



RDF Journey in Jordan

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NEXUS

TOO MUCH WASTE !

- 2.2 billion ton/year (worldwide)
- \$ 375.5 billion/year (worldwide)
- 1.42 kg/capita/day of municipal solid waste (worldwide)

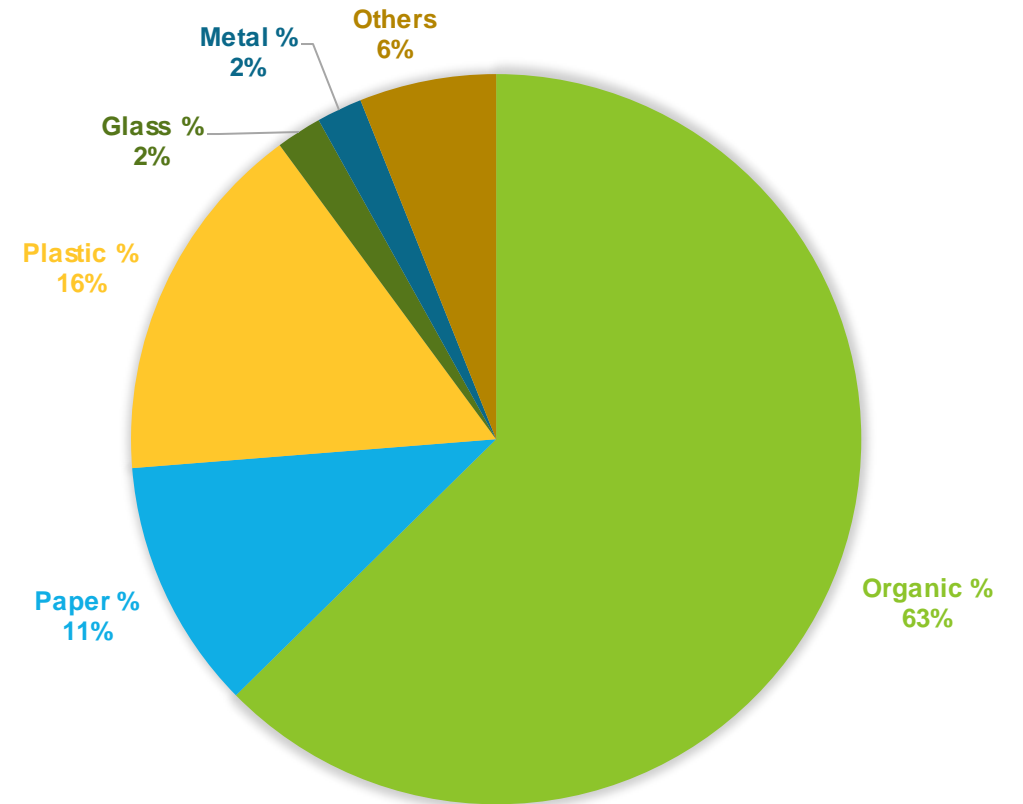
- 1.3 kg/capita/day of municipal solid waste (Jordan)
- 5.4 million ton/year (Jordan)



Waste composition/ Jordan

Landfill characterisation

WASTE COMPOSITION



Historical review

2003 / Used oil

2004 / olive residue

2005 / shredded textile

2005 / Farm residue

2007 / used Tyres

2008 / walnut shell & rice husk

2007-2013 / Municipal waste

2010 / Pyrolysis industrial fuel

2012 / waste water treatment
sludge



Today

Less than 1.5 % of total generated waste is used as alternative fuels



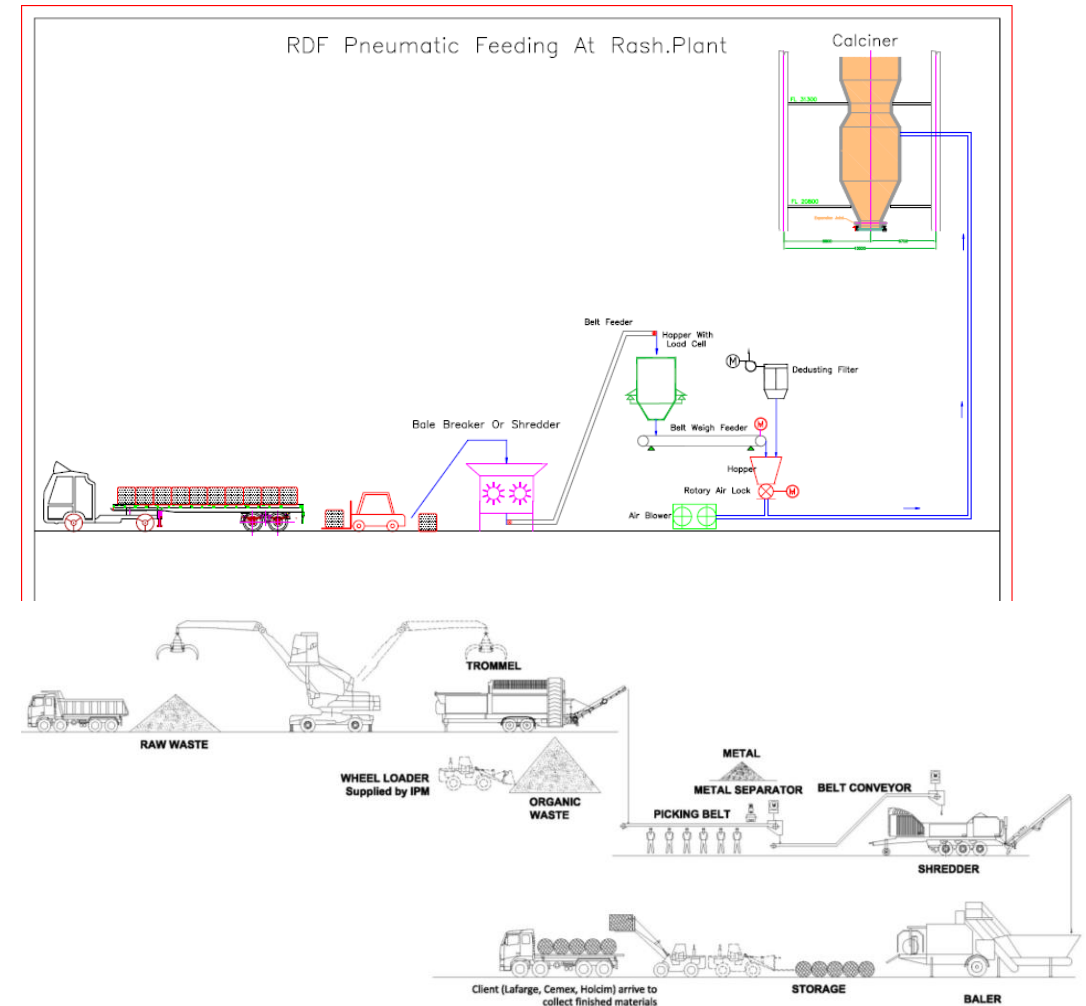
Alternative Fuel potential Consumers



- Main industrial factories
 - › Cement industry
 - › Potash Industry
 - › Steel industry
 - › Phosphate Industry
- Small and medium consumers
 - › Animal farms
 - › Food & beverage
 - › Home applications

Technical Obstacles facing usage of A.F. in industrial plants

- Costly feeding systems (new equipment)
- Limited capacity (difficult handling)
- Operation complications (unstable quality)
- Storage limitations (big volume)
- Transportation limitations (low density/ packing)

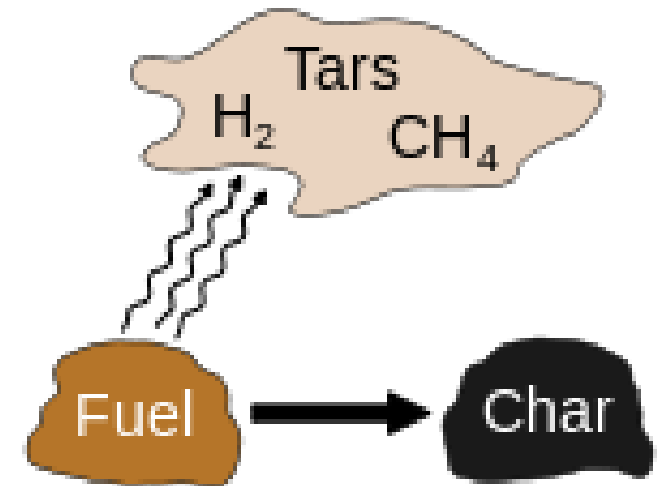


Regulations, Laws , Instructions, Supervision and Licensing

Governmental Obstructions

Pyrolysis as a solution

Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen (or any halogen). It involves the simultaneous change of chemical composition and physical phase, and is irreversible



Inputs & Outputs

Alternative Fuels

Tires (cars, trucks...etc.), Rubber belt conveyors, Rubber scrap produced as byproduct in rubber industry, Plastic wastes, agricultural waste, animal waste, oil sludge, waste oils, grease, industrial waste, oil shale..etc.)

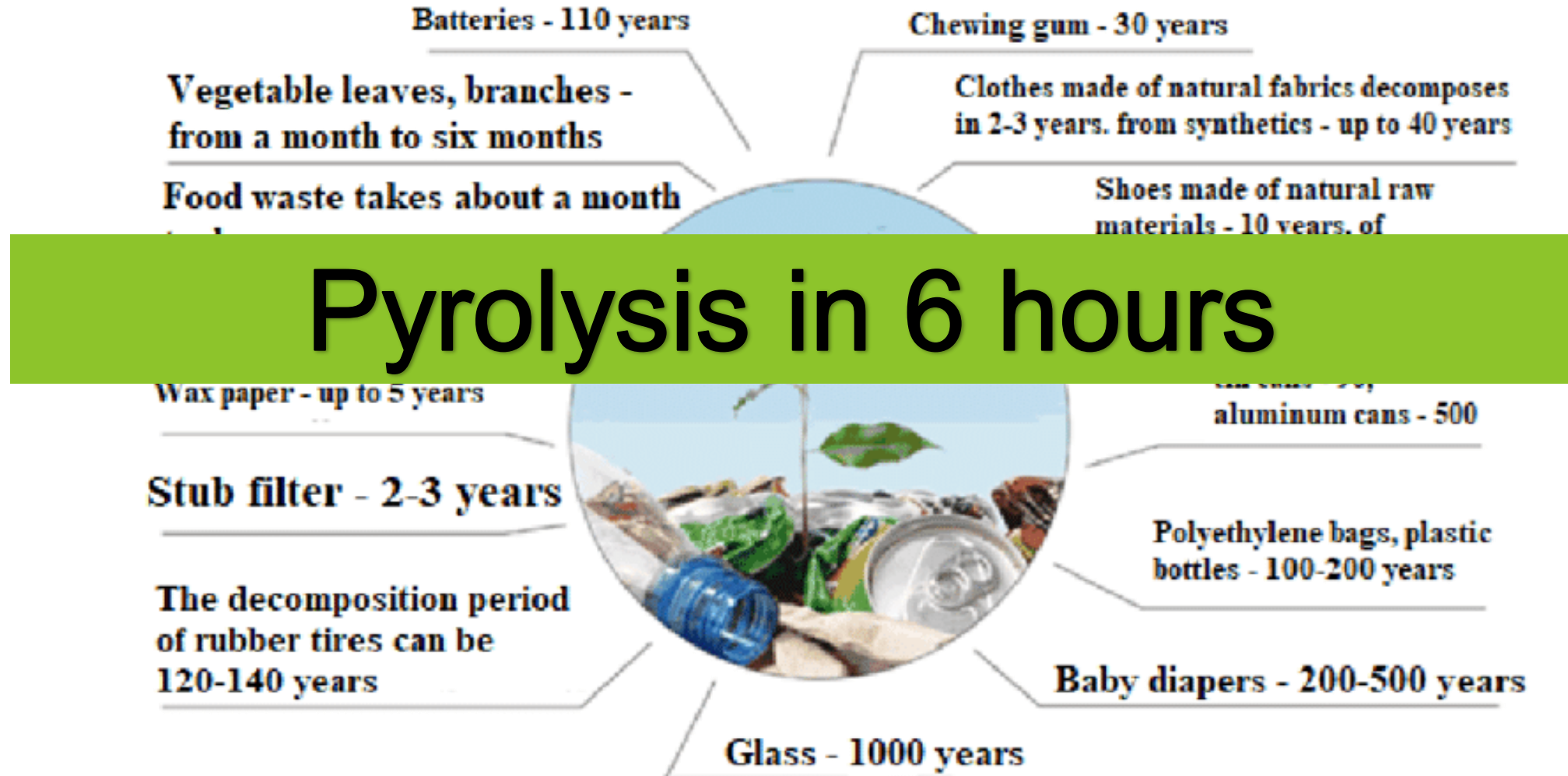
Pyrolysis

After Pyrolysis

Pyrolysis diesel

Carbon Black

Natural Decomposition



Products specifications/ Industrial diesel:



• Chemical analysis:

#	Test	result	Unit	Testing standard
1	Density @ 15 °C	895.7	Kg/m ³	ASTM D 4052-11
2	Total Sulphur content	0.66	% Wt.	ASTM D 4294-10
3	Ash Content	0.0000	% Wt.	ASTM D 482-13
4	Water Content	0.00	% Wt.	ASTM D 95-13
5	Gross heat of combustion	9972	Cal/g	ASTM D 240-14
6	Kinematic viscosity @100°C	1.191	cSt	ASTM D 445-15

Advantages of pyrolysis oil:

1. Suitable replacement for normal diesel oil.
2. Higher/similar calorific value than normal diesel oil.
3. Much lower Sulphur content than diesel oil.
4. Higher burn-ability than diesel oil (lower flashpoint)
5. Environmental friendly due to lower ash content and carbon residue.
6. Can be fired using small (even household) burners.



Products specifications/ Carbon Black

Test	Result	Unit	Test Method
Gross Heat of consumption	7304	Cal/g	ASTM D 240-14
Moisture content, 45 min @ 100 °C	0.91	% Wt.	

Advantages of carbon black fuel:

1. High calorific value compared with other solid fuels (>7,000 Kcal/Kg).
2. Much lower Sulphur content than other solid fuels (2-2.5%).
3. Environmental friendly due to lower ash content and carbon residue.
4. Can be fired using small boilers.
5. Easy handling



Pyrolysis Technology

Advantages



- Pyrolysis oil can be used as 1:1 replacement for diesel.
- Carbon black can be used as 1:1 replacement for ground petcock/ coal. (no need for grinding before feeding)
- Easy feeding into all types of burning systems
- Easy bulk transportation.
- No storage restrictions
- Consistent quality that does not affect operational parameters of plants.



Green Industrial Solutions

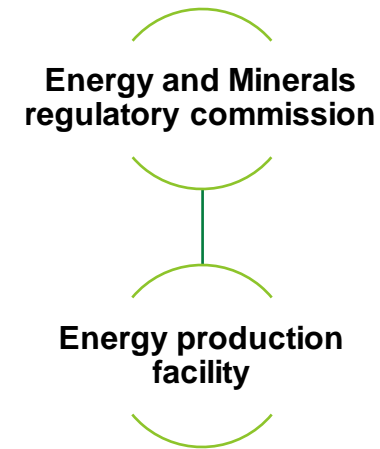
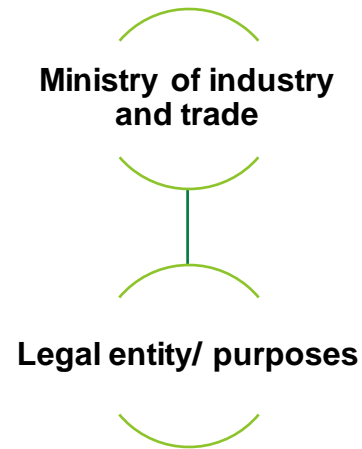
Success Story



- Disposal of 8 million used tires
- Produced 21 million liters of industrial fuel
- Produced 20,000 tons of solid powder fuel (carbon black)
- Produced 10,000 tons of steel wires
- Achieved up to 10 tons/hour feeding rate of carbon black at cement plants
- Replaced 100% of conventional diesel in cement and many steel plants



Pre-approvals and licenses



Supervision and regulations



Energy and Minerals regulatory commission

Ministry of Environment

Inspection teams

Royal department for environment protection

Civil defense

Ministry of Labor

Local Municipality

Social insurance

Customs department

Ministry of Internal affairs

Ministry of health

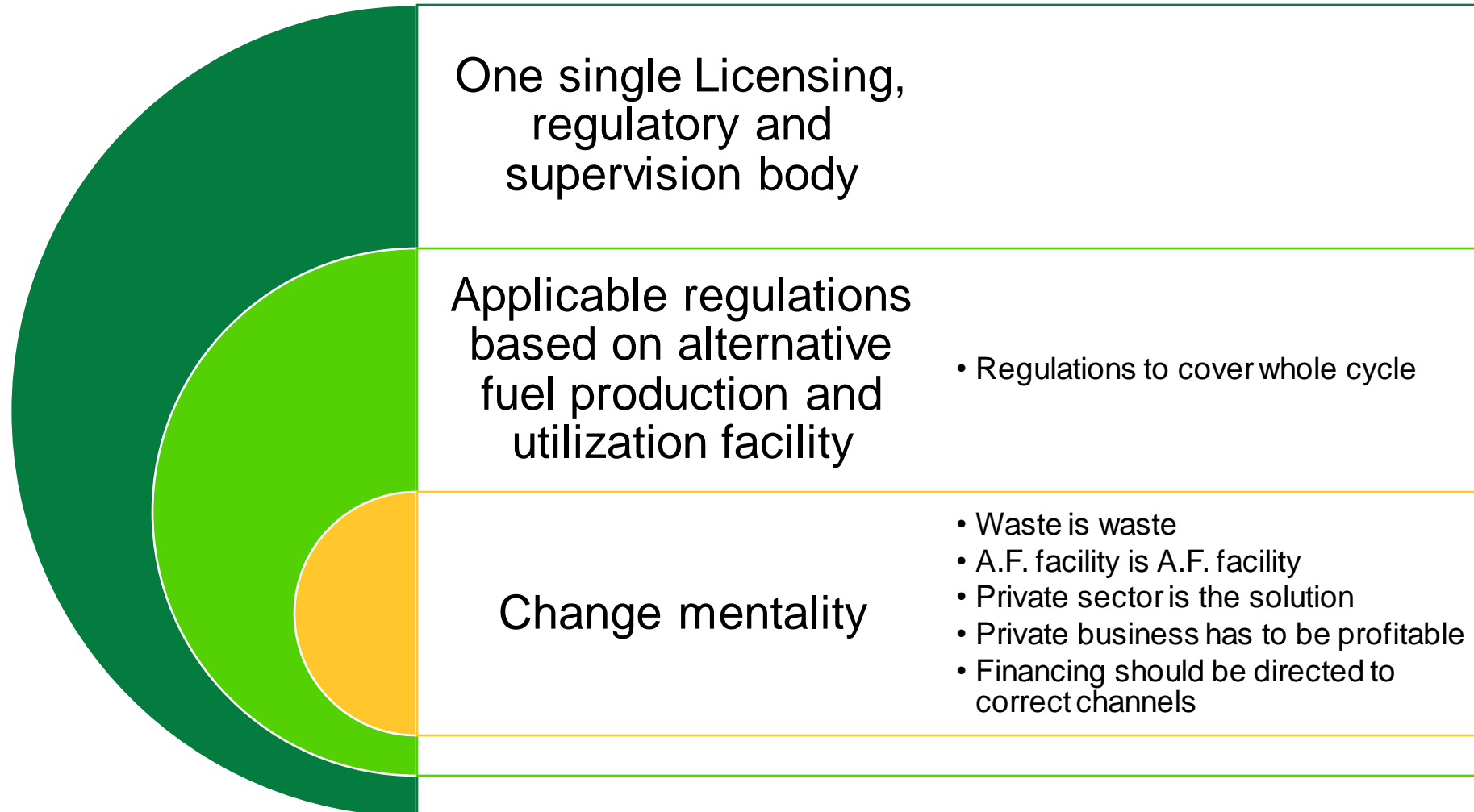
Third party inspections

Income and Sales Tax Department

Customs Department

Successful business model

In order to reach the first RDF unit in Jordan



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