EXPERIENCE WITH BIOGRACE – FROM A VERIFIER VIEW

Sarah Moritz – SGS Germany GmbH

WHEN YOU NEED TO BE SURE

SGS

AGENDA

1. Short introduction
2. General set up GHG verification at SGS
3. Experience with Biograce – an overview
4. Experience with Biograce on different verification items
5. Transport emissions
6. Further remarks
7. Conclusions/ Opportunities for Improvement

SHORT INTRODUCTION

SHORT INTRODUCTION

- **Sarah Moritz**
- **SGS Germany, Emstek** (Center of Excellence for ISCC and REDcert certification)
- Regulatory Consultant,GHG expert, Auditor
- Degree in biology
- Work experience:
- 3 years working at SGS in ISCC certification
- 2 years GHG expert at SGS, review of GHG calculations
- 2 years GHG emissions calculation of renewable energies (Federal Enviroment Agency of Germany)

SGS GERMANY GMBH

- **SGS** was the first company who was approved for the certification of sustainable biofuels
- **SGS** has a world-wide network of more than 70 approved auditors in different regions of the world (Europe, North and South America, South East Asia, Australia)
- **SGS** has certified companies with individual greenhouse gas calculation from the beginning of ISCC certification
- **SGS** is the world leader in ISCC certification

- **With our exeperience we are a competent and professional partner for companies who would like to obtain ISCC certification**

GENERAL SET UP
GHG VERIFICATION

common practice at SGS:

- Expert verifies the calculation & literature data
- Expert creates a checklist for on-site audit
- Auditor on-site confirms on-site gathered data (e.g. amount of fertilizers, process energy source, amount of co-products)
- Pool of highly qualified GHG experts (ISO 14 064, EU ETS and other standards)

EXPERIENCE WITH BIOGRACE

EXPERIENCE WITH BIOGRACE

- 2014: about 50 Companies with individual calculations

About 10 % used Biograce

Other percent used their own format usually in excel, very rarely other calculator (ENZO2)

VERIFICATION ITEMS

REGULAR VERIFICATION:

- List of **emission sources (all sources included?)**
- Correct use of **emission factors** (correct emission factor used?)
- Report of **activity data** (activity data correct?)
- Divided by annual product output
- **+ allocation (if applicable?)**
- (+ land use change (if applicable))
- Right application of **methodology** (calculated according to the correct formulas?)

VERIFICATION ITEMS

VERIFICATION WHEN BIOGRACE IS USED:

- List of **emission sources (all sources included?)**
- ~~Correct use of **emission factors** (correct emission factor used?)~~
- Report of **activity data** (activity data correct?) **+ correct conversion of units**
- Divided by annual product output
- ~~**+ allocation (if applicable)**~~
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EXPERIENCE WITH BIOGRACE ON DIFFERENT VERIFICATION ITEMS

VERIFICATION ITEMS

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- Report of **activity data** (activity data correct?) **+ correct conversion of units**
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EMISSION SOURCES

1. Still has to be verified if all emission sources are included
2. Not possible to include other emission sources in calculation

- **Example 1**

Cultivation level: natural gas for drying cannot be included

EMISSION SOURCES

Yield		
Rapeseed	3.113	kg ha^{-1} $year^{-1}$
Moisture content	10,0%	
Co-product Straw	n/a	kg ha^{-1} $year^{-1}$
Energy consumption		
Diesel	2.963	MJ ha^{-1} $year^{-1}$
Agro chemicals		
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$
Manure	0,0	kg N ha^{-1} $year^{-1}$
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$
K_2O-fertiliser (kg K_2O)	49,5	kg K_2O ha^{-1} $year^{-1}$
P_2O_5-fertiliser (kg P_2O_5)	33,7	kg P_2O_5 ha^{-1} $year^{-1}$
Pesticides	1,2	kg ha^{-1} $year^{-1}$
Seeding material		
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$
Field N_2O emissions	3,10	kg ha^{-1} $year^{-1}$

Field N_2O emissions can be calculated in the sheet N2O emissions IPCC

Rapeseed drying

Rapeseed	1,000	$MJ_{Rapeseed}$ / $MJ_{Rapeseed}$
Energy consumption		
Diesel	0,00018	MJ / $MJ_{Rapeseed}$
Electricity EU mix LV	0,00308	MJ / $MJ_{Rapeseed}$

EMISSION SOURCES

1. Still has to be verified if all emission sources are included
2. Not possible to include other sources in calculation

- **Example 2**

Conversion level: difficult to include other energy sources

EMISSION SOURCES

EXAMPLE 2: Company buys steam from external supplier who produces steam from natural gas. Only MWh of steam known and fuel of steam production plant

	1	2	3	4	5	6	7	8	9	
IDARD VALUES	parameter:	**GWP**	**GHG emission coefficient**							
	unit:	$gCO_{2,eq}$ / g	gCO_2/kg	gCH_4/kg	gN_2O/kg	$gCO_{2\text{-}eq}$/kg	gCO_2/MJ	gCH_4/MJ	gN_2O/MJ	$gCO_{2\text{-}eq}$/M
s from steam production (per MJ steam or heat)										
and N_2O emissions from NG boiler								0,0028	0,0011	0,39
and N_2O emissions from NG CHP								0,0000	0,0000	0,00
and N_2O emissions from Lignite CHP								0,0023	0,0126	3,79
and N_2O emissions from Straw CHP								0,0000	0,0000	0,00
and N_2O emissions from NG gas engine								0,0533	0,0000	1,23

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ACTIVITY DATA

- DATA WHICH HAS BEEN INSERTED IN THE CALCULATION MUST BE VERIFIED ON-SITE

ACTIVITY DATA

- Typical example for calculation of cultivation emissions:

Yield		
Rapeseed	3.113	kg ha^{-1} $year^{-1}$
Moisture content	10,0%	
Co-product Straw	n/a	kg ha^{-1} $year^{-1}$
Energy consumption		
Diesel	2.963	MJ ha^{-1} $year^{-1}$
Agro chemicals		
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$
Manure	0,0	kg N ha^{-1} $year^{-1}$
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$
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Pesticides	1,2	kg ha^{-1} $year^{-1}$
Seeding material		
Seeds- rapeseed	6	kg ha^{-1} $year^{-1}$
Field N_2O emissions	3,10	kg ha^{-1} $year^{-1}$

Field N_2O emissions can be calculated in the sheet N2O emissions IPCC

Farmers usually do not cultivate one only feedstock

→ Fuel and energy consumption usually not measured for each feedstock

→ Approximation necessary

ACTIVITY DATA

- Typical example for calculation of cultivation emissions:

Yield		
Rapeseed	3.113	kg ha^{-1} $year^{-1}$
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Utilization of Urea (CH_4N_2O), 100 kg/ha

- Only N-content has to be inserted in Biograce

→ Stochiometric conversion necessary

→ Prone to mistakes

ACTIVITY DATA

- Typical example for calculation of conversion process:

Yield		
Crude vegetable oil	**0,6125**	MJ_{Oil} / $MJ_{Rapeseed}$
Co-product Rapeseed cake	**0,3875**	$MJ_{Rapeseed\ cake}$ / MJ_{Rapes}
Energy consumption		
Electricity EU mix MV	**0,0118**	MJ / MJ_{Oil}
Steam (from NG boiler)	**0,0557**	MJ / MJ_{Oil}
NG Boiler		
CH_4 and N_2O emissions from NG boiler		
Natural gas input / MJ steam	**1,111**	MJ / MJ_{Steam}
Natural gas (4000 km, EU Mix qualilty)	0,062	MJ / MJ_{Oil}
Electricity input / MJ steam	**0,020**	MJ / MJ_{Steam}
Electricity EU mix MV	0,001	MJ / MJ_{Oil}
Chemicals		
n-Hexane	**0,0043**	MJ / MJ_{Oil}

- Yields in kg_{output}/kg_{input}
- Electricity bills in kWh
- Steam in kWh or kg
- Natural gas in kWh or m3
- Hexane in kg

➔ Mistakes occur when conversion to „biograce units“ is made

ACTIVITY DATA

- Typical example for calculation of biodiesel process:

Ethanol from sugar beet
Ethanol from wheat (process fuel not specified)
Ethanol from wheat (lignite CHP)
Ethanol from wheat (natural gas steam boiler)
Ethanol from wheat (natural gas CHP)
Ethanol from wheat (straw CHP)
Ethanol from corn (community produced) (natural gas
Ethanol from sugarcane
FAME from rape seed
FAME from sunflower
FAME from soybean
FAME from palm oil (process not specified)
FAME from palm oil (methane capture at oil mill)
FAME from waste vegetable or animal oil

- Different feedstocks (e.g. refined rapeseed, palm and soybean oil) are used in extraction process
- Necessary to fill out a Biograce sheet for each feedstock
- Problem: consumptions are usually not known for each feedstock but for total incoming refined oil and outgoing biodiesel

→ Also applies to other conversion processes

VERIFICATION ITEMS

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ANNUAL OUTPUT

- Typical example for calculation of extraction process:

Yield		
Crude vegetable oil	**0,6125**	MJ_{Oil} / $MJ_{Rapeseed}$
Co-product Rapeseed cake	**0,3875**	$MJ_{Rapeseed\ cake}$ / MJ_{Rapes}
Energy consumption		
Electricity EU mix MV	**0,0118**	MJ / MJ_{Oil}
Steam (from NG boiler)	**0,0557**	MJ / MJ_{Oil}
NG Boiler		
CH_4 and N_2O emissions from NG boiler		
Natural gas input / MJ steam	**1,111**	MJ / MJ_{Steam}
Natural gas (4000 km, EU Mix qualilty)	0,062	MJ / MJ_{Oil}
Electricity input / MJ steam	**0,020**	MJ / MJ_{Steam}
Electricity EU mix MV	0,001	MJ / MJ_{Oil}
Chemicals		
n-Hexane	**0,0043**	MJ / MJ_{Oil}

- Usually measured in kg

→ Conversion necessary

→ Mistakes are common

VERIFICATION ITEMS

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1. Verification of eligibility for allocation

Example crude glycerin

Rapeseed oil	170.000	t per year
Biodiesel	166.600	t per year
Co-products		
Crude Glycerin	25.500	t per year
LHV Co-Product	16,0	MJ per kg
Chemicals		
Methanol	16.000	t per year
Hydrochloric acid (HCl)	500	t per year

ALLOCATION

1. Verification of eligibility for allocation
2. **New co-products cannot be added in Biograce**

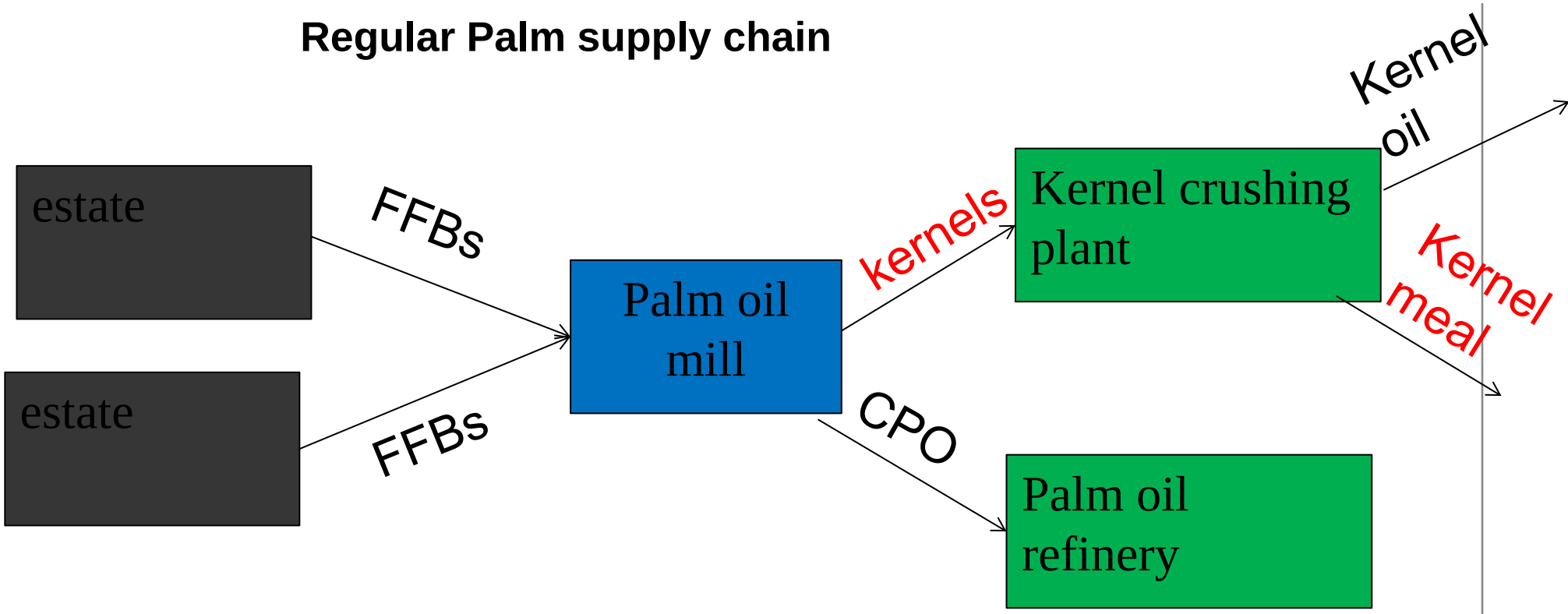
Example lecitine

Products (Output)				
	main output product	crude rapseed oil	250.000	t/year
	co-products:	rapeseed meal	300.000	t/year
		rapeseed lecithine	2.900	t/year

ALLOCATION

1. Verification of eligibility for allocation
2. New co-products cannot be added in Biograce
3. **For crude palm oil allocation only to Palm kernel meal, not palm kernel**

			Total emission before allocation:		
co-product					
			Emissions up to and including this process step:		
Main product:	Palm oil		Energy content (based on 1 MJ)	1,0000	MJ
Co-product:	Kernel meal		Energy content co-product	0,0506	MJ
			Total:	1,0506	MJ
			Total emission after allocation:		


Regular Palm supply chain
estate
estate
FFBs
FFBs
Palm oil mill
kernels
CPO
Kernel crushing plant
Palm oil refinery
Kernel oil
Kernel meal

ALLOCATION

1. Verification of eligibility for allocation
2. New co-products cannot be added in Biograce
3. For crude palm oil allocation only to Palm kernel meal, not palm kernel
4. **No allocation to free fatty acids possible in Biograce**

ALLOCATION

1. Verification of eligibility for allocation
2. New co-products cannot be added in Biograce
3. For crude palm oil allocation only to Palm kernel meal, not palm kernel
4. No allocation to free fatty acids possible in Biograce
5. **Lower heating values are different than the ones from the RED**

Example Oil mill

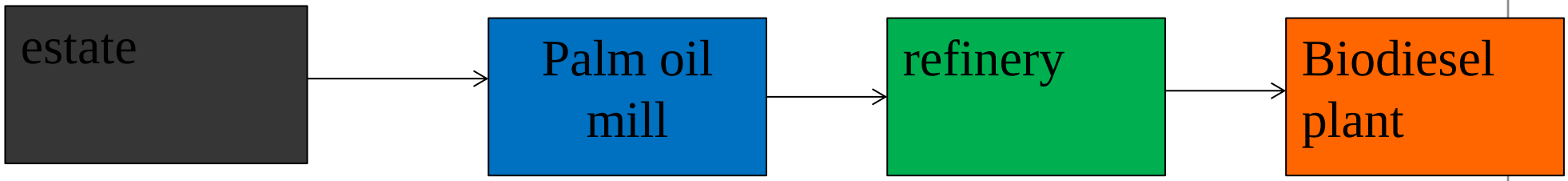
			source
Input			
rapeseed	500.000.000	kg/yr	
emissions rapeseed (cultivation)	678,18	kgCO2eq/t rapeseed	
rapeseed emissions per t crude oil	1.397	kgCO2eq/t crude oil	
Output			
crude rapeseed oil	242.645	t/yr	
rapeseed meal	305.766.000	kg/yr	
conversion factors			
crude rapeseed oil	0,485	kg rapeseed/kg crude oil	
rapeseed meal	0,612	kg rapeseed meal/kg crude oil	
lower heating values			
crude rapeseed oil	36	MJ/kg	Biograce
rapeseed meal	18,7	MJ/kg	Biograce
electricity consumption			
electricity consumption (from the grid)	22.000.000	kWh/yr	
emission factor	0,4700	kgCO2eq/kWh	ISCC 205 document
CO2e-Emissions	10.340.000	kgCO2eq	
CO2 Emissions total electricity per t rapeseed oil	43	kgCO2eq/t crude oil	
steam production (natural gas)	104.000.000	kWh/yr	
emisssion factor natural gas	0,09	kgCO2eq/kWh	ISCC 205 document
CO2e-Emissions natural gas	9.360.000,00	kgCO2eq	
chemicals			
processwater	60.000.000	kg/yr	
emissionfactor process water	0,0003	kgCO2eq/kg	ISCC 205 document

Available LHVs from RED!
(vegetable oil: 37 MJ/kg)

TRANSPORT EMISSIONS

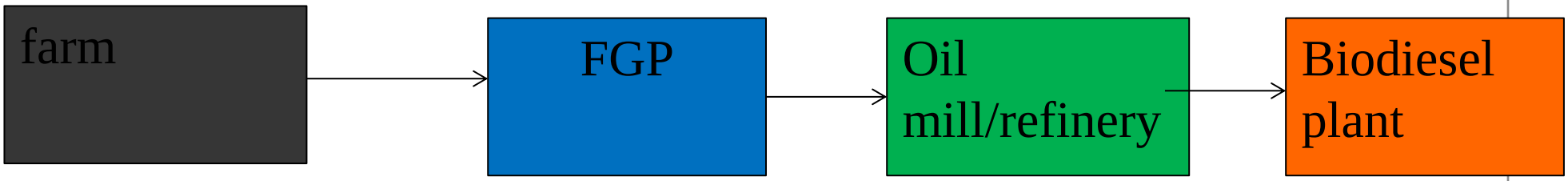
TRANSPORT EMISSIONS

- Transport emissions do not show real situation
- Usually transport between different conversion units



TRANSPORT EMISSIONS

- Transport emissions do not show real situation
- Usually transport between different conversion units
- Often transport from farm to trader



TRANSPORT EMISSIONS

- For all transportation fuel efficiency in MJ/tkm, it would be helpful if Biograce would state more clearly when a return empty is assumed as part of the calculation factor
- Biograce misses more fuel efficiency factors for sea transport by bulk carriers, like in Biograce II where factors for Panamax and for inland bulk carrier exist. Helpful to have more factors, reflecting the fuel efficiency of other kinds of bulk carriers (supramax, handysize and coasters).

FURTHER REMARKS

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- Not possible to calculate other feedstocks (e.g. Jatropha, triticale, barley, rye)
- NUTS2 values from member states reports cannot be used in the Biograce tool
- N-fertilizer has different names in calculation sheet and N2O-sheet

F_{SN}		kg N/ha/year	N in synthetic fertilizer
F_{ON}		kg N/ha/year	N in organic fertilizer
F_{CR}	#DIV/0!	kg N/ha/year	N in crop residues
F_{SOM}	0,00	kg N/ha/year	N mineralized

Agro chemicals		
N-fertiliser (kg N)	137,4	kg N ha^{-1} $year^{-1}$
Manure	0,0	kg N ha^{-1} $year^{-1}$
CaO-fertiliser (kg CaO)	19,0	kg CaO ha^{-1} $year^{-1}$
K_2O-fertiliser (kg K_2O)	49,5	kg K_2O ha^{-1} $year^{-1}$
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Pesticides	1,2	kg ha^{-1} $year^{-1}$

CONCLUSION/OPPORTUNITIES FOR IMPROVEMENT

CONCLUSION

- Biograce eases the work of a verifier since methodology (correct use of formulas) does not have to be checked
- However additional checks have to be made which were not necessary when an own calculation tool is used (right conversion of units, correct allocation, etc.)
- Should be made more practical and more in line with reality

→ „real“ units should be used

→ Should be able to adapt supply chain (other co-products, transport emissions, other feedstocks)

- Suggestion: one version for recalculating the default values, other version with more flexibility to calculate for individual situation

THANK YOU FOR YOUR ATTENTION!

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