Sustainability & Environment

The clock is thicking towards 2030, how to reduce CO2 emmisions.

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Abstract

The Paris Agreement requires all Parties to put forward their best efforts through nationally determined contributions (NDCs). In Norway Department of Transportation has difined a goal of 50% reduction in emmissions from the construction and maintenance of raods. Hence, the asphalt industry is also required to reduce its CO2 emissions by 50% by 2030. The current combined emissions from asphalt operations in Norway amount to 380,000 tons, approximately 51 kg CO2 per ton of asphalt produced. The past years, the Asphalt Industry has taken several steps towards a more sustainability asphalt industry to contribute to such reduction. Warm mix Asphalt, Reclaimed Asphalt, alternative fuels, dry aggregate is tooles that all will contribute to reduction in emissions. To be able to prove a reductions in emissions according to the Paris Aggrement, and national requirements, a set and rules has to be determined. EAPA published a " Guidance Document for Product Category Rules" which was used in Norway to produce a PCR for asphalt production (npcr-025-2017-version-1-1-part-b-for-asphalt). Once this national rules was determind, a web-tool has been developed operated by a 3rd part. This tool eneables all asphalt manufacturers to document the actual emmissions from each plant. Further the Road owner or client can produse an LCA for a project .This paper give examples of emmisions from an asphalt plant and what can be done to meet the Paris and national goals to reduse CO2 emmissions. The numbers are based on average values in Norway and type of production equipment is not taken into account.

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4. INTRODUCTION

The Norwegian Asphalt Contractor Association (EBA) represent some 80% of the Asphalt Contractors companies but 97% of the production volume in Norway.
EBA started more than 20 years ago to work strategically to what amount our industry effect the environment and that the industry has an environmental responsibility and how could we, the asphalt industry, meet possible future requirements regulated from EU, Our Government or the Road Administration.

The first task was to prevent a possible "Waste-fee" set by the Government on reclaimed Asphalt. This action led to the founding of the non-profit organisation "Kontrollordningen for Asfaltgjennvinning" KFA (Control of the usage of reclaimed asphalt). It was a decision proposed by The Asphalt contractors, The Road Administration, Civil Aviation Administration agreed upon and to prove that we take care of all "waste" from asphalt. This idea was initiated by EBA and has for 20 years helped all participants to prove that 100% of Asphalt is reused directly in production of Asphalt or in the road construction.

The second task was to reduce emission of greenhouse gases from the Asphalt Industry. To do this, actual data from all the members had to be collected and calculated and used as a base line for the next years. The numbers were summarised by the EBA and form 2006-2010 the emission from production of asphalt (ex. Bitumen) was reduced by 10-20%. Some members started to look in to alternative fuels at the asphalt plant to replace fuel. (Liquid Petroleum Gas was the first step)

In 2009 EBA developed the firs EPD for asphalt pavements and this was a standard AC mix used in Norway and the average emissions from all contractors collected the years before was used.

In 2011 EBA started the project Warm Mix Asphalt (LTA-2011). This project was finalised in 2015 and by 2018 WMA represent 20% of the the total production in Norway. This project has been reported earlier in EAPA.

For the past 4 years EBA has worked intensively to develop a web-tool to produce an EPD for each mix at each plant. Production of raw-materials, transportation to the Asphalt Plant, the production itself, transportation to site and finally the paving process.

The current combined emissions from asphalt operations in Norway are to 370,000 tons, approximately 51 kg CO_2 per ton of asphalt produced.

We have the tools but will never reach such goals unless our clients start to ask for such reduction in actual procurement.

5. REDUCION OF EMMISSIONS FROM ASPHALT PRODUCTION

In this paper we have created a summary of the climate accounts in asphalt production based on the figures in the EPD generator for asphalt production (www.epd-norge.no).

The figures are average estimates, and variations between factories will obviously occur. The level of modernization for energy-efficient factories, the choice of fuel, the distance for transporting stone and bitumen, as well as the finished product, the quality of raw materials and the recycling ratio – all of this will affect the environmental impact and climate account of the final product.

5.1. The EPD Generator

The web based EPD tool have been developed by LCA.no. Prior to this development the program operator EPD-Norway formed a PCR-committee to produce the Product Category Rules for asphalt. All members of the asphalt contractor association participated in this work group and gave input to the PCR. Due to the work in EAPA Task Group Carbon Footprint and the guidance document which was established late 2016 the actual period for the PCR work in Norway was reduced to a minimum (2 months).

The tool was approved in 2017 and all members in EBA use this to calculate emissions from each plant or for each mix. When asked for in tender documents, the contractors can produce a project specific EPD.

When using the tool, the operator selects raw materials to be used, transport distances for these to the plant and input from last year's usage for fuels/electricity/ equipment used at plant etc. Hence, only kg, km is to be entered in the tool. All calculations are done within the tool and emission factors for each material, fuel, diesel, LPG, LNG etc is not possible to be changed by the user.

5.2. Factor effecting the emissions from Asphalt

Stationary asphalt plants
Traditionally diesel/fuel oil has been the most widely used energy source for heating the mixing process in asphalt plants. However, in the past decade many plants have switched to gas (LPG/LNG). A recent development is to use biogas, bio-oil or pellets for the heating process. These alternatives are defined as CO2 neutral, and may contribute to reduce CO2 emissions by up to 90 % compared to fuel oil in plant production.

Mobile asphalt plants
Mobile asphalt plants are used for one to two years for projects which have no nearby stationary plants, and the transportation from stationary plants is too far away. By using local aggregates in a mobile plant, the transport distance for both raw materials and the finished produced material is shorter. Some of the mobile plants use fuel oil for heating, and then the environmental benefit is negated by increased emissions from the actual production. The mobile plants may be heated using both gas and biomass, so the opportunities for cleaner operations are very much present. Veidekke has in recent years moved away from fuel oil for heating.

Transportation to site
The transport distance between the asphalt plant and the job site impact emissions but constitutes normally a relatively small proportion of the overall emissions from the production process.
There are exeptions. In Norway, about 2 million tonnes of asphalt are transported by boat, and sometimes this transport is over long distanses. It can also be more than 100 km transport by trucks. Such transport can create high CO2 emissions.
Now there is little room to manoeuvre until we potentially make the switch to electric trucks and ships.

Aggregates
Aggregate and bitumen are the main components in asphalt production. They represent around 22 kg per ton of the overall greenhouse gas emissions from asphalt production. It is particularly the transportation of aggregates to the asphalt plants that has a negative impact. The use of local stone materials can therefore have a major impact on reducing emissions.

Reclaimed asphalt
The effect of recycling has a direct impact on the carbon footprint. In the case of 50 per cent recycling, CO2 emissions are reduced by 50 per cent from production. However, only 30 per cent of the 1.2 million tons of sheets and cuttings that arrive every year at the recycling plants is used to produce new asphalt. The remainder is used for filling edges and as a levelling layer. Here Norway is underperforming and is second last in Europe (source: EAPA statistics from 2017).

Paving
It may come as a surprise, but the actual paving accounts for only five to six per cent of the overall emissions. Some suppliers are working on hybrid and electric pavers and rollers, but as the impact is relatively minor compared to other measures in the production process, this has attracted little attention so far

Asphalt service lifespan
The service lifespan of asphalt is built into the EPD tool, but it has not yet been brought into use as parameter in the EPD generator. It is without a doubt an important factor in terms of climate impact. On high-traffic roads that normally are resurfaced every five year, a year added to its lifespan will mean a 20% reduction in CO2 emissions. Most of the contracts with functional requirements, implemented between 2006 and 2012, have shown that the service life can be almost doubled depending on mix design and quality of the job.

5.3. Example of reduction in emissions

As base line the average asphalt mix of an AC 11 according to EN 13108-1 is used. EBA has published an EPD for x at www.epd-norge.no

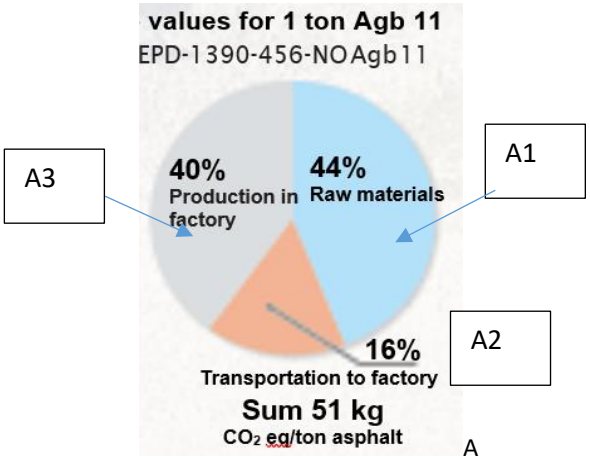

Figure 1: Emissions from A1, A2 and A3 Standard mix in Norway.
A1: Raw materials (bitumen, aggregates)
A2: Transport to asphalt factory
A3: Production in Factory

Reclaimed Asphalt

As mentioned earlier, the total volume of reclaimed asphalt is reported each year in Norway by KFA. In 2018 the total volume of RA represented 17% of raw material in asphalt production. If this was used in production at plant it would reduce the emissions with> 10%

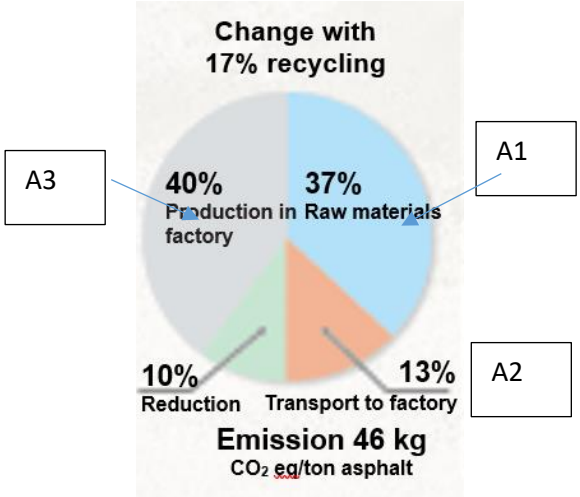

Figure 2: Emissions from A1, A2 and A3 17% RA.

The effect of dry aggregates is well known and just to reduce the water content in aggregates prior to production with use of storage halls, tents, roofs contribute for some of the aggregates e.g. Fines.

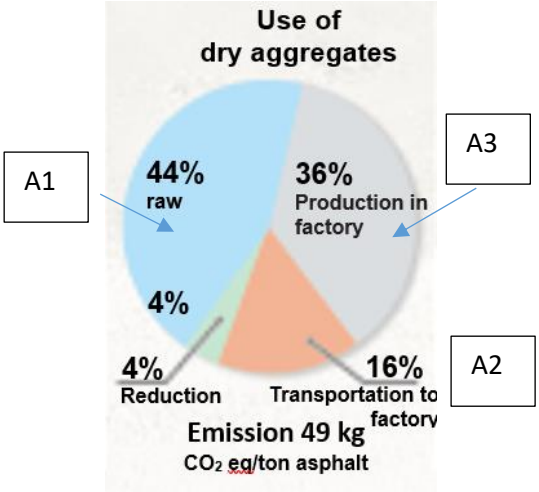

Figure 3: Emissions from A1, A2 and A3 Dry Aggregate.

As several production plants changed from diesel/fuel to as (LPG/LNG) contributes to reduction. As the development of alternative fuels increases also "carbon natural" fuels e.g. Biomass is starting to be used in different countries.

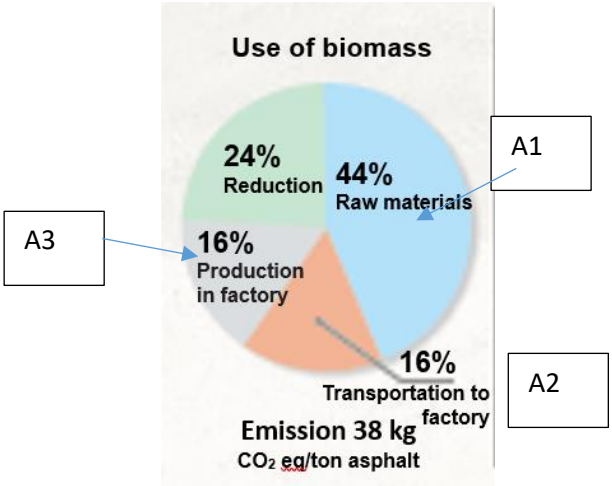

Figure 4: Emissions from A1, A2 and A3 Biomass as alternative fuel.

If all these actions were used at an asphalt plant this will represent a reduction in emissions of 38%.

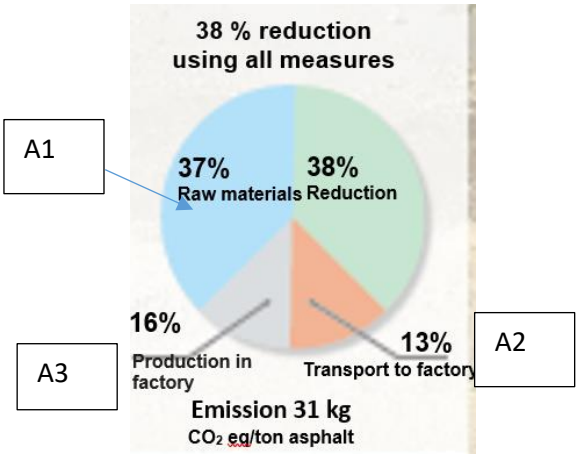

Figure 4: Emissions from A1, A2 and A3 All the above.

5.4. Summary of possible reductions

Table 1. Effect of different actions to reduce emissions

	"NEPD -1390-456-NO Agb 11 Available from EPD Norway"	17% Recycling	Use of dry aggregates	Use of biomass	"Using all measures ,17% recycling, dry aggregates and biomass"
	CO_2 eq kg/t	CO_2 eq kg/t	CO_2 eq kg/t	CO_2 eq kg/t	CO_2 eq kg/t
A1 = Raw materials	22.5	18.7	22.5	22.5	18.7
A2 = Transportation to plant	8.1	6.7	8.1	8.1	6.7
A3 = Production at plant	20.4	20.4	18.4	8.0	6.0
Reduction	0.0	5.2	2.0	12.4	19.6
Total emissions per ton asphalt	**51.0**	**45.8**	**49.0**	**38.6**	**31.4**

5.5. Status as of 2018 in Norway

Production for last year ends at 7.5 million tons of asphalt. This means emissions of 383,000 tons of CO2, or 51 kg CO2 per ton of asphalt. These figures apply up to the point where the asphalt leaves the plant.
Some of these measures requires a change of attitude to be implemented, while others require investments at the plants and increased heating costs.

If all plants in Norway implemented all these measures, CO2 emissions could be reduced by 40 per cent. By reintroducing function contracts, lifespan of asphalt can be increased, and the asphalt industry will achieve their set targets by 2030.

The asphalt industry can help public and private clients reach their climate targets. This setup shows which measures are required to achieve the climate targets. If clients and developers pursue the climate target and either impose requirements of low emissions or reward emission reductions, the asphalt industry can help to reach the set targets. The asphalt industry represents revenues of NOK 10-12 billion. The industry has the tools to document the level of emissions as well as effect of measures taken to reduce emissions. The only precondition is that clients and developers change their asphalt ordering priorities from lowest price to lower emissions.

This means that the customer takes the Government's environmental goals seriously, imposes environmental demands and is willing to pay for such a change.

5.6. Status as of 2020 in Norway

In 3-4 of the Road Administrations tenders for 2019 it has been asked for a project specific EPD and the tender with lowest emissions will be given a reduction in the evaluation of the tender price.

The state-owned company Nye Veier AS use Best Value Procurement for their tenders and on of the 5 goals in all tender has been Reduction of emissions with 40%. This mean that the contractor must prove reduction in the project and the Asphalt Industry can be a major part in meeting such goals.

Hopefully this will be increased by 2020 and at the congress an updated status will be presented.

6. Acknowledgements

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Geir Lange
Arne Aakre
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7. Bibliography & reference(s)

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