per environmental aspect:

- **Climate**: Electric driving contributes to achieving the government's CO_2 objectives for the traffic sector under the Clean and Thrifty[6] programme and the Energy Innovation Agenda[7]. The Netherlands Organisation for Applied Scientific Research (TNO)[8] has calculated that in 2020 an electric car will emit around 35% less CO_2 (well to wheel) than the average car with an internal combustion engine (69 g/km versus 107 g/km) assuming that the electric car is charged with 'average' current from the grid. But even when the electricity is produced in a coal-fired power station (without CO_2 capture) the electric car still has a substantial 22% advantage. Taking into account that electricity production falls under the European emission trading system (ETS), a much greater CO_2 advantage is arguable, mounting even to 100%, because ETS guarantees that an increase in demand for electricity sparked by the introduction of electric cars will not lead to an increase in CO_2 emission. When green electricity or electricity from designated sustainable electric power plants is sold for electric car use, guarantees of origin can be provided to demonstrate that the electricity is from sustainable generation. Companies and individuals can install this link at their own discretion. Regarding the enhanced objective of the share of sustainable energy, the government's target of 20% sustainable energy by 2020 remains unchanged. In 2007, the Energy Research Centre of the Netherlands (ECN) calculated the results of the Clean and Thrifty programme. The final conclusion was that the programme's original goal would lead to 35% sustainable electricity by 2020. That will make the 'average' current much more sustainable in 2020 than is the case today.
- **Air quality**: Electric cars do not emit fine particles, NO_x or other atmospheric pollutants. This benefits air quality in city centres and along busy roadways and has positive effects on public health. Various local and regional authorities have chosen to use electric vehicles in selected locations to satisfy European norms for fine particles (2011) and NO_2 (2015). The Netherlands as a whole will still be able to satisfy European air quality standards for fine particles and NO_2 even without the large-scale introduction of electric cars. The National Cooperation Programme on Air Quality (NSL) and the gradual increase of clean Euro 6 cars in the vehicle fleet assure this.
- **Noise**: Electric cars are quiet and thus help make our country a better place to live, given that today noise pollution is a subject of discussion in many places in the Netherlands today and that road traffic is its main cause.

Market ventures – vista for electric driving

Electric driving long seemed unattainable, but the business community now sees a vista for an interesting business case. Vehicle and battery manufacturers, energy companies, local and regional authorities, banks, leasing companies and social organisations (see box) have set up joint ventures aimed at pilot projects, experiments and market launches.

[6] In 2020, the transport industry will emit as much CO_2 as in 1990, i.e. 30 to 34 MTON.
[7] By 2020 the Netherlands will have one of the most efficient transport systems in Europe.
[8] *Comparison of Well-to-wheel Emissions of (Average) Electric Vehicles with Conventional Diesel/petrol Vehicles*, TNO Advisory Group on Transport Emission, 7 April 2009.

Examples of joint ventures are: Leaseplan, Nuon and Mobility Mixx's Electric Transport Alliance (EVA), the Amsterdam Electric Transport that the municipality of Amsterdam set up with ABN AMRO, Rabobank, Leaseplan, Van Gansewinkel, Schiphol, taxi firm TCA and the postal service TNT, the c,mm,n project that the Foundation for Nature Conservation and Environmental Protection and Delft Technical University, Eindhoven and Twente set up with Rabobank, Athlon Car Lease, Logica and DHV consultants, het Electric Driving Icon Project that Urgenda set up with TNT, Eneco, Triodus Bank and others and various pilot projects that Essent/Enexis run in conjunction with various provinces and municipalities. The Sustainable mobility and Sustainable electricity supply energy transition platforms are working on introducing electric driving.

Various other parties are also working seriously on electric transport, among them established car manufacturers including Renault, Nissan and Mitsubishi who have announced the introduction of fully electric cars. Toyota will introduce a plug-in hybrid later this year. Opel will offer an electric car with a small internal combustion engine or generator (range extender) that can charge batteries while on the road when necessary. Yet there are also companies that would not normally leap to mind. One example is Dutch Railways/Prorail, that sees an opportunity for better use of its electrical infrastructure that can easily be made suitable for electric driving. Another is Tuk Tuk Company that wants to exchange current petrol-driven Thai three-wheelers for electric models. Finally, companies new to the Netherlands are interested in the market. Better Place, originally an American company, wants to be an electric vehicle operator similar to a mobile phone operator. Dutch DuraCar (Quicc lorry), Norwegian Th!nk, Indian Tata and Chinese BYD and other new vehicle manufacturers are also interested.

The Netherlands would be a good place to test electric driving. In principle, our country is extremely well suited for this because of the relative short distances within and between cities, relatively short commutes to work (average 30 km) and its sturdy power supply network. Nevertheless, other suitable countries also present themselves as testing laboratory for electric driving (see annex 1). It is best to work and exchange experiences with these countries. It is expected that there will be but few electric cars in the next few years. Competition between countries to acquire those that are available can easily lead to a less than ideal situation for all concerned. The Netherlands will make the first move in setting up this international cooperation and exchange.
The European regulatory framework (CO_2 standards for passenger vehicles, directive on the use of renewable fuels, directive on the quality of petrol and diesel fuels) contains a stimulus for the roll-out of electric driving, albeit that this stimulus to switch to electric cars will only be truly vigorous as of 2020. Annex 3 shows why.

Hurdles hindering and uncertainties regarding large-scale roll-out

Several (interrelated) hurdles and uncertainties will have to be overcome before there can be a large-scale roll-out of electric cars.

More research and development on *batteries* is needed. Batteries now used in electric cars cannot match the operating range of conventional cars; they are only suitable for certain kinds of use, like intra-urban mobility. Future development in this area is still uncertain. On one side there are views that presuppose continued development of battery technology aimed at increasing operating range so that a fully electric car can compete with conventional car on this point in the future. On the other there are views that presuppose continued development aimed at miniaturising batteries and reducing their cost. In that case, the range of operation would remain unchanged, but this would not inhibit the vehicle because an internal combustion engine (plug-in hybrid) can take over or because the range extender mentioned earlier can charge empty batteries as you drive. All by all, it will often be possible to drive fully electrically, because most trips are under 30-50 km.

One major uncertainty is whether a secure supply of raw materials, including lithium, for manufacturing batteries will remain available. No guarantees can be given right now. In any case, the studies on the three-way catalytic converter and the soot filter show that advancing technological development can ensure that the same yield can be achieved with fewer raw materials and that reuse is possible.

What *recharging infrastructure* will be needed? Several scenarios are being discussed. They vary from rapid charging (10-15 minutes) at usual petrol stations to mainly slow charging. For slow charging observations fluctuate on the proportion of replenishment outlets needed at home, at work and in public places. Some see battery change stations as one alternative for (rapid) battery charges. Notwithstanding the foregoing, the basic charging infrastructure to permit electric driving will have to be in place within the foreseeable future. The government is pleased with municipal projects like Amsterdam's that take replenishment outlets into account in spatial planning and even install these outlets. The same holds for grid managers' projects (plan for 10,000 replenishment outlets) and Dutch Railway/Prorail's plan to contribute to a strategically located charging infrastructure. One key point is to coordinate projects to prevent fragmentation into too many types of replenishment points.

The government is keeping an eye on plug standardisation. The agreement among European car manufacturers to introduce a standard plug system is promising. This agreement was reached on 23 April 2009 at General Motors' insistence. BMW, Volkswagen, Fiat, General Motors, Mitsubishi, Toyota and others agreed to adopt the standard plug.

The *business case* for electric cars is noted for a relatively high purchase price because of the battery (costs around €8,000 to €10,000 when produced large-scale) and relatively low variable costs because current is comparatively cheap and electric cars require less maintenance. In principle, the initial investment costs can be recovered in time. Annex 4 contains an elaborated business case that produces a few important ideas:

- Part of the electric car's variable cost advantage is linked to the number of km driven (cost of electricity). Sample comparisons show that the people who spend a lot of time on the road will recoup the relatively high purchase price rather quickly. The case of people with a widely varying travel pattern would seem to be in contradiction with electric cars' restricted operating range
- It is expected that the anticipated development in the price of batteries will improve the business case over the next few years.

- Practical performance for various use profiles and the lifespan and residual value of the cars/batteries are still uncertain factors.
- Disconnecting car (purchase) and battery (lease) seems to be a promising option for keeping purchase prices more in line with regular fuel vehicles. Leasing the battery can ease individual purchaser's uncertainty about the car's lifespan and residual value, although the leasing companies will presumably charge higher fees for this.
- Tax and km allowance for the electric car will also greatly influence the future business case.

Energy supply is a point for attention. There is a peripheral and substantive relation with intelligent grids. When there are many electric cars, the time when they can be recharged must be regulated. If all vehicles are recharged at the same time, there will be peaks in the demand for electricity that exceed available capacity, certainly during the day. Managed expansion of the number of electric cars in the fleet will also ensure that there is enough time for development. The next few years will not immediately produce so many electric cars that grid managers need start expanding and adapting their networks now.

That is why the 2008 Energy Report (House of Representatives, parliamentary year 2007-2008, 31510, n° 1) contains an extensive discussion of intelligent networks. Within Europe, the Netherlands plays a pioneering role when it comes to power supply networks and smart grids. Network managers are aware of the challenges and they have the high-level knowledge they need. Because the Netherlands is small, smart grids can be easily enlarged. The government wants the Netherlands to be at the forefront of smart grid technology and applications. The basis for this is a shared vision and the various parties' willingness to cooperate. The government will take the first steps toward setting up a joint venture in which net managers, research institutions, the Netherlands Competition Authority (NMa) and public authorities work together. In addition, the government will investigate possibilities for stimulating network innovation. It will examine whether a system in which grid managers receive a financial stimulus outside the regulatory framework for which they are later assessed (as in the UK) can be an effective and efficient way to expand network innovation.

We need a common vision if we are to bring about a transition in the field of infrastructure. That is why the government (in close cooperation with European activities) will set up a Smart Grids Task Force in which public authorities, regulators, researchers, network companies, customers and infra-industry are represented. The task force will be assigned the job of developing medium and long-term visions, indicating how these visions can be achieved and determining what action must be taken now. Among these actions will be research and development, pilot and upscaling projects and the regulation of networks. If the Netherlands can enlarge its leadership position, that would offer great opportunities for exporting knowledge, because other countries will also have to take this step.

There are also questions about the link between electric driving and the smart metre. The smart metre is a stepping-stone toward energy transition and smart grids. That is why the Minister of Economic Affairs worked with interested parties to ensure that the requirements for the smart metre would result in a platform for new developments and supplementary services. As part of the proposed Market Model Improvement Act, the Minister of Economic Affairs is preparing regulations

specifying what the smart metre must be able to do. The Dutch Industry Standard (Dutch Technical Agreement [NTA] 8130) will serve as guideline. Of chief importance is that room be left for innovation. There must be a possibility to add new functions to smart metre in the future. This can be anchored in the regulations later when needed. The smart metre has still not been adapted to the network-based intelligence required for the use of electric cars. However, the platform to add this development in the future is present and has received the European Commission's support. The Commission has mandated CEN/CENELEC to make agreements to promote the interoperability of smart metres.

There are also questions on *safety*. These touch on the safety of electric vehicles as such, e.g. in the event of accidents. The first European type-approval for a fully electric car – from the Government Road Transport Agency, by the way – dates only from May 2009. Regulations governing how collision-proof, fireproof and waterproof battery packs must be are still to be developed in the next few years. Traffic safety is also an issue because the motor makes no noise to warn pedestrians and cyclists that a vehicle is approaching.

Because of the abovementioned hurdles and uncertainties, private and business users' actual *acceptance of electric cars* and their willingness to purchase them is unreliable right now. It is important that laboratories and other means be used in the next few years to get an idea of this and to take steps. This should also be done regarding the purpose for which electric vehicles will be purchased. Is this as replacement for regular fuel vehicles or as second household car for relatively short trips? Cost alone will not determine consumers' choice for or against electric driving. Driving also involves emotion. That is why broad acceptance of electric driving is important. In addition, the availability of a broad selection of attractive models is also a prerequisite. In this context, *consumer protection and comfort* are points for attention in the sense of open access for all vehicles to replenishment infrastructure and a free choice of charging and other services. Encouraging market mechanisms and creating and supervising a level playing field for existing and new companies are a part of this as are efforts to reach a maximum of innovation and a clear and attractive investment climate.

Central government grants for accelerated introduction of electric cars and programme of measures for 2009-2011

1. Initiating structured cooperation between public authorities, market and social organisations – the Formula E team

The present embryonic stage of electric driving, with the abovementioned hurdles and uncertainties and the mountain of research and development still to be done, encounters many stalemates. We can only break out of these when public authorities, market parties and social organisations join forces. No one can make electric driving a success all alone. Properly concerted action between parties over a period of years is necessary. At the instigation of the Foundation for Nature Conservation and Environmental Protection and the Dutch Automotive Federation, the government will take steps to establish a national E team to guide this action over the coming years, to break out of stalemates and to give expression to the involvement and responsibility of all parties. This team will be entrusted with the task of linking, stimulating and bring to fruition the efforts of the business community and social organisations. Annex 5 contains a brief description of the

Formula E team. A decree establishing the team is being prepared on the basis of this annex.

2. Programme of measures 2009-2011

The main ambition for 2009-2011 is to turn the Netherlands into an international laboratory for electric driving. Market players and social organisations will have to be the ones to do this. The central government will take the following measures to support their efforts:

a. The central government will see to establishing and financing a monitored *laboratory programme*. Practical tests and demonstration projects with electric vehicles will be subsidised, monitored and evaluated via a tendering scheme. The (interim) learning experiences will be broadly communicated so that all parties involved in the roll-out will have access to the most recent information. This concerns technical aspects and behavioural aspects including consumers' acceptance of electric cars. The projects will target a proof of concept for electric driving via:
   - Testing: subjecting the technology and its user-friendliness to tests by intensive and lengthy practical use.
   - Learning: gaining insight in the added value, acceptance and operation of this system option and in the actual hurdles in practice and the options for adequately eliminating these hurdles.
   - Proving and demonstrating: providing substantiation for the usability of electric cars in daily life for various user profiles, including urban distribution.

   The laboratory programme will be closely attuned to the innovation programme for intelligent grids still to be developed under the Energy Innovation Agenda (that treats built up surroundings and other demand-side elements).

b. The central government and local and regional authorities serve as *launching customer* and also stimulate other fleet owners, like leasing companies, couriers and (urban) distribution companies. If fleet owners acquire a substantial number of electric vehicles for their own use, the increase the learning effect and go some way toward ensuring that vehicles in laboratories are upscaled.

c. The central government stimulates the construction of the *recharging and energy infrastructure* needed for running electric vehicles, including the adaptation to the present electricity infrastructure. The Ministry of Transport, Public Works and Water Management has made the construction of this infrastructure part of its policy on filling stations. This will take modification of local electricity grids into account and will see whether it is meaningful to locate electric outlets near locally generated sustainable energy, with special attention for new construction and renovation of residential and industrial sites. If the public authority contributes to the cost of setting up the electric outlets, it will try to require them to be fed by green energy. The central government will see to the coordination between the Formula E team and the Smart Grids Task Force.

d. The central government will contribute to investment (and the associated encouragement of innovation) in research and development and in the production of *electrical vehicles and/or components for these*.

e. The central government is assigned *the role of managing* the gathering of the right parties. This is especially concerned with supporting the creation of and facilitating *purchasing consortia* for the acquisition of electric vehicles on favourable terms. It also includes supporting the creation of *municipal distribution centres* that allows electric vehicles to be used to distribute goods within a city.

f. The central government sees to *ancillary policy*. The electric car can profit from an extensive pallet of tax incentives. The central government will also provide a clear statement on how electric cars will fit into the road pricing system. In addition, the Ministry of Transport, Public Works and Water Management will encourage the Government Road Transport Agency (RDW) to advance its leading international position in European type-approvals of electric cars and to develop testing facilities and knowledge and skills for electric driving.

The central government will reserve a maximum of €65 million for this purpose. €10 million are reserved for measure a. The Energy Innovation Agenda's Sustainable Mobility programme already covers this amount. €55 million is reserved for measures b through d. This sum is also prompted by the government's effort to respond to the financial-economic crisis that affects our country. €20 of this €55 million is financed from the intensification of Responsible Entrepreneurship in the government's Supplementary Policy Agreement. €20 comes from the 2nd instalment of Energy Innovation Agenda resources brought forward for this purpose. In addition, a final extra sum not to exceed €15 million is created for tax facilities for the purchase of electric vehicles and electric charging infrastructure.

The central government measures support the market and create opportunities for innovating entrepreneurs to develop new sustainable products and to launch them on the market. This strengthens the economic structure and employment. The government estimates that the maximum €65 million available will result in a national outlay of around €500 million. The effect on employment is expected to be around 1,500 to 2,000 work years. If the market development is successful, the structural effects for our economy could be considerable.

Because this is important for investors, and because they have questioned the central government on this point, we will now address tax incentives for electric cars. We will also address how to deal with the loss of income from excise duty when there is a shift from cars run on standard fuels on which excise duty is charged to cars run on electricity on which no excise duty is charged.

Tax incentives for electric cars
Right now quite a few tax incentives stimulate opting for an electric car. Zero-emission vehicles, among which electric cars, are fully exempt from road tax (MRB) and purchase tax on passenger cars and motorcycles (BPM). The nominal addition for income tax for electric company cars is reduced to 14%.

The exemption from BPM runs to 1 July 2013. As the government indicated in its letter on tax incentives for green behaviour (House of Representatives, parliamentary year, 2008-2009, 31492, n° 11), the 2010 tax plan will propose extending electric cars' exemption from BPM to 2018, the year in which road pricing will have fully replaced BPM.
Despite the BPM exemption, it is still much more expensive to buy an electric car than a hybrid or regular fuel vehicle. The acquisition price is even proportionately much higher when one chooses for smaller electric cars. However, we expect the price of electric cars to fall when there are more on the market. Given that, the government's aforementioned letter on tax incentives for green behaviour has proposed that the nominal addition for income tax for zero-emission vehicles be set at 10% through 2014.
In time, road pricing will also replace MRB. The government will give precedence to examining the potential and feasibility of exempting zero-emission vehicles from the CO_2 portion of the kilometre rate.

In addition to the aforesaid incentive measures, the Random Depreciation of Environmental Investments Scheme (VAMIL) and the Environmental Investment Allowance Scheme (MIA) offer facilities for entrepreneurs who purchase an electric car for business-related transport. As of this year, the investment in public electric outlets for vehicles will be integrated in VAMIL and MIA. The objective is to stimulate the construction of the infrastructure needed for electric cars. This year, the tax allowance for investment in electric vehicles and replenishment outlets will be increased to the maximum allowable level within the frameworks for granting state aid.

Loss of excise duty and energy tax on electricity
The Netherlands has no excise duty on electricity, but it does have an energy tax. A shift from petrol and diesel cars to electric cars will mean a reduction in excise revenue and an increase in energy tax revenue. If we start from the forecast 200,000 electric cars in 2020 and a loss of excise revenue of €640 per car,[9] that would mean a loss of €130 million in excise revenue in 2020. This is balanced by an increase in energy tax revenue. Assuming an annual consumption of 2880 kWh per car for 200,000 electric cars, the extra energy tax revenue would be between €0.3 and €63 million, depending on the tax bracket in which the electricity consumption falls. A spectacular rise in the number of electric cars in the fleet would lead to a loss of tax income. The market players are aware of this and want to know with some degree of certainty how the government plans to deal with this. After all, the lower cost per km plays an important role in the business case for electric cars.

Given the (current) budget rules, excise revenue lost because of an increase in the proportion of electric cars in the fleet need not be covered annually. This is an endogenous or inherent development. Nevertheless, it remains true that the central government's real income will decline. Depending on the overall picture of public finance, future governments will face curtailed budgetary leeway. Future governments can then opt to cover the lost excise revenue. A new government has many modalities for doing so. One such could be increasing the excise on petrol and/or diesel. In addition to providing budgetary coverage, this would

[9] For convenience sake, the average excise on petrol/diesel is taken to be €0.60 per litre, times 16,000 km and a mileage of 15 km/litre gives €640 per year.

provide additional stimulus to choose for an electric car. Another option is an increase in the energy tax, which would also stimulate thrifty use of energy in other areas besides mobility. Coverage from taxation not related to mobility is also an option. Given the forecast evolution in the number of electric cars sold, the excise revenue lost during the present government's term will be negligible. The loss during the next government's term is also expected to be low.

3. Ensuring a coordinated and phased (programmatic) approach to market launch

The Formula E team's encouragement of and control over the introducing electric cars in the Netherlands will ensure a coordinated, but above all a phased programmatic approach in which the right things are done at the right time, step by step, retaining the greatest possible flexibility. The potential for electric driving is too great to be treated carelessly and thoughtlessly. We should not commit ourselves too early to matters that are still uncertain and that my be superseded in the near future. On the other hand, enough guidance must be given to provide the market with pointers for investment and product development.

The government envisages four programme stages linked to four anticipated market development phases in 2009-2020:

Period	Market development	Expected number of electric cars	Programme stage
2009-2011	Laboratories	<100 to <1000	Programme start-up
2012-2015	Upscaling	15,000 to 20,000	Programme implementation
2015-2020	Continued roll-out	200,000	Programme consolidation
>2020	Mature market	1,000,000 cars in 2025	Programme scaleback

This action plan and other projects and plans from various quarters of society mark the beginning of the programme start-up. The Formula E team will use all plans as source material when designing its own operational plan. Prior to each new phase, we will have to reflect on the activities required in that phase as discernible from the knowledge and experience gained in the phase just ending. This will continue to the time the market has reached maturity and the need for stimulus recedes.

You see above the number of electric cars that the government expects to enter the Dutch fleet in the indicated periods. Annex 6 contains the quantitative basis for this estimate. When compared to the targets for 2020 in the plan drafted by the Foundation for Nature Conservation and Environmental Protection (1,000,000 cars) and the Dutch Automotive Federation (725,000 cars), our prognosis for 2020 is quite modest. One reason is that the foregoing prognosis excludes normal hybrids, restricting itself to plug-in hybrids and fully electric vehicles (whether or not with range extender). Another can be that this is a prognosis and not a target. The government believes that the time for formulating a quantitative ambition for electric cars in 2020 will only be ripe after completion of the laboratory phase in 2011/2012, when its results can provide a better view of the real prospects for electric driving and the degree to which the practical hurdles and uncertainties can be resolved. It is more realistic to say that until 2020 we

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can only speak of a steadily evolving market. After that, the market can grow rapidly, once the initial hurdles, uncertainties and teething troubles are past and the benefits of electric cars appeal to a larger buying public. 1,000,000 electric cars can then be a reality by around 2025.

In conclusion

Electric driving offers our country sustainability and economic opportunities. We must, however, dispel various hurdles and uncertainties before we can take advantage of these opportunities. That is why the central government contributes to facilitating and enabling this. In the period 2009-2011 it will budget a maximum of €65 million on laboratories and launching customership, on constructing (charging and energy) infrastructure and on the production of electric cars and/or components for them. As market players, research and educational institutions and social organisations also play their role under the Formula E team, the introduction of electric driving in our country can be a success and the national expenditures on electric driving in the next few years will reach approximately €500 million. 200,000 electric cars in 2020 and 1,000,000 in 2025 is achievable.

We trust that your house shares the government's enthusiasm for the opportunities that electric driving offers and that you will work with the government and all other concerned parties to make this action plan a success. Let's all press forward, electrically!

Respectfully,

Appendices

1. Electric driving in an international perspective
2. The electric car and the environment (CO_2, air quality, noise and waste material)
3. Stimuli for electric driving in the European regulatory framework
4. Business case for electric driving – comparative cost estimate
5. The Formula E team – objective, structure and tasks
6. Quantitative estimate of trends in the market for electric vehicles

Annex 1: Electric driving in an international perspective

The countries around us also realise that electric driving offers many opportunities. The national governments of large European countries are investing seriously in the accelerated introduction of electric cars on the market. Germany and France are linking their response to the economic crisis to the opportunities that electric driving offers for sustainable mobility. That is closely related to the importance of the auto industry for these countries' total economy. The Netherlands, by contrast, has a well-developed component industry and many opportunities to benefit from the development and implementation of the electric car. Given the currently limited capacity for producing electric cars, it is wise for the Netherlands to seek international cooperation when stimulating the accelerated market introduction and to do what it can to ensure that projects are international. That can prevent national governments from competing with one another in enticing manufacturers of electric cars.

The measures in other countries consist primarily of:
- state aid for experiments
- stimulating the consumer purchases
- stimulating research and development
- development of replenishment infrastructure
- ancillary policy

The following contains brief descriptions of what Germany, France, Great Britain and the US are doing.

Germany
Germany wants to be the market leader in electromobility. The national objective is to have 1 million electric vehicles and plug-in hybrids on the road by 2020. This design is strategically important for the future for several reasons. That is why €135 million extra has been made available for:
- Developing model regions for electromobility that stimulate use of electric vehicles and develop public electric outlets (€115 million).
- Development of a battery-testing centre. This should fill the gap for actual testing and certification of cars (€20 million).

Besides this, public authorities support the development of batteries, granting €120 million to an industry consortium that will invest €360 million in research on, and development of, batteries over the next few years.

For the moment, the German auto manufacturers are counting mainly on improving conventional internal combustion engines and are achieving promising results. In addition, Volkswagen, Opel, Audi, BMW and Porsche will be putting a broad range of hybrid models on the market in the next few years. But few fully electric cars will be manufactured in the next few years.

France
Within the context of the *Pacte Automobile*, France gave auto manufacturers in the country (PSA, Renault) €7.4 billion in February 2009. The plan is intended to help the auto industry to make the transition to a massive, industrial supply for clean vehicles by removing hindrances that impede this introduction. For France (and Germany), the auto industry is an important economic sector representing €140 in turnover and 275,000 jobs. In the pact, the French government combined

the need to stimulate the auto industry with the need to move on to sustainable mobility.
This sum is intended for:
- Research and development of a new generation of hybrid and electric vehicles
- Stimulating customer demand
- Development of replenishment infrastructure
- Promotion of industrial supply (by launching customership)
- Informing customers (on pros and cons of the various types of vehicles)
- Mobilising government agencies by appointing an inter-ministry coordinator.

French auto manufacturers are investing heavily in alternative vehicles. Renault works with Nissan and NEC on electric models. Citroën will introduce diesel hybrids and micro-hybrids, but no fully electric vehicles. Peugeot sees to European production of fully electric iMiEV for its partner Mitsubishi.

Finally, Paris is stimulating the introduction of electric scooters by subsidising their purchase and placing free replenishment outlets throughout the city.

Great Britain
The British government has agreed to a £100 million, 5-year stimulus package for sustainable mobility. £10 million of this is intended to place 100 electric vehicles in cities and villages to allow customers to become acquainted with, and practice electric driving. In addition, the government is investing in the roll-out of replenishment infrastructure and cooperation with other countries in establishing and adopting standards.

US
There is no federal policy to stimulate electric transport. Since the installation of the Obama administration, the federal government does see itself playing a role in developing and stimulating new technology for electric vehicles. This falls under the Department of Energy (DoE), that carries out an extensive list of R&D activities and also subsidises research via federal laboratories and universities. Much of the research stimulated by the DoE's Office of Renewable Energy and Efficiency (EERE) relates to energy storage systems (super condensers, new generation batteries), and the infrastructure needed for sustainable energy generation and distribution for recharging electric vehicles. Xcel Energy's SmartGridCity project is also linked to this. This is a $100 million pilot project to install the power grid of the future in Boulder Colorado. Hybrid vehicles will also be able to return electricity to this grid.

DoE/EERE's FreedomCAR and Vehicle Technologies programme (FCVT)(2) is developing new techniques to reduce transport-related energy-intensity. The long-term objective is to reduce dependence on fossil sources of energy (and their main suppliers) and to reduce the cost of transport to the economy and environment. The FCVT programme, carried out by four national research laboratories (Sandia, NREL, Oak Ridge, and Argonne), has an annual budget that varied in recent years from $160 to $180 million.

Furthermore, in early February, President Obama set 1 million plug-in hybrid vehicles on US roads as target for 2015. It is uncertain how this is to be done, except that a $7,500 tax break per plug-in hybrid has been suggested.

Besides this, the federal stimulus package also contains a serious amount ($2.4 billion) for R&D on techniques that pave the way for electric vehicles. $1.5 billion of these funds for "Electric Drive Vehicle Battery and Component Manufacturing Initiative" is earmarked for manufacturers of new, efficient batteries and $500 million for companies that make other components needed for electric vehicles. In addition, $400 million will be invested in testing and evaluating plug-in hybrid vehicles and in laying the electric infrastructure and training the personnel needed to maintain and repair these vehicles.

Finally, on a federal level the National Highway Traffic Safety Authority (NHTSA) and Environmental Protection Agency (EPA) will impose 'Corporate Average Fuel Economy (CAFE) standards on automobile manufacturers that sell cars in the US. Manufacturers that do not comply with these will be fined. In 2007, President Bush announced a measure that would place the CAFE standard at 35 mpg in 2020; this would include light trucks and SUVs. Although the usefulness of the CAFE regulation is strongly disputed in the US, it may well act as stimulus on the development and introduction of electric drive systems.

Denmark
The Danish authorities subsidise the purchase of electric cars (approximately €7,500 for a car in the B segment). In addition, electric cars are exempt from road tax and can park for free. The government has funded practical tests with electric cars; many R&D programmes were linked to these. The objective was to determine the impact on the electricity grid and the practical utility of electric cars. Copenhagen started with a very ambitious plan to have 85% of the municipal fleet run on electricity by 2015.

China
The Chinese government wants to make China the worldwide market leader for electric cars. It has launched large-scale plans to achieve this. By stimulating industry and subsidising purchases, China was to increase production capacity for hybrid and electric cars from approximately 2,100 in 2008 to 500,000 in 2011. In 13 Chinese cities, up to €7,500 is subsidy is given per hybrid or electric car used as municipal vehicle or taxi. In addition, projects to install recharging infrastructure and stimulate electric driving are being developed in many other cities.

The public authorities are financing a €100 million development programme. The Chinese authorities can do a lot to steer production by imposing standards on auto manufacturers and government-owned company in the future.

Electric vehicles are cleaner, quieter and thriftier than conventional vehicles running on diesel and petrol. They are expected to be an important link in the transition to sustainable mobility and can contribute to attaining the transport industry's long-term environmental objectives. This annex addresses the benefits of electric vehicles for reducing CO_2 emissions (climate problem, air pollution emissions (air quality problem and National Emission ceilings) and noise; waste issues are also treated.

The Chinese manufacturer BYD (Build Your Dreams) is one of the most promising new players. A long-time manufacturer of batteries, BYD has accumulated much in-house knowledge on this subject. The present supply of electric cars is still low.

Annex 2: The electric car and the environment

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Climate

The Netherlands Environmental Assessment Agency (PBL) and Energy Research Centre of the Netherlands (ECN) have published very recent reports that discuss the role of electric vehicles in the transition to sustainable mobility. The need to reduce CO_2 emissions is the most important mainspring.
In its report on *Electric Driving: Evaluation of the Transition based on System Options*, the PBL starts by observing that "electric cars – in combination with electricity generation based on renewable resources and clean fissile fuel – have the potential in the long-term to reduce the CO_2 emission of passenger cars and other light vehicles by 80-90%".
The main message in the ECN's report on *Sustainable Innovation in Road Traffic: An Evaluation of Four Paths to Sustainable Mobility* is that "attaining long-term objectives in the transport industry will only be possible via (near) zero-emission technology, including energy conservation, sustainable hydrogen and electricity, and sustainable [...] biofuels. This long-term option must be developed before we reach the outer limits for improving the internal combustion engine." ECN has calculated that the innovation paths could lead to a 30-50% reduction in traffic-related CO_2 between now and 2040. Electric vehicles, plug-in hybrids and hydrogen-fuelled cars have an important role in the innovation paths. The main text considers the last to be electric cars that derive their current from a hydrogen fuel cell rather from the grid.

The Netherlands Organisation for Applied Scientific Research (TNO) has calculated the CO_2 return for an individual electric passenger car. The calculations look at the entire fuel chain because, while diesel/petrol motors emit their CO_2 mainly from their tail pipes, electric vehicles' CO_2 emission is linked to electricity generation. We can deduce from the memorandum entitled *Comparison of Well-to-wheel Emissions of (Average) Electric Vehicles to that of Conventional Diesel/Petrol Vehicles* that in 2020 an electric car will emit about 35% less CO_2 than the average car with an internal combustion engine (69 g/km vs. 107 g/km). These figures relate to the situation in which the electric car is recharged with 'average' current from the grid. It also presupposes that the *Clean & Thrifty* programme achieves its E sector goals. But TNO calculated that even when the electricity is produced in a coal-fired power station (without CO_2 capture) the electric car still has a substantial 22% advantage.
However, we can also reason that the CO_2 benefit is greater, even to 100% because electricity falls under the European emission trading system (ETS), which means that an increase in demand for electricity sparked by the introduction of electric cars will not lead to an increase in CO_2 emission for the E sector.
An optimally thrifty hybrid car may achieve a well-to-wheel emission comparable to that of an electric car by 2020. The heralded 3rd generation Prius has a well-to-wheel emission of around 100 g/km (at a tank-to-wheel emission of under 90 g/km). These hybrids are being fitted with some of the same technology and characteristics as electric vehicles. To reach much lower emissions in the period after 2020, these vehicles will be dependent on the development of sustainable biofuels.

Vehicle CO_2 emission in 2020

	TTW (g/km)	WTW (g/km)
Average new petrol/diesel	95	107
New electric car	0	69 (range 0 – 83)

CO_2-reduction in 2020 when there are 200,000 electric vehicles (12.000-15.000 km/yr)

CO_2 emission reduction in traffic sector	0.3 Mton
CO_2 emission reduction in the Netherlands	0.1 – 0.3 Mton

Air quality
Electrical vehicles do not emit exhaust gasses and are thus cleaner than the petrol and diesel cars that will satisfy even the most stringent future emission norms (Euro 6/VI). Electric vehicles with a petrol or diesel fuelled range-extender offer the possibility to drive emission-free in those areas where the air quality problem is most keenly felt.
The Netherlands will satisfy the European air quality standards by 2011 (fine particles) and 2015 (NO_2). Various local and regional authorities therefore choose to introduce electric vehicles by way of contribution to solving specific local air quality problems. Often these involve vehicles that travel in those specific locations.
In implementing the National Cooperation Programme on Air Quality (NSL) the Netherlands will satisfy European air quality standards. A large-scale introduction of electric vehicles will not be needed for this before 2015. In the period after 2015 it is expected that the increasing number of clean Euro 6/VI vehicles will prevent the rise of any new problem areas, even given the predicted increase in the need for transportation. However, electric vehicles will lead to an improvement in air quality, which in its turn will have a positive effect on public health.

National emission ceiling
At this time, the UN and the EU are discussing new national emission (NEC) ceilings for air polluting substances for 2020.
Electric vehicles will help us keep under these ceilings. However, the degree to which they do so depends on the way electricity is generated. As was described in the section on climate, wind energy will, in principle, have a more positive effect than the use of coal-fired power station. However, the magnitude of the positive contribution that electric vehicles will have depends mainly on the way the E sector evolves and what it does to reduce emission.

Noise
Electric vehicles are quieter than vehicles with an internal combustion engine, especially at lower speeds (at higher speeds, tyre noise is dominant). Large-scale introduction of electric vehicles will lead to a reduction in the noise burden. Some 10% of Dutch citizens undergo hindersome traffic noise each year (figure from the Netherlands Environmental Assessment Agency's 2003 environmental balance report). Quieter traffic, especially in combination with cleaner traffic, will provide more room for spatial design in the Netherlands. Right now there are no known studies that quantify the positive effect of quiet vehicles on public health and spatial design. The main text mentioned the safety issue connected to silent motors.

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Waste

The materials used in, and the demolition of, vehicles are highly regulated in the European End-of-Life Directive and other measures. In this context, an electric vehicle can be thought of as a conventional car with a large battery. Specific material and waste characteristics of electric vehicles focus on the battery. However, the battery falls under the same legislation as the rest of the vehicle and so will have to be recycled when discarded prematurely just like the rest of the vehicle will. High raw material prices, especially for lithium-ion batteries, offer a strong economic incentive for organising efficient reuse. Power companies are already thinking of large scale reuse of batteries from electric cars to storing wind energy.

Annex 3: Stimuli for electric driving in the European regulatory framework

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Brussels' regulations as incentive for electric cars

We expect the publication soon of EU directives on CO_2 standards for passenger cars, fuel quality and renewable energy. An agreement was reached on this in December 2008. These regulations will boost the introduction of electric cars. This annex assesses in broad terms the incentive power and the time it will take effect.

CO_2 standards for passenger cars

The CO_2 standard regards an electric car as a zero-emission vehicle (0 g/km). This means that in 2020 the electric car will offer an advantage of 95 g/km, because the standard for the average car sold in 2020 will be 95 g/km.
It is presupposed that the marginal cost in 2020 will be €95 per g/km. This is the cost of bringing the average car from 96 to 95 g/km. That is also the reason why the fine has been set at €95 g/km.
In theory, that brings the incentive for electric cars to €9,025 (95 g/km * €95 g/km). In practice, the advantage will be perceived as somewhat lower because the marginal cost will be estimated or experienced as lower or because electric vehicles may be somewhat smaller than the average new car. A conservative estimate of the incentive for electric cars in 2020 comes out at €7,500 to €8,500.

The incentive will be lower in the period up to 2015 although the g/km advantage will be larger,[10] since the marginal cost will be much lower. As matters appear now, car manufacturers will achieve the 2015 CO_2 standard of 130 g/km with the technology now being applied to new models. This seems to lead to a contrary situation in which the standard alone offers too little incentive to put electric cars on the market even though sales of electric vehicles would make it easier for manufacturers to meet the standard. At a sales volume of 10,000 electric cars in 2015, the effect on the average CO_2 figure for that year would be approximately 3 g/km. If the fine were to express the value of the CO_2 advantage of electric cars, then the average value would be €15 g/km. In theory, that brings the 2015 incentive for electric cars to €3,000 (195 g/km * €15 g/km).
In reality, the incentive will be much lower because the theoretical incentive peaks in 2015. In 2012 through 2014 the incentive is near zero. The 130 g/km standard will come into effect gradually over this period. Because manufacturers will be making their conventional cars thriftier in the run-up to 2015, the CO_2 standard offers no compelling reason for them to put electric vehicles on the market.
After 2015, the incentive will once again dwindle to zero. One reason is the removal of the multiplier, another is that manufacturers will have to make their conventional vehicles much more thrifty to meet the 2020 95 g/km standard. Because the incentive in 2012-2019 varies so greatly, manufacturers will probably not include a CO_2 advantage in their product planning. Conclusion: The CO_2 standard for passenger cars offers a one-off incentive at the time of purchase. The following table summarises these incentives.

[10] The advantage in 2015 would be around 195 g/km which is much larger than that in 2020 (95 g/km). One reason for this is that the CO_2 standard for 2015 is an average of 130 g/km. Another is that in the period up to 2015 electric vehicles are given greater weight in the equation (multiplier 3.5 in 2012 and 2013; 2.5 in 2014 en 1.5 in 2015).

Table: Incentives for electric cars based on European CO_2 regulations

Period	Theoretical incentive per electric car (one-off)	Most likely incentive per electric car (one-off)
2012-2014	€0	€0
2015	€3.000	€0
2016-2017	€1,000 to €1,500	€0
2018-2019	€0	€0
2020ff	€9.025	€7,500 to €8,500

Directives on Renewable Energy and Fuel Quality

The renewable energy directive requires that alternatives replace 10% of petrol and diesel delivered to the transport industry by 2020. This will largely be met by mixing in biofuels. However, supplying electricity for cars is also an option. Right now the open market value of a bioticket representing the energy equivalent of one litre of petrol or diesel is €0.20 to €0.30. This value is higher than the cost of biofuels. If the demand for biofuels increases over the next few years and the sustainability criteria are applied to biofuels, we can expect the price of biotickets will grow toward, but remain higher than, the price of biofuels. A cautious estimate for 2012-2020 would be a bioticket price of €0.30/litre. in 2015, new cars will get 20 km/litre and in 2020 around 25. This means that a new electric car that clocks 12,000 km/year will replace around 600 litres of petrol/diesel in 2015 and 500 litres in 2020. The renewable energy directive contains a €150 to €200 annual incentive for electric cars.

The biofuel quality directive requires greenhouse gases over the entire life cycle of petrol and diesel fall by 6% between 2011 and 2020. This, too, will largely be met by with the help of biofuels, although, once again, the supply of electricity to cars is included. Because biofuels must achieve at least a 50% CO_2 performance level by 2017, the fuel quality directive could lead to the use of (at most) 12% biofuel (as apposed to a ceiling of 10% in the renewable energy directive). We expect that part of the required 6% reduction in greenhouse gases will be satisfied by other parts of the chain, e.g. reduced burn-off during oil extraction. That is why we assume that the renewable energy and the biofuel quality directives will have the same consequences for the use of biofuels and thus the same incentive effect on the supply of electricity to cars. Conclusion: The renewable energy and biofuel quality directives give rise to an annual incentive of €150 to €200 per electric car.

Annex 4: Business case for electric driving – comparative cost estimate

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Variable cost comparison

Because of their batteries, electric vehicles are more expensive to purchase than comparable car models with an internal combustion engine. However, it is cheaper to operate electric cars because the current is relatively inexpensive and the cars require less maintenance. In principle, the initial investment costs can be recovered in time. How long this will take depends on a list of variables:

- 1. cost development of battery packs
- 2. type of electric car and, hence, battery size
- 3. tax aspects and other financial triggers
- 4. uncertainties regarding acceptance, lifespan and residual value

Re 1: Cost of lithium-ion batteries (€/kWh)

2010	575-770
2015	385-580
2020	190-230

These prices assume large-scale production. Low product volumes, use of inverters and other extensions will mean "bare-bones" electric vehicles (i.e. minus the battery pack) will cost around the same as normal cars.

Re 2: Type of electric car / battery size

We identify three types: the small city car, examples are Toyota Aygo and Citroen C1 and C2; mid-range cars, e.g. VW Golf and Toyota Prius (hybrid) and idem plug-in. The last travels short distances on electricity, switching to the internal combustion engine for longer distances.

The estimate that the battery pack for the city car differs little from that of the mid-range vehicles is striking.

small city car	16 kWh
mid-range car	20 kWh
plug-in hybrid	5/6 kWh to 16kWh

Re 3: tax aspects and other financial triggers

Electric cars are exempt from purchase (BPM) and road (MRB) taxes. The energy tax on electricity is low compared to the excise duty on petrol and diesel. An electric car's higher acquisition price means that the VAT and, for commercial vehicles, the nominal addition to income and wage taxes is higher than for a comparable car run on regular fuel. The Environmental Investment Allowance Scheme (MIA) and the Random Depreciation of Environmental Investments Scheme (VAMIL) foresee an extra investment allowance and accelerated depreciation for company cars purchased for business-related use.
The European directive governing the average 120 g/km CO_2 emission for passenger cars will contain a financial incentive for electric cars because the emission reduction for normal cars will become increasingly expensive. This is calculated at €95 per gram CO_2 less. For an electric car, this can amount to an €8,000 bonus as of 2020. For more information on t his see Annex 3.

Re 4: Uncertainties

For the rest, the business case is uncertain because there is no evidence that various categories of people will accept and use the vehicle in practical situations and because the lifespan and residual value of cars and batteries is not known. We base our calculations on a lifespan equal to that of a normal car.

Results of a few comparisons between electric cars and cars run on normal fuel

The following contains the results of a few comparisons between electric cars and cars run on normal fuel operated by private citizens, taking into account battery prices (low side of the bandwidth) and tax situation in 2010. These results are only indicative, since much depends on the assumptions and the selected models.

City car: Fictitious electric car versus petrol-fuelled Citroën C2

Basic assumptions: average annual mileage: 10,000 km; average fuel consumption 6 litre/100km at €1.50/litre; electricity consumption at 6.5 km per kWh at €0.22/kWh; purchase price "bare" car €7,500; annual maintenance benefit for electric car €300.

Return time on purchase of electric car: 8 years.
The battery price anticipated for 2020 can cut this in half.
If the electric car is compared with a Toyota Aygo, that profits from purchase (BPM) tax because of its low CO_2 emission, the return time is much longer.

Mid-range: Fictitious electric car versus petrol-fuelled VW golf

Basic assumptions: average annual mileage: 15,000 km; average fuel consumption 7 litre/100 km at €1.50/litre; electricity consumption at 5.5 km per kWh at €0.22/kWh; purchase price "bare" car €15,000; annual maintenance benefit for electric car €350.

Return time on purchase of electric car: 5 to 6 years.
The battery price anticipated for 2020 can cut this in half.
If the electric car is compared with a Toyota Prius, that profits from purchase (BPM) tax because of its low CO_2 emission, the return time is 8 years.

Mid-range: plug-in hybrid (e.g. Prius) versus petrol-fuelled VW Golf

Basic assumptions: average annual mileage 18,000 km, assumption that 40% of the km are on electricity, battery pack good for 25 km electric at €4,000, average fuel consumption: 7 litre/100 km at €1.50/litre and electricity consumption of 5 km per kWh at €0.22/kWh, "bare" purchase price of car €23,500, no maintenance benefit.

Return time on purchase of plug-in hybrid: 9 to 10 years.
The battery price anticipated for 2020 can cut this in half.
If the plug-in hybrid is compared with a hybrid Prius, that profits from purchase (BPM) tax because of its low CO_2 emission, the return time is much longer.

Small dual purpose for commercial transport: Fictive electric versus diesel-fuelled Opel Combo

Basic assumptions: average annual mileage: 30,000 km; average fuel consumption 7 litres of diesel fuel/100 km at €1.10/litre; electricity consumption at 5 km per kWh at €0.10/kWh(wholesale rate); purchase price "bare" car €6,000 (€1,000 benefit over diesel); annual maintenance benefit for electric car €650, taking into account 6% interest on the extra purchase of the battery:

Return time on purchase of electric car: 4 to 5 years.
When the MIA and VAMIL schemes are used, the return time will improve.
The battery price anticipated for 2020 can cut the return time in half.

Conclusion
These examples show that the increase costs for those often on the road can be recovered quickly (as in the case of the small dual purpose for cargo). In come cases, (especially people who spend a lot of time in widely varying travel patterns) this would seem to be in contradiction with electric cars' restricted operating range.

We have to keep in mind that the calculations are made for the statistical situation in 2010. However, several of the business case's key factors are in flux:

1. The anticipated decline in the price of batteries will improve the business case.
2. It is not yet known how the electric car will be included in road pricing. It is expected that some incentive in road pricing will be needed alongside the current incentive in purchase (BPM) and road (MRB) taxes. This could take the shape of an exemption for the CO_2 portion of the road pricing.
3. As road pricing is introduced, the purchase tax on passenger cars and motorcycles (BPM) will be gradually lowered and the road tax (MRB) increased. That reduces the incentive based on the electric car's exemption from purchase (BMP) tax. However, the incentive based the electric car's exemption from road tax (MRB) will be all the greater.
4. The conversion from the purchase tax (BPM) tax base from catalogue price to CO_2 emission in the period 2010 to 2013 can also have an impact on the business case. In many cases, gas-guzzlers will become more expensive (except for models with a high catalogue price), which will make an electric version of the same model more attractive.
5. Cars run on normal fuel will become more fuel-efficient and the number of hybrid models will grow.
6. Fuel prices will evolve.

The calculations do not take into account any interest owed or lost due to the higher price of acquiring an electric car. One idea learned from the calculations made this far is that separating the cost of car (purchase) and battery (lease) may well stimulate choice for an electric car. The price of conventional and electric cars need not differ by much and uncertainty on the lifespan and residual value is not such a heavy burden on the individual purchaser. However, it is expected that the leasing companies will charge higher rates to cover uncertainty about the residual value.

Company cars (leased cars)
The foregoing business case is made for private cars and the company car used solely for business purposes. Matters differ somewhat for company cars that are

also used for private purposes. In opting for a leased car, the driver of a company car has to take into account the question: What is my additional tax liability? Those about to choose a leased car must also ask: which car fits within my leasing budget?

Additional tax liability
The driver of a company car incurs an additional tax liability for his leased car when het drives this car more than 500 km for private purposes. The notional charge is a percent of the catalogue price. The driver must pay wage/income tax on this notional charge. Since 2008, the percentage of the notional charge has been dependent on the car's CO_2 emission. The basic rate is 25% of the catalogue price. There is a discount that depends on the car's CO_2 emission. The driver of a petrol-fuelled car with CO_2 emission under 140 g/km pays 20%. The driver of a car with CO_2 emission under 110 g/km pays 14%. In principle, a completely electric car will still have to pay a 14% nominal charge, since its CO_2 emission (tank to wheel 0 g/km) is lower than the aforesaid 110 g/km. An electric car's higher catalogue price because off the battery pack has an impact on the nominal charge. That means that the nominal charge will be a hindrance for choosing an electric car instead of a small or mid-rage car run on regular fuel. This problem will diminish as batteries become cheaper. The 10% rate on nominal additional income for zero emission vehicles that the government is to introduce in the 2010 tax plan can help get the market going.

Leasing budget
The cost of the leasing contract will have to take into account the purchase price of the car and variable costs like road tax (MRB), fuel, depreciation and maintenance. Since an electric car costs more to buy but has lower variable costs, the more km driven per year the shorter the time-to-revenue will be. The leased car's situation is special because the present leasing contract usually runs for 4 years. When an electric version of a given model is much more expensive than the petrol or diesel version and the variable costs do not compensate for this within 4 years, the result could be that the employee is not given the choice between the electric version or the petrol/diesel version of the same model.

Annex 5: The Formula E team – objective, structure/staffing and tasks

Mobiliteit
Directorate-General for Mobility

Date
3 July 2009

Our reference
VENW/DGMO_2009/4571

Objective

Electric driving is still in its early stages. There are various hurdles and uncertainties. There is still a lot of research and development work to do. Given that, we need a Formula E team to prod and guide the requisite cooperation between public authorities, market players and social organisations, to resolve deadlocks and to ensure the involvement and responsibility of all parties by inspiring them to do their part and to call them to account when they fail to do so. Put briefly, the Formula E team is the motor behind the accelerated introduction of electric cars in the Netherlands.

Organisational structure / staffing

- The Formula E team is a compact work team. The chairman is a robust, respected and resourceful spearhead able to open doors. The members are respected persons from sectors indispensable for the introduction and roll-out of electric driving. For the time being we think of the energy industry, auto manufacturers, Dutch components and subsidiary industry, users groups, financiers/bankers/leasing companies and environmentalists.
- The Formula E team will be given an independent secretariat large and skilled enough to support it in preparing and following up meetings, drafting a work programme, etc. etc.
- Various other organisations, joint ventures and social groups not involved in electric driving but not represented on the team will support the Formula E team with activities and advice.

Task

The Formula E team will be entrusted with the following tasks:

- To prod and link various projects and joint ventures in the country to attain critical mass speed.
- To serve as lever for resolving problems that local and regional authorities, market players and joint ventures encounter in introducing electric driving to see to it that all parties (including the central government) full their roles property and to call to order those that fail to do so.
- To keep a overall view of the progress of the activities – as defined in the Netherlands Society for Nature and Environment and the Dutch Automotive Federation's national electric driving action plan – needed to introduce and roll out electric driving in the Netherlands and to give compelling advice and call to order the central government (and other parties) regarding any adjustments that may be needed.
- To question and advise the parties.
- To perform these tasks in close cooperation with the central government acting as principal and in regular consultation with the government.

Annex 6: Quantitative estimate of trends in the market for electric vehicles

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Electric car's successful market introduction and penetration (including plug-in hybrids and fully electric vehicles whether or not with range extender) will follow the normal rules of the S-curve. These rules can be summarised as follows:

1. After market introduction, the penetration rate in the early years will be modest (slowly rising curve). This has to do with the hurdles, uncertainties and teething problems (like convenience and residual value) that are inevitably part of the introduction of new technology and that only a relatively small group of early adopters encounter. In other words, the early adopters do not let rough patches frightened them away from buying an electric car.

2. As the initial hurdles, uncertainties and teething problems are resolved and the advantages of electric cars become evident, partly due to government action, more car buyers will become interested in the electric car. In a few years' time, electric cars' market share will grow rapidly (sharply rising curve).

3. At a given point, the rapid growth of the market share will slow and the market share of electric will stabilise (levelling curve).

Around 500,000 to 600,000 new cars are sold in the Netherlands each year. As far as we know now, sufficient numbers of electric cars will only become available in 2012-2013, i.e. enough different makes and models to allow early adopters to purchase an electric car. In the early years after sufficient numbers of electric cars become available, the laws of the S-curve say that the market share will rise modestly (slowly rising curve). This run-up period is expected to take around 5 years (2013 through 2017). After this period, when, if all goes well, a larger buying public will have accepted the technology and advantages of electric driving, due in part to government incentives; a second period of accelerated growth can begin (strongly rising curve). This period generally extends over a loner period – say 15 years – to the time the growth in market share slows and stabilises (levelling curve). Given a 15-year period of rapid growth in market share starting in 2018, stabilisation should come in 2032/2033. Assuming that the market share for electric cars stabilises at 75%, we can - with the help of the information given above (and a presumed 13-year lifespan) - forecast the following phased inclusion of electric cars in the national fleet. This forecast for 2020 reaches 200,000 electric cars and the oft mentioned 1,000,000 electric cars is reached around 2024/2025:

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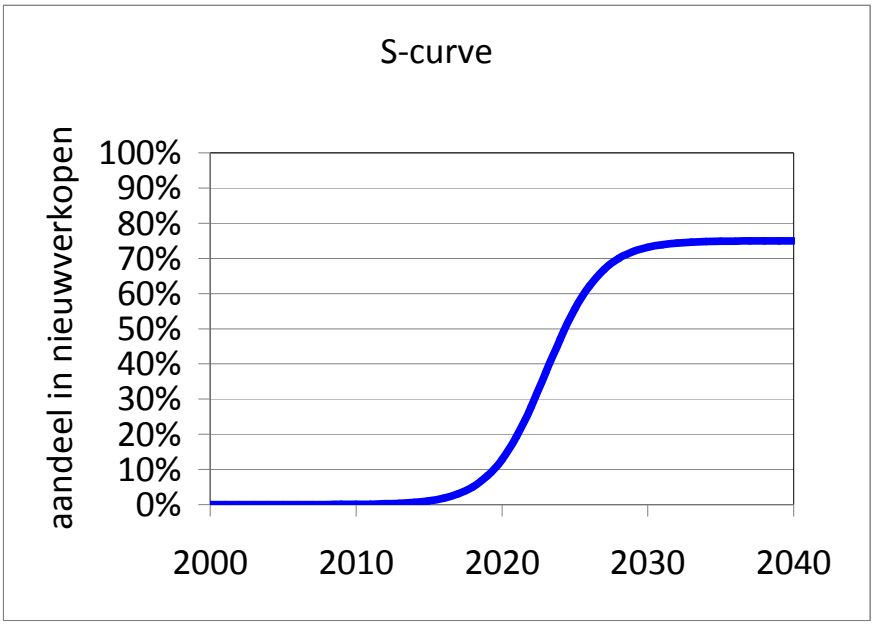
Cumulative

Year	**Market share**	**Number sold**	**Number in fleet**
2010	0%	1,173	1,172
2011	0%	1,985	1,983
2012	0%	3,358	3,354
2013	0%	5,677	5,670
2014	1%	9,587	9,577
2015	1%	16,167	16,149
2016	2%	27,192	27,163
2017	3%	45,544	45,494
2018	5%	75,754	75,670
2019	8%	124,618	124,475
2020	13%	201,543	201,301
2021	19%	317,967	317,557
2022	28%	485,087	484,393
2023	38%	710,087	708,913
2024	47%	992,967	990,982
2025	56%	1,326,543	1,323,185
2026	62%	1,699,618	1,693,941
2027	67%	2,100,754	2,091,167
2028	70%	2,520,544	2,504,377
2029	72%	2,952,192	2,925,000
2030	73%	3,391,167	3,345,623
2031	74%	3,834,587	3,758,833
2032	74%	4,280,677	4,156,059
2033	75%	4,728,358	4,526,815

The corresponding S-curve can be depicted graphically as follows:



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