

## Energy Efficiency in Transport: Successes and Failures

—Transcript of a webinar offered by the Clean Energy Solutions Center on 22 April 2015—  
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### Webinar Panelists

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**Carine Sebi** Project Manager, Energy Efficiency Specialist, Enerdata

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**Sean** Hello, everyone. I'm Sean Esterly with the National Renewable Energy Laboratory, and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with Enerdata. Today's webinar is focused on Energy Efficiency in Transport looking at Successes and Failures.

One important note of mention before we begin our presentations is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center's resource library as one of many best practices resources reviewed and selected by technical experts.

Before we begin, I just want to go over some of the webinar features. You do have two options for audio. You may either listen through your computer or call in over the telephone. If you choose to listen through your computer, please go to the audio pane in the GoToWebinar and select the "mic and speakers" option. It will just help eliminate any echo or feedback. If you choose to dial in by phone simply select the telephone option and a box on the right side will display the number and audio PIN you should use to dial in. If anyone is having technical difficulties with the webinar, contact the GoToWebinar at the number displayed at the bottom of the slide. That number is 888.259.382.

We do encourage anyone from the audience to ask questions at any point. We do keep all attendees on mute so to ask a question simply type it into the

“Questions” pane and submit it there. If you are having difficulty viewing the materials through the webinar portal, we will be posting PDF copies of the presentations at [cleanenergysolutions.org/training](http://cleanenergysolutions.org/training) and you may follow along as our speakers present. Also, an audio recording of the presentations will be posted to the Solutions Center training page within about a week of today's broadcast and just a reminder we are also adding the recordings to the Solutions Center YouTube channel where you will find other informative webinars, as well as video interviews with thought leaders on clean energy policy topics.

Today's webinar agenda is centered around the presentations from our guest panelists Bruno Lapillonne and Carine Sebi. These panelists have been kind enough to join us to review the various policy measures implemented in the transport sector, such as minimum energy performance standards, labels and promotion of modal shifts within the European Union and in G20 countries and to relate them to energy demand growth and energy efficiency improvements.

Before our speakers begin their presentations I will provide a short informative overview of the Clean Energy Solutions Center Initiative. Then, following the presentations, we will have a question and answer session where I'll present the panelists any questions submitted by the audience, followed by closing remarks and then a very brief survey.

This slide provides a bit of background in terms of how the Solutions Center came to be formed. The Solutions Center is one of 13 initiatives of the Clean Energy Ministerial that was launched in April of 2011 and is primarily led by Australia, the United States, and other CEM partners. Outcomes of this unique initiative include support of developing countries and emerging economies through enhancement of resources on policies relating to energy access, no-cost expert policy assistance, and peer to peer learning and training tools, such as the webinar you are attending today.

There are four primary goals for the Solutions Center: The first goal is to serve as a clearinghouse of clean energy policy resources. Second, is to share policy best practices, data, and analysis tools specific to clean energy policies and programs. Third, is to deliver the Solutions Center delivers dynamic services that enable expert assistance, learning, and peer to peer sharing of experiences. And then lastly, the Center fosters dialogue on emerging policy issues and innovation around the globe.

Our primary audience for the Solutions Center is energy policy makers and analysts from governments and technical organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

One of the marquee features that the Solutions Center provides is the no-cost expert policy assistance known as “Ask-an-Expert.” The Ask an Expert program has established a broad team of over 30 experts from around the globe who are each available to provide remote policy advice and analysis to all countries at no cost. For example, in the area of Low-Emission Vehicles we are very pleased to have Ted Sears, a Senior Project Leader at the

National Renewable Energy Lab, serving as one of our experts. If you have a need for policy assistance in low-emission vehicles, or any other clean energy sector, we encourage you to use this valuable service. Again, the assistance is provided free of charge. If you have a question for our experts please submit it through our simple online form at [cleanenergysolutions.org/expert](http://cleanenergysolutions.org/expert), or to find out how the Ask-an-Expert service can benefit your work please contact me, Sean Esterly, directly at [sean.esterly@nrel.gov](mailto:sean.esterly@nrel.gov) or at 303.384.7436. Those are also being displayed on the slide that is currently being shown. We also invite you to spread the word about this service to those in your networks and organizations.

Now, I'd like to provide brief introductions for today's panelists.

First up today is Bruno Lapillonne, Vice President and Co-Founder, Enerdata. Bruno is a globally recognized expert of energy efficiency and demand, energy supply and demand, and policy monitoring and evaluation.

And then following Bruno we'll hear from Carine Sebi, a Project Manager and Energy Efficiency Specialist from Enerdata. Carine specializes in energy efficiency and participates in various European and French projects on energy efficiency. She served as a technical coordinator on the ODYSSEE project for the European Commission. She also works on experimental economics, public policy assessment and demand.

And with those introductions I'd now like to welcome Bruno to the webinar.

Bruno

Good morning and good afternoon everybody. To start with I will say a few words about Enerdata, which is a company of about 40 people with an office in Grenoble France, Paris, and Singapore. We are working quite a lot on energy efficiency on many issues we will present in this webinar but we are also involved in the world modeling of oil and gas supply, power supply, as well as the carbon market.

The source of information that we use for this webinar relies on various projects that we have carried out for ADEME, the French agency for energy efficiency and environment, for which we have been looking at both the trend in energy efficiency indicators and also at policy evaluation. This includes the European project ODYSSEE and MURE. ODYSSEE is an indicator and MURE is the policy. You will have the link behind these different projects. The project of the World Energy Council is looking at energy efficiency worldwide and also at the aspect of quantitative trends in terms of energy efficiency indicators in terms of evaluation. There is a project focusing on G20 countries for IPEEC and also they are always at two dimensions. A fourth project is more on policy, which tries to identify the most interesting and innovative policy practice in Europe. Most of these projects cover all sectors but here we'll focus on transport.

The presentation or we will start with the presentation of the main energy efficiency or energy consumption trends in transport. We'll follow with an overview of policies and then we'll go into more detail with policies in different areas. My colleague Carine will spend some time presenting the different measures trying to improve the improvement of the different modes

of transport. Then I will conclude with other parts of energy policies and the main conclusion about the success and failures about the policies.

We will illustrate this presentation with numbers from the G20 to reduce the number of countries but very often we have tried to have a worldwide view. In Europe we tried to look at each country individually. G20 countries represent about 80% of the world in energy consumption. The first slide shows what is the importance of transport in the final energy consumption of the different countries. It's represented by about 25% for G20 and a rather stable share. In other countries, as you can see, the share of transport is a different scope. It is quite important in USA, Mexico, Brazil and Australia, but quite small in China and India but increasing. In EU countries the trend is generally to have lower share of transport in some countries like Germany or Italy.

One word about the definition of "transport", according to IEA, transport doesn't include the consumption for international transport, which is not negligible. It is growing very fast. If we were to include this international air transport this would raise the consumption to 27% at the G20 and for all countries, of course, it would increase the share of transport.

Then, there are large disparities, which can be shown on the graph to the left in terms of energy consumption per capita for transport with very small numbers for Asian countries (India, Indonesia, China), around 0.2 toe per capita, which can be compared to the countries on the right which are close to 2 toe per capita, which means that they consume 10 times more. This implies that there is still a large potential for growth in the countries on the left, which doesn't mean that they will catch up with the countries on the right but clearly the consumption is going to increase. In non-OECD countries there is an increasing trend in the consumption of transport that is driven by the economy growth. The ownership of cars and increased traffic, which is about 5% per year in Asia but there are countries where this is decreasing, which is the case with most non-OECD countries. I will come back to that later.

This decrease is partly linked to energy efficiency. We have tried, in the case of Europe, to quantify what was the worldwide energy efficiency and we present that in the conclusion.

If we keep the definition of IEA, roads represent about 90% of the consumption in G20 and the dominate share in all countries. Only in Russia, China, or India is rail transport important. Air transport, which only includes domestic transport, is not so important here. So, we will focus on road transport in our presentation.

The transport consumption is decoupled from economic growth. If we see, for example, G20 the consumption is growing, which is shown in blue. It is growing much less rapidly than the economic growth, shown by the GDP in green, which means that the energy intensity of transport consumption per unit of GDP is decreasing, which is shown by the red line. On the left side you can see the different situation of countries, its value of the intensity in 2013 in index with 102,000. All countries at that are below 100, which is the

majority of countries where we have this decoupling with the consumption of transport growing much slower than GDP. Only in a few countries (Brazil, Indonesia) the consumption is growing faster than GDP. This is now shown in the graph but there are quite different levels of transport intensity, even when measured with purchasing power parities with a factor 4 between, for instance, India and Canada. Those are two extremes of the values.

Transport is still strongly dependent on oil, although there are policies to replace oil with alternative fuels, which means to think the transport sectors have an increasing influence on the oil market. On the other side the oil market and the change in international oil price have an important impact on the transport sector.

Despite a general progression of alternative fuels that is shown on the right side, alternative fuels are biofuel and natural gas, the dependence of this sector on oil is still about 90% at G20 level with very different situations with countries like Argentina, Brazil, or France that have a high penetration of alternative fuels. In the case of France and Brazil it is biofuel. In the case of Argentina it is natural gas.

Let's go now to the policies. Usually we consider there are three levels of action for policy makers in terms of changing the pattern of energy demand in the transport sector. The first one is to improve the efficiency of the different modes or shifting to alternative fuels, which include measures to improve vehicle efficiency, permission of alternative fuels or soft measures like eco-driving. As you will see, this represents the majority of the measures that have been involved. The second level in green implies changing the type of models that are being used. This is already a policy that is in between energy and transport sector. The third level is reducing transport demand, which is a measure that is our policy that we've combined different dimensions, which goes from energy transport and urbanization. This, for the last type of measure, is a measure that can only be considered on the long term and we have few examples of such policies because it implies a good cooperation between different areas.

Based on a survey we have carried out for the World Energy Council in 2012, which covered all countries in the world, we have only a sample for some G20 countries but everything can be found on the WEC energy database or the WEC report. What came out is that the regulations are the dominant measure. Regulation includes monitoring levels of minimum energy efficiency or CO2 standard forecasts. Then we have financial or fiscal measures that represent each and every group 20%.

Here we did not include fuel pricing and taxation because in principal a lot of countries are having such policies. Almost all OECD countries have high tax on motor fuels. It is clear this is a prerequisite for an energy efficient policy and transport, giving a good signal to the user of the different modes of transport.

If we look at EU countries, where we are using a different database that is called MURE, you have the link here. It is possible to go into more detail as

to the distribution of measures by mode and type of actions. It turns out that about half of the measures are addressing the improvement of the efficiency of cars or reducing the emissions of carbon, those go together, 20% of them with improving the efficiency of automobiles, trucks, light duty vehicles, buses, planes, trains, and about 15% of the measures are dealing with modal shift for passengers. About 10% are dealing with driving behaviors or eco-driving. What is surprising is that modal shift for goods only represent less than 5% of the measures. Then my colleague will continue by focusing on measured energy efficiency improvements.

Carine

Thank you Bruno for this introduction. I think that now we have a clear understanding of the main trends in terms of energy consumption in transport. You presented the main policies and instruments that the government can implement. You just explained that the energy consumption in transport is decreasing since 2000 in some countries. This is mostly due to a greater diffusion of more efficient roads and vehicles governed by the implementation of measures, like you said, regulations and implemented measures. The name of this section is to provide you names of the measures implemented in road transport because, as you were explaining, it represents the large majority of transport and energy consumption.

First, I present measures targeting cars. That's the major move in road transport and then measures targeting transport of goods. Then Bruno will present you measures on modal shifts to decrease the individual transport of food and passengers.

Just a remark, I'll illustrate measures implemented in some countries, as an example, but in any case the list of countries I mention is exhaustive.

So this...sorry, yes. This one first. This slide lists the main instruments that are implementing to improve energy efficiency of cars. Implementers have a set of policy instruments and there is a combination of measures presently considered packages to improve efficiency of new vehicles, most of them cars. Among these measures we have first the energy levels developing that aim to increase the number of efficient cars by raising awareness about vehicle energy consumption, allowing comparison across all models and technologies. The fuel consumption of the CO<sub>2</sub> emissions of cars implemented is displayed on this level in the sales. Most G20 countries have energy efficiency levels for cars. One of the latest implemented was in Saudi Arabia that they implemented a level that had been for new cars and light commercial vehicles in August 2014. However, some countries have not yet implemented this level, like in Argentina, Indonesia, Russia, or Turkey. In Brazil and in India, for instance, the energy levels for cars are voluntary. Then there is a second measure mentioned by Bruno and that is really important, which is the Minimum Energy Performance Standards, in short MEPS or we call them as we well the Fuel Efficiency Standard that are implemented to stop production or to stop import of inefficient vehicles. Most of the time the standards I express in terms of fuel amounts in liters or CO<sub>2</sub> emissions like grams CO<sub>2</sub> per kilometer. In case of non-compliance with the standards the manufacturers are obliged to pay fines or tax that is generally, which is proportional to the extra amount of CO<sub>2</sub> introduced or to the

shortfall of inefficiency. The third item you can see that the government can apply a fuel taxes on motor fuels. The energy consumption of cars is also driven by cars of course and the government supply of fuel taxes on motor fuels decrease energy consumption or average distance or to give incentive as well, at long term, to induce you to buy more efficient cars or equipment.

The forth item you have the efficiency of CO2 based tax on cars. We need to reduce the CO2 emission of fuel consumption. Governments often opt for tax that is based on fuel efficiency, which is measured by liters per 100 kilometers.

Finally, you have all the financial schemes or any premium to promote alternative motors like hybrid or electric vehicles.

On this slide this is exactly the same type of slide as presented by Bruno for the World Energy Council report that we did in 2012. Here it focuses only on the G20 countries and on the measures implemented on cars. This slide provides you the number of measures, the type - that is to say inner regulation fiscal or financial measures. One can easily see, as explained by Bruno, that regulation are the dominant measures implemented. Indeed 13 G20 countries implemented labels on cars and 50% have a fuel efficiency standard. Then come fiscal measures, that is to say the taxes I presented you.

This slide provides you some examples of energy labels that are implemented in some G20 countries. In total, 13 G20 countries have implemented these labels, so the majority, although there is, unfortunately, not much organization in the approaches yet. For instance, Australia fuel consumption label, which is mandatory since 2009, is not comparative at the EU level but it does clearly display urban, rural, and combined fuel forecast consumption as well as combined test CO2 emissions. The European label - so in 2000 the EU Parliament introduced labeling legislation and [inaudible 25:02] France and the UK have adopted a scale that's a comparative level. This label has a CO2 based color code system, which is similar to energy efficiency labels for appliances. Then, the last example I can describe is the Chinese one. Even if it's in Chinese I can explain to you that this fuel consumption label has been mandatory since January 2000. It includes, like the Australian one, city, highway, and combined fuel consumption. It displays other types of information like the vehicle name, motor type, and so on, but this label doesn't show the CO2 emissions, for instance. You see that there is an increasing awareness of vehicle energy performance but the countries do not choose the same methodology.

Of course these measures target mainly cars but they have been recently extended to other types of vehicles. Let's focus on the labeling. The labeling has been extended to vans, for instance, in Denmark and in France, or to used cars labels are proposed for cars, rentals, in France. There is other extension to car components. Indeed, car energy losses do not stem only from engines. A significant proportion of losses occur in others, even the wheels. Some countries introduced labels on tire efficiency, which is the case in 2012 in Europe or in the USA that implemented since 2007. Other labeling provides as well some monetary unit, that is to say the amount of savings you can gain

from this label. There is other regulation and there is a particular extension of MEPS to other vehicles. That's true that some of these are applied to both cars and light vehicles or commercial vehicles, but even Japan distinguishes two types and has different standards for passenger cars and light commercial vehicles. Canada and USA claim an average target for passenger car and light commercial vehicles, although separate targets for each category are also stated. Heavy-duty vehicles MEPS exist in Canada, China, Japan and USA.

The Tyre Pressure Monitoring System, TPMS, increases the fuel efficiency of vehicles by providing the drivers with the information of air pressure in the tires. These measures have been implemented in the USA, Korea, for instance, and are expected to be implemented in Russia in 2016.

About the financial and fiscal incentives that aim to boost the car market, they were put in place in order to promote the purchase and the production of energy efficient or alternative fuel vehicles. Fiscal incentives, such as purchase or annual registration tax reduction for efficient vehicles have become frequent in G20 countries after 2000. The measures targeting a higher tax on the purchase of fuel inefficient vehicles is implemented in a lot of G20 countries to promote efficient cars or to discourage ownership of cars with low fuel efficiency. For instance in Canada, excess tax on fuel-inefficient cars is applied at purchase since 2007. In China the excess tax depends only on the engine size. In USA the government tax is collected from manufacturers and there are many other examples on the extra steps implemented worldwide.

There is, as well, some combined tax, like in France. We have a mixed concept of tax for inefficient parts and incentives for efficient cars, known as bonus/malus. Cars with low emissions get a subsidy or premium, a bonus, while cars with high CO<sub>2</sub> emissions have to pay a tax, a malus. You will see on the next slide the impact of this measure that has been implemented first in 2008 in several months and then there was a second round in 2012 where we clearly see the impact on the market, on the car market. As well, most EU countries like Germany applies a reduction of annual registration tax on CO<sub>2</sub> emissions of cars. About the incentive given to electric vehicles, in Italy the annual registration tax exemption is applied to only electric cars during 5 years after registration. The level of the fee depends on the engine size, emissions rate, and the region. In India as well there is some tax exemption, exemption or reduction. They are common in several states for electric cars. Then there is as well some tax for extra emissions, like in South Africa and with new cars with any extra emission over 120 grams CO<sub>2</sub> per kilometer are taxed at a rate of \$9 per extra gram kilometer since 2010. Then some G20 countries give financial incentive for efficient car purchase. However, they are less common than fiscal incentives. For instance, the subsidies schemes for electric and hybrid cars and even efficient cars to increase their share on the market are, when implemented, like in Japan, China, or UK. Then there is this last scheme I put on that slide, which is as well as another type of incentive, which is the scrappage schemes that aim to accelerate efficient car markets. Indeed grants are often distributed to owners of old cars that buy new efficient ones. Eligibility, [inaudible 32:49] differ from country to country. Some offer grants for new car eligibility or they provide public transport allowance rather than subsidizing the new car purchase, such as in

Canada and Italy. Many many countries implemented this kind of scrappage schema, however, the implementation of such schema often implies negative community and only temporary...boosts only temporarily the car market toward the efficient vehicles.

On that slide, as I explained previously, we showed the impact of the bonus malus program in France. The graphic shows the average CO2 emission of the cars bought each year. So we constantly need new cars and you can see the first cycle should impact the first round of the Bonus Malus implemented in 2008 where you see there is a drop, a decrease, in this average and it leads to a continuously decreased second round of the program in 2012.

What happened on the specific consumption of new cars, of course, is measures have a positive impact and there is a very strong effect of the standards and the incentive measures on new cars. As we can see there is a rapid decrease of the specific consumption of new cars in most countries due to these policies and this trend will continue in the next decade if given the existing standard where we have some information up to 2025. So there is a positive impact of standards and incentives on new cars and, as well, on the car stock. Indeed there is a drop in energy consumption per car, which is mainly explained by an increase in energy efficiency of the vehicle stock, which itself is a result of the diffusion of more efficient new cars as I just explained. For instance, on average, specific consumption decreased by 1.2% per year in the EU since the decade.

In addition to regulation and taxes on vehicles, the energy consumption of cars, as I said previously, is driven by prices. Unfortunately, only a few countries in the G20 produce annual data of the energy use of cars, but from the data available one can see there is a negative correlation between the energy consumption per car and the motor fuel price. Indeed higher fuel processes imply more energy efficient cars and lower distance traveled per car. The European countries with prices significantly higher than other countries have the lowest in energy consumption per car. Let's now turn to the transport of goods or road/freight transport and the measures that are implemented in that sector. We're presenting here the main regulation and measures that aim to improve the energy efficiency of transport companies. Policies on eco-driving, awareness campaigns, and programs of development of railroad transport infrastructure contributing to the specific conception of road freight services. Several countries have implemented regulation for transport companies, such as mandatory audits, energy managers, energy consumption reporting, energy savings plans, or eco-driving. There is, as well, some energy efficiency obligation or white certificates implemented in the transport sector. Indeed in the frame of the European energy efficiency directive some EU countries, such as France for instance, implemented the measures to establish energy efficiency obligations. The goal is to drive forward energy efficiency improvement in the household, business, industry, and transport sector. Transport white certificates are marginal influence and represent 3.2% of all certificates distributed per year. I will provide you examples of measures that are provided in the frame of the energy efficiency obligation in France. It includes equipment and services measures, transport equipment measures, include modal shift, [inaudible 38:30], vehicle

replacement with more efficient eco ones and so on. The transport service measures include training of the public road transport driving eco-drive, carpool from home to work journey, and so on. There are as well voluntary agreements with transport company program optimization of supply chains and carry more approaches of the measures that address transport companies toward increasing the efficiency of road freight transport, although the effectiveness of voluntary movements can be very dependent on circumstances, and they are useful at setting sector targets and contributing to energy efficiency in case of sufficient participation. For instance, France has implemented or introduced a voluntary agreement in 2008 and it targets CO2 carrier undertakes. There are as well some fees or tolls for trucks that are function of the efficiency/emission of vehicles, which is the case in Germany, Switzerland, Latvia, or Poland. Last but not least, there are some measures increasing the fleet efficiency, besides fuel efficiency. It is possible to improve the carry capacities and optimize the routing. USA, Canada, and Australia have eco-trucks, which are more than 25 meters and carry 60 tons at a time. They are similar measures implemented in Europe but it concerns truck-carrying maximum of 40 tons at a time.

In terms of trends in freight transport, the unit consumption of road freight per ton kilometers provides an assessment of the energy efficiency of freight transport services. As shown in this slide there is a decreasing trend in the unit consumption of road freight transport in most countries thanks to the more efficient vehicles and the better fleet management, or increased load factors. The load factor is measured here by the average traffic in term kilometer carried by each truck per year. It increases because each truck is on average better loaded or because of a reduction in anti-running. However, we can see that there is a reverse trend recently in some EU countries, such as UK, Italy, and even USA since 2007 because of the economic recession.

Now Bruno will finish the policy measure presentation with the modal shift policies.

Bruno

This relates to the second type of policy I mentioned in the introduction, which is more a policy for the transport minister and not for the energy minister, which makes it sometimes difficult to implement. It could even be in some countries' policies, in terms of modal shift, to go in the right direction because they have different objectives. What is meant by modal shift is to shift passenger traffic part of the traffic from cars to public transport, for instance, to urban rail transport like metro, tram, or to rapid bus system, which is very popular in Latin American countries, or high speed trains - like in France, China, Spain, and so on. The second level is to shift part of the freight traffic from trucks to rail and water transport through the development of appropriate infrastructure and really, infrastructure for the rail and what we call combined rail and water transport. We should put in trucks, on trains, or trucks and boats, which limit the break of transport for the delivery for the final consumers. There exist strong barriers and long delays to implement this measure because it goes through investment and this doesn't happen very quickly and very easily.

The measures that are implemented to promote modal shifts are of different kinds. The first one is to limit the use of a car or limit the private car ownership to reduce the number of cars. Limiting car use can be done by special fees in urban areas. This is the case in London or in several cities in Norway. To provide this disincentive to the use of car with limiting the place for cars by putting bus lanes instead of a place for roads for cars, parking charges, restricting parking, incentives to carpooling and car sharing, which would reduce the number of cars on the road. This is still limited but there are a lot of small measures to encourage that. There are some measures that have been implemented only in a few countries that can have a strong impact, especially in Asian countries, is limit car ownership, which is what is done in China and Beijing city, which is where the number of new cars on the road is limited through a mixed system of lottery and tax. Another policy that has been implemented in Europe for a long period already in Denmark where there is very very high tax, which is clearly a disincentive. As a result the number of cars per capita in Denmark is the lowest in Europe. On the map they are richest country. Then, for the transport of goods, there can be incentives to carry the freight by water and rail transport. First of all by taxing the transport by trucks, this is a system of toll that Carine mentioned, which we increase the cost of transportation. What should mentioned is that at the same time tolls can be linked to the efficiency of vehicles, so you can have double effect, increase the efficiency of trucks and reduce the traffic. There are several countries in Europe that have implemented this system. France tried to do it but it wasn't favored and could not be accepted so the measure has been scratched. There can be also incentives for companies to use railways instead of a road, you know, like Australia for instance and other countries as well. All that implies that also infrastructure for alternative modes to the road are built and they're a requirement of transportation infrastructure, the requirement of high-speed train to substitute air transport or to attract the user of cars. We have also to note that even if this is wishful policy that there are several countries where infrastructure of rail transport is still limited given the size of the country, which limits the possibility of just sinking a modal shift in the transport sector.

What are the results? The results are not so positive. We can see here all the share of public transport for passenger traffic has changed over time. What can we see really in countries where they're not developed, like China or to a lesser extent Russia have been a big decrease in their share of public transport. When people can afford to buy cars or have access to cars they quickly shifted from public transport to the use of cars. The impact is shown on the graph. In many other countries, OECD countries, the share of public transport is decreasing as well. We can note, however, that in the UK, France, or Italy the share of public transport is increasing. So this is a positive sign. We made a link to the development of rail transport, intercity rail transport, or metro trams in cities. This is still limited at the EU level. I assume there are less than 1% of countries where we see this trend.

With respect to the transport of the freight, the picture is even more uniform in the sense that the most countries, except I think Mexico and UK, but they are already at very low level, show a share of rail and water is decreasing. In some countries transport of good by rail or water transport is quite significant,

about 60% in Russia, Korea, Canada, USA, and Australia. This can be seen as good practice but it's also explained by the fact they have to carry quite heavy goods like coal in Russia or China or India, which are mainly transported by rail and water, which offer size of the weight of rail transport.

Now the conclusion. The title of the presentation was about success and failures. What are the successes and what are the failures? First of all, the first success is that the consumption is decreasing in most OECD countries and this is explained by energy efficiency and consumption, as we will see later. Also, by lower distance travel that's linked to higher price of fuel, which is a result of higher tax because of the higher price of the international markets, which was true until 2013. Now the price has decreased and the other driver was lower activity into the economic recession in OECD countries.

In non-OECD countries we have a different picture, which we can call a failure, but it's not fully a failure. Its economic growth is very positive. In these countries the consumption is going up quite rapidly, as we have seen at the beginning and this is partly due to the economic growth and also to the fact that more people have access to cars.

Other successes are the penetration of alternative fuel that is working, but slowly. This is some kind of failure that there is still a strong relation to oil in transport. Everybody is talking about the future of electricity in transport but we have to admit that the electrification of transport is still far from what we could expect. It's less than 2% in 2012. I think in European countries it is about the same, although it might be even lower.

Other success is what Carine showed - the dramatic progression in the efficiency of cars, which is the result of the regulation and taxes that have been implemented. The one failure that everybody focuses on is cars but forgets the other types of vehicles. The result in OECD countries is the failure of cars is decreasing because this has made the best progress, which means a share of trucks, light duty vehicles is increasing in consumption because there are less policies. We should not forget that in developing countries and emerging countries the weight of cars is much less important than in OECD countries. They are really...it is really on the transport of goods that the effort should be made. This is not the case.

A final success that we consider has been quite a good package of measures and comprehensive combined measures to improve the efficiency of vehicles and cars and for, alternatively, correspond to the first type of measure I presented in the graph about the three levels of policies. With respect to the second policy that was linked to modal shift, we can say that it did not work. We can only see a slight impact in a few countries. For passenger and for freight it is really marginal. There are few measures for addressing transport demand because it has to combine measures in different areas like changing the transportation pattern to have more in the city. This implies different policies from transport of energy policies. This is what makes the complexity of the policies to be implemented in the transport sector.

With respect to Europe, we have quite detailed data and we are able to explain the decrease in the consumption of transport. It is shown on the left for the total consumption for goods and passengers and in the middle for the detail for goods and on the right for passenger.

Let's comment from the total consumption. It has decreased as shown by the rate by \$30 million equivalents. It is no longer an increase but a decrease since 2007, which is the start of the economic recession but we can show that only 40% is explained by the economic recession, less traffic, which is shown by the blue bar. About 60% is shown by energy efficiency, which is shown by the green bar. All are negative so they all contribute to reduce the consumption. Modal shift had a marginal effect for the moment. The green bar, which shows the impact of energy efficiency mainly, represents the savings for cars, as Carine said, for road freight transport. The economic recession has a negative effect and actually led to negative savings. The same that the truck we're using proportionately more energy to carry 1 ton kilometer because of empty running and because of the fact that we're not fully loaded. This we conclude our presentation and now we can go to questions. Thank you for your audience.

Sean Thank you very much Bruno and Carine for those presentations. As Bruno mentioned we will move on now to the Question and Answer session of the webinar. If anyone in the audience does have any questions for the panelists, you may submit those in the questions pane of the GoToWebinar window. We did receive quite a few questions already so I'll go ahead and get started with the first one that we have. That first question that actually came in before the webinar asks - what is the evolution in the efficiency in heavy trucks look like? I know you touched on this in your presentations quite a bit but maybe a quick summary?

Carine That's true. I presented a slide on the specific conception of freight transport that is mainly concerns trucks. We have seen that decreasing since last decade but we can mention as well, and this is exactly what Bruno just explained about these load factors, which is really important in freight transport. It explained that the fact that this specific conception of roads might increase during the economic recession because the trucks were not full. They were half empty and thus the transport ton of goods kilometers was decreased and our attempt at efficiency of freight transport. Maybe Bruno, you want to add something about this truck energy consumption?

Bruno Well, the efficiency of trucks can be defined with different indicators. You can usually relate the consumption to tons kilometers carried and this is what was explained by Carine previously and what was shown in the slide previously. We can sync our efficiency by liter per ton kilometer but this may be misleading because one factor behind this decrease in the specific consumption per ton kilometer is the fact that the trucks are bigger. Per ton kilometers will consume more but we carry more and we truck like 50 tons, like in the US, compared to trucks that are much smaller on average in emerging countries. We cannot have the same efficiency.

- Carine Thanks to the measures I presented to increase these load factors and to increase the size of these big trucks and so on, of course it improved the efficiency as well of the truck fleet.
- Sean Great, thank you both. Moving on to the next question from the audience - it's wondering if you have any insight or information on electric vehicles and very fast chargers and how they could influence electric vehicle development for highway use? They mention that the Kia Soul, which is a kilowatt electric vehicle. They're referencing the very fast chargers for EV vehicles.
- Bruno There are a lot of hopes with electric vehicles but for the moment they are mainly considered to be used in urban areas as their capacity is still not enough to be used on long distance or they will go through a hybrid system. A rechargeable hybrid is a mix of electric and traditional energy.
- Carine Sebi That's true that the vehicles are often linked to a [inaudible 58:52], which is really concentrated in rural areas, sorry, urban areas and concern a short distance, as Bruno explained. In Europe, in particular, most of the measures target or are linked with smart grids.
- Sean Great, thank you again. So we had a few questions that have come and that are all slightly related so I'm going to try to group them together. They are a little broad questions but they are asking for your opinion on this. In your opinion, what are the best measures that you would suggest to implement for both the case of developing countries and measures that have the greatest potential for energy savings and greenhouse gas reductions? Again, the best measures for developing countries and, in your opinion, the best measures to implement energy savings and greenhouse gas reductions.
- Carine I'll start and I'm sure Bruno will complete. In developing countries I think that the main issue is about car ownership that will increase drastically because the behavioral trends are going to want one car per household so this is the main target for energy efficiency measures and policies. To limit this equipment ownership increase there are several measures. First of all is to promote in urban areas the [inaudible 100:43] transports and in long transport to promote the train and high-speed rail train. We have some data showing that there is a great potential in China. Where, in India it is quite well developed. In China there are a lot of programs on high-speed rail. Then, to tax and to put excess tax on cars or individual passenger cars and to promote alternatives at the same time to promote alternative or efficient fuel vehicles.
- Bruno Well I can try to compliment. For developing countries we have to make a distinction between countries that produce cars and countries that import cars. If the import cars then the measures that have been implemented in OECD countries have to be adapted, for instance, by thinking of labels for second hand cars or possibly for minimum of energy standards for imported cars. There are not really examples of that. Some countries have done that for particular appliances but this could be extended to cars. Whereas for car producing countries, the measures that are already implemented in China and Brazil can also be important to implement in these countries. Then a second type of measure that we have to take into account also, buses represent a

significant share of the consumption and part of these buses use energy in urban areas. Usually we have an inefficient bus, polluting bus, or one of the priorities could be to shift in a sense to more efficient buses using natural gas, compressed natural gas. A set priority that this belongs to a second category of measures, which means it's long to implement and more difficult and more costly is, of course, to develop public transport like we have in Europe and OECD large cities in OECD countries. The development of this rapid transit system is still not as developed as it should be. It could be great transport but it could be also bus rapid system, which reduces the cost of the infrastructure. Another large potential, maybe the second question, but it is sort of the first one. What we see in developing countries the majority of freight is carried by medium trucks because they are not big companies like in OECD countries, which are small companies with a limited number of trucks and that, will tell the energy efficiency. I don't know what type of policy should be implemented but it is a matter of organization of the transport system that should rely on bigger companies and bigger trucks to improve the energy efficiency of the system.

Sean Thank you Bruno and Carine. The next question came in during the beginning of the webinar and you did touch on it a little bit but what standard requirement, most of these standard requirements they note apply when dealing with second hand cars.

Bruno I think there are really few requirements in terms of standards. What exists in terms of second hand cars are limits as to the age of the car that they allow to be imported into a country. So it has some impact on efficiency if you prohibit the import of cars that are more than 5 years old, of course, they will be more efficient than very old cars. I don't see any other examples in that respect. As I said, this is something that has to be addressed.

Sean Great, thank you Bruno. We can move on to the next question. What this attendee wanted to know...they note that they are from Trinidad and Tobago where they now have a few incentives for more efficient vehicles. They are wondering if any work has been done on what they are calling the rebound effect, otherwise known as the Jevons paradox. I'm not sure if you're familiar with that. They're wondering what policy measures can be used to address or combat this.

Bruno What you are saying is that in Trinidad and Tobago there are efficiency standards but the rebound effect is that by driving more the user will spend the same amount of money. This is what is usually what is called the rebound effect.

Sean Yeah.

Bruno We believe the best policy to limit the rebound effect is to have high energy prices. If you have very low energy prices then the standard is clear. Since the price is already low I don't think it will have a big impact on rebound effect but it could have an impact. The only way to remove the rebound effect is to have incentive prices.

- Carine We have an appendix of the presentation. We will see that there is the decomposition of the energy trends where we split with the distance effect and in some countries we see that there is a trend toward the decreasing annual distance held by car, even if there are energy standards that limit the consumption of kilometers and so on. I think that this rebound effect is limited and it is more limited by the effect that there is an increase in access in fuel prices.
- Bruno Yeah, what happened actually is that the same time the standards were implemented there was an increase in the price of international oil, which in OECD countries was reflected on the consumer. This explains most of the decrease in the distance traveled by car. Clearly we did not have the rebound effect. We had the reverse effect. People purchased more efficient cars and at the same time they drove less. This could change now that we have low prices. We don't have enough history to measure it.
- Carine They is as well several changes, where at least in OECD countries in Europe, where people they try to use less individual cars and so on, driven by all these policies. As well they have these behaviors and yeah, and willingness to leave their cars.
- Sean Great, thank you again. The next question we have is talking about energy and CO2 labeling. They are wondering what are some of the easiest ways to make energy and CO2 labeling for vehicles mandatory to help raise public awareness. Are there any examples of that?
- Carine Well, it has to be an initiative of the government, by the way, so to be mandatory maybe in some developing countries. There is a step where in India, for instance, or in Brazil, I don't remember, there is a first step to implement voluntary labeling and then make them mandatory. Then I will explain, to enforce this standard is to ask manufacturers to pay a fee or a fine if they do not respect the standards.
- Bruno In terms of labeling, clearly, from the consumer point of view, energy labeling is more efficient than CO2 labeling. It is easier to understand the measurement in liters, miles per gallon, kilometer per liter, than in CO2. Another way to make it attractive and suitable to the consumer is to express it in terms of money spent, which is what some countries impose like New Zealand and UK where you have both consumption in liter/miles per gallon but also in dollar, in pound, they understand.
- Carine As well, in terms of acceptability, what we said is that these levels can be fixed according to any other type of labeling like we did in Europe with appliances where the labels are quite similar from one product to another. That increases acceptability of the end users. It is the comprehension of the label.
- Sean Great, thank you again. The next question from our attendees - they note that scrappage schemes and similar schemes go against the efforts to establish socio-economic development in poorer countries. What has worked best in these contexts where public transport services and infrastructure are weak, thereby pushing the incentives own private vehicles in road for free?

- Carine Are you saying there is a tradeoff between scrappage schemes that give incentives for individual cars while at the same time they are promoting public transport? Are you asking a question about this tradeoff or did I misunderstand?
- Sean Yes, exactly. About the tradeoff.
- Carine Well, on one side the scrappage scheme means to increase the average efficiency of the car fleets. That's right. That's right as well that it cannot give incentive to big transports but I'm not sure there is a direct link because users are different and you develop a public transport in urban areas and you make difficult tests to cars I mean it will have no impact. The scrappage is the promotion of the public transport.
- Bruno By the way, scrappage schemes have been implemented for trucks in some countries, especially in Latin America in Chile and Columbia, to give incentives to the truck owner to replace their old trucks with a more efficient truck. That was not the question. About the question on scrappage schemes for cars, we can have another scheme where you give money to the car owner not only to replace his car but to get rid of his car in exchange of subsidy or in exchange to subscription to public transport or something like this. I think that there are examples of this type. Scrappage doesn't necessarily mean that you give money to replace the car. It can be also to get rid of an inefficient car and using subsidy for using public transport.
- Carine Exactly, this is what I mentioned during the presentation and it is implemented in Canada and Italy. Rather than slighting a new car purchase they promote, they provide public transport allowance.
- Sean Next question notes that you mention that energy efficiency for transport should focus on freight rather than cars in emerging markets. What's the order of magnitude of the energy consumption between that sector, the heavy-duty vehicles, versus cars, light duty personal vehicles?
- Bruno Well, the difficulty is that the transport sector is very poorly known in emerging countries. That's why we only give that out for OECD countries and cars are 50% of the consumption but we know that in emerging countries that's not true. There are few countries that are able to break down the consumption of road transport, for instance, by type - what is consumed by trucks, by cars, and so on. We are working on a project in Latin America that we did not mention. It's called the BEA. It's an energy efficiency indicator project for Latin American countries where we are looking at this question. It is sponsored by ADN and CEPAL ECLAC, the United Commission for Latin America. On the internet you can find information on that. We were not able to get data about this breakdown of the consumption of road transport. I remember only one country, Chile, but this is among the most developed in Latin America. It's part of OECD so it's not really an emerging country. They were able to break down the consumption by type of vehicle and like that you can see that trucks represent a significant share of the consumption, as were buses, and cars not so important.

Sean Thank you Bruno. Next question from our attendee - they want to start by thanking you for the presentations and for sharing your experiences and they also note that the presentation was mainly concentrated on G20 and selected BRICS countries. As for the small and least developing countries, they note Nepal and others in South Asia and sub-Saharan African countries, the transport sector energy consumption and demand are quite different. For transfer policies in these countries technical efficiency is exogenous as they are imported. Could you please share your thought suggestions on future transport energy efficiency policies that are non-technical? Happy to repeat that if you need me to.

Carine What do you call exogenous? You mentioned exogenous, no?

Sean Exogenous? Yes, so they're noting that the technical efficiency is exogenous. The cars are imported. They're not manufactured in-country.

Bruno We'll try to answer to that. First of all, we benefit from the fact that exporting countries will produce more efficient vehicles. So using imported vehicles would be more efficient just because of technical progress in other countries but they could receive the vehicles that are not allowed on the road in the countries with strict standards. They could add up to receive some less efficient second hand vehicles. So this goes to the comment we made about having measures on the second hand vehicles. This answered part of your question? I don't know if there was another part?

Sean Umm.

Bruno These are non-technical measures, but I would say non-technical measures are the most difficult to implement, as we explained. Even OECD countries we are not very proud of the research with non-technical measures. What has been successful are non-technical measures.

Sean Okay, yeah, I think that addresses it. Thank you Bruno. We'll kind of shift topics now. One of our attendees is wondering how you see the development of natural gas in transport, specifically for North America, Europe, and China.

Bruno Well there are great expectations as to the development of gas in transport, especially in the states because of the availability of cars. They are planned to shift everything to natural gas, trains, trucks. So it is possible this will take place. In Europe I don't think we have the same availability of gas and there is less expectation on that side. In Europe we are more focusing on reducing CO2 emissions to look at biofuels because they don't emit CO2 into the calculations of emissions.

Carine And to give some insight into the trends that I can update. Slide number 9 that Bruno described on the show of automatic fuels and I can add this piece according to electric fuel and natural gas so that we'll be able to see the pollution in each country and show of natural gas in particular. We'll improve that slide so that we'll give data.

Sean Great, and if the attendees want access to the slides you can go to [cleanenergysolutions.org/training](http://cleanenergysolutions.org/training) and the slides are available for download

out there as well. We have a couple questions left that we'll try to get to. We are running towards the end of our time so maybe just some briefer answers for these if possible. One question notes that most modeling on transport energy needs focuses on urban transport. They're wondering what's the share of urban transport need in total passenger transport. Obviously that's going to be different country to country but what are the similarities and differences in terms of transport demand and fuel efficiency between urban passenger transport and total passenger transport?

Bruno It's very difficult to get.

Sean Yeah.

Bruno Even about the traffic. Even when speaking about the speed of the vehicles, even with the traffic, we have little data. As I mentioned, this project covering all Latin American countries we discovered that data on traffic do not exist in most of the countries. They don't know what is the traffic of freight, for instance, by road. By rail, of course, it is easy to know it but there is little traffic by rail and traffic by truck it is not well known. I would say now for passengers urban transport probably represents the majority because for several of the same ways in urban areas, compared to the non-urban areas, we consume more per kilometer or per mile driven because they are less efficient when used in urban areas, especially if there is a lot of congestion. This will really contribute to increase the share of urban transport. For freight I would say the majority would be in transit transportation and transportation from factories to city but not really urban transportation. So the picture is different for freight and for passenger.

Sean Thank you Bruno and I guess one last question that might do a nice job of summarizing some of the points that you've had so far - what do we need to support more of a modal shift in transportation?

Bruno I think you can make all the information you want to promote public transport or the use of rail transport for freight. For passengers what is important is the quality of the service. If you have crowded public transport or that are not punctual at all, nobody will rely on it. If you have good quality public transports that go faster than cars, people will use public transport without additional public policy. The answer is really to improve the quality of the public transport, security, everything.

Carine It includes cycle lines as well. (laughter)

Bruno Depending on the climate.

Carine Sebi Anyway, the city has to take into account the buses and the situation that Bruno mentioned.

Bruno The figure of modal shift that has to go through transfer means that investment, time, and it costs money. They are never the priority. This should be the priority, the long-term priority and public/private partnership can be considered for that.

Sean

Great, thank you very much. We are almost out of time now so we'll go ahead and wrap up the webinar. To the attendees that submitted questions that maybe we did not have time to get to, I do apologize for that but I will forward those along to our panelists and give them the option of answering through email directly to you.

At this point we'd like to ask you for your help in completing our survey so that we may evaluate how we're doing and improve for future webinars. The first statement is - the webinar content provided me with useful information and insight. Just select the option that expresses your opinion - strongly agree, agree, not sure, disagree, or strongly disagree. The next question is - the webinar's presenters were effective. Then the final one - overall the webinar met my expectations.

Thank you very much for answering our survey and again on behalf of and on behalf of the Clean Energy Solutions Center, I'd like to just thank again our expert panelists, Bruno and Carine, and also to our attendees for participating in today's Webinar. We very much appreciate everyone's time and

I invite our attendees to check the Solutions Center web site if you'd like to view the slides or listen to a recording of today's broadcast as well as any previously held webinars. Additionally, you will find information on upcoming webinars and other training events. Just a reminder, we are also posting webinar recordings to the Clean Energy Solutions Center You Tube Channel. Please allow for about one week for the audio recordings to be posted and we also invite you to inform your colleagues and those in your networks about Solution Center resources and services, including the no-cost Ask-An-Expert policy support. With that I hope everyone has a great rest of your day and we hope to see you again at future Clean Energy Solutions Center events. This concludes our webinar.