



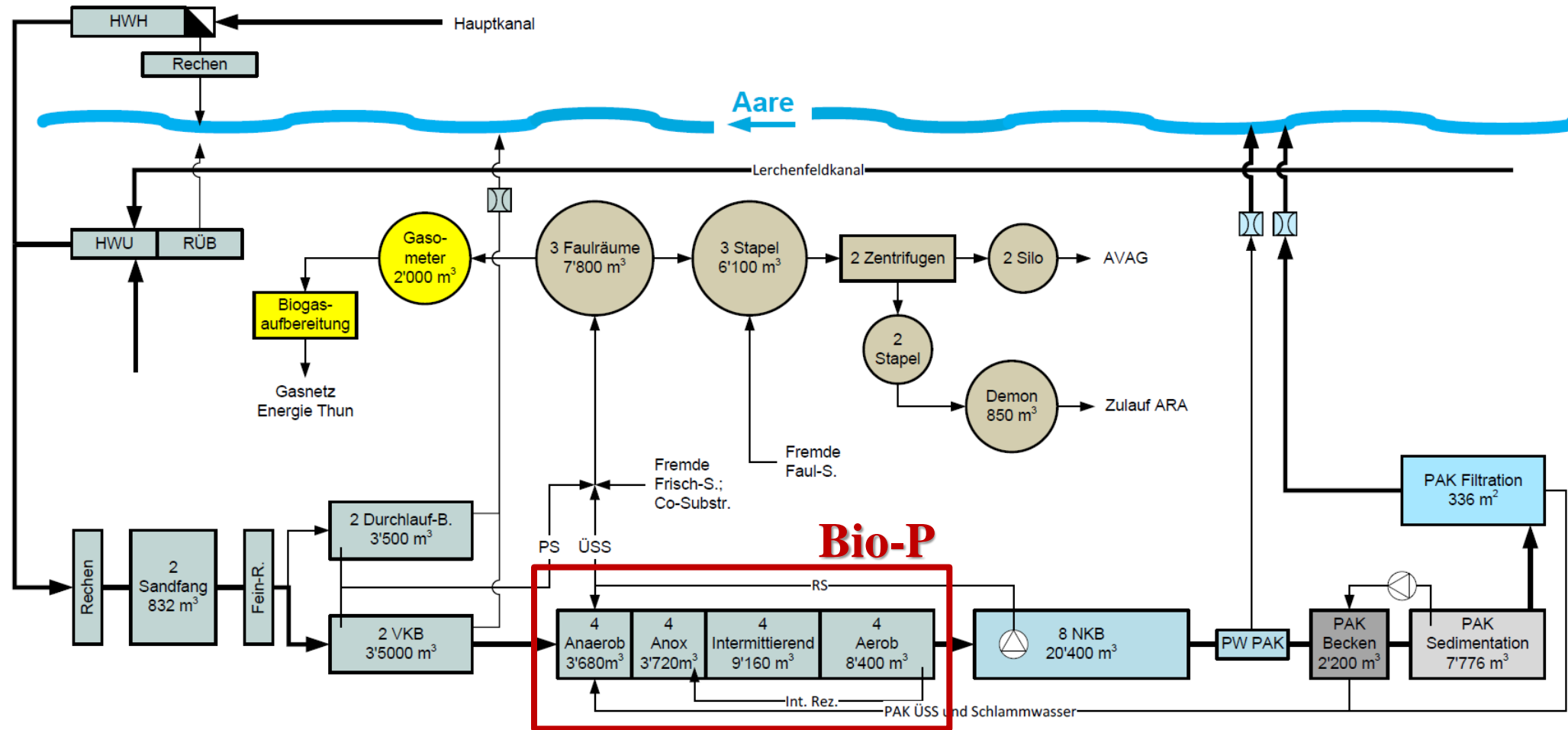
Phosphor-Recycling Situation auf der ARA Thunersee

Angeschlossen sind:

- 35 Verbandsgemeinden
- 1 Gemeinde mit Vertrag
- 125'000 Einwohner
- 155'000 EW

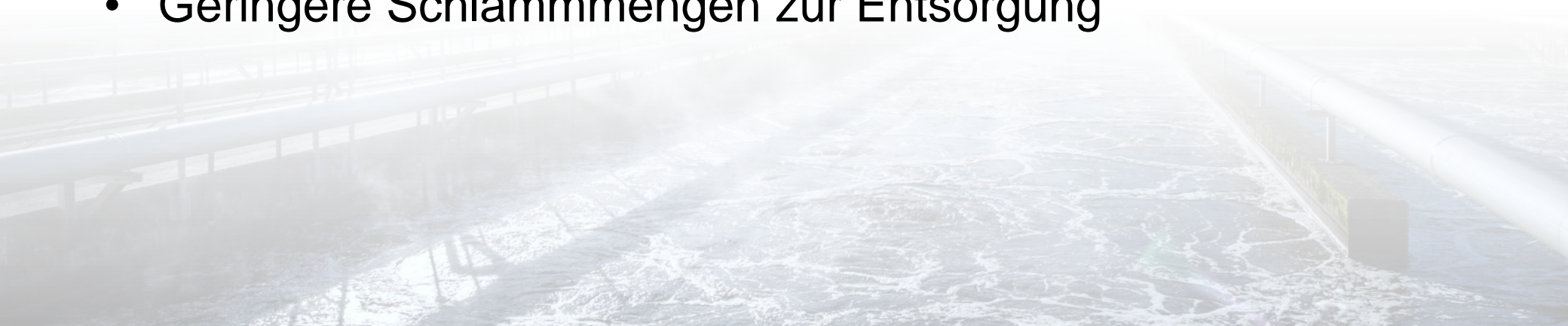


Verfahrensschema

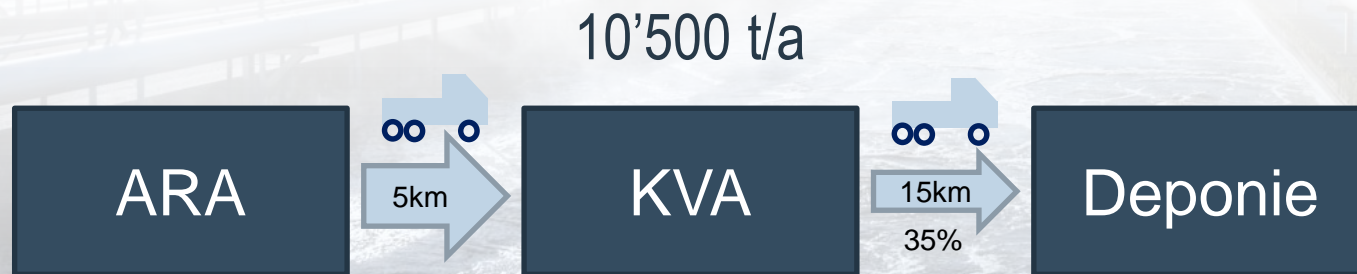


Vorteile Bio-P allgemein:

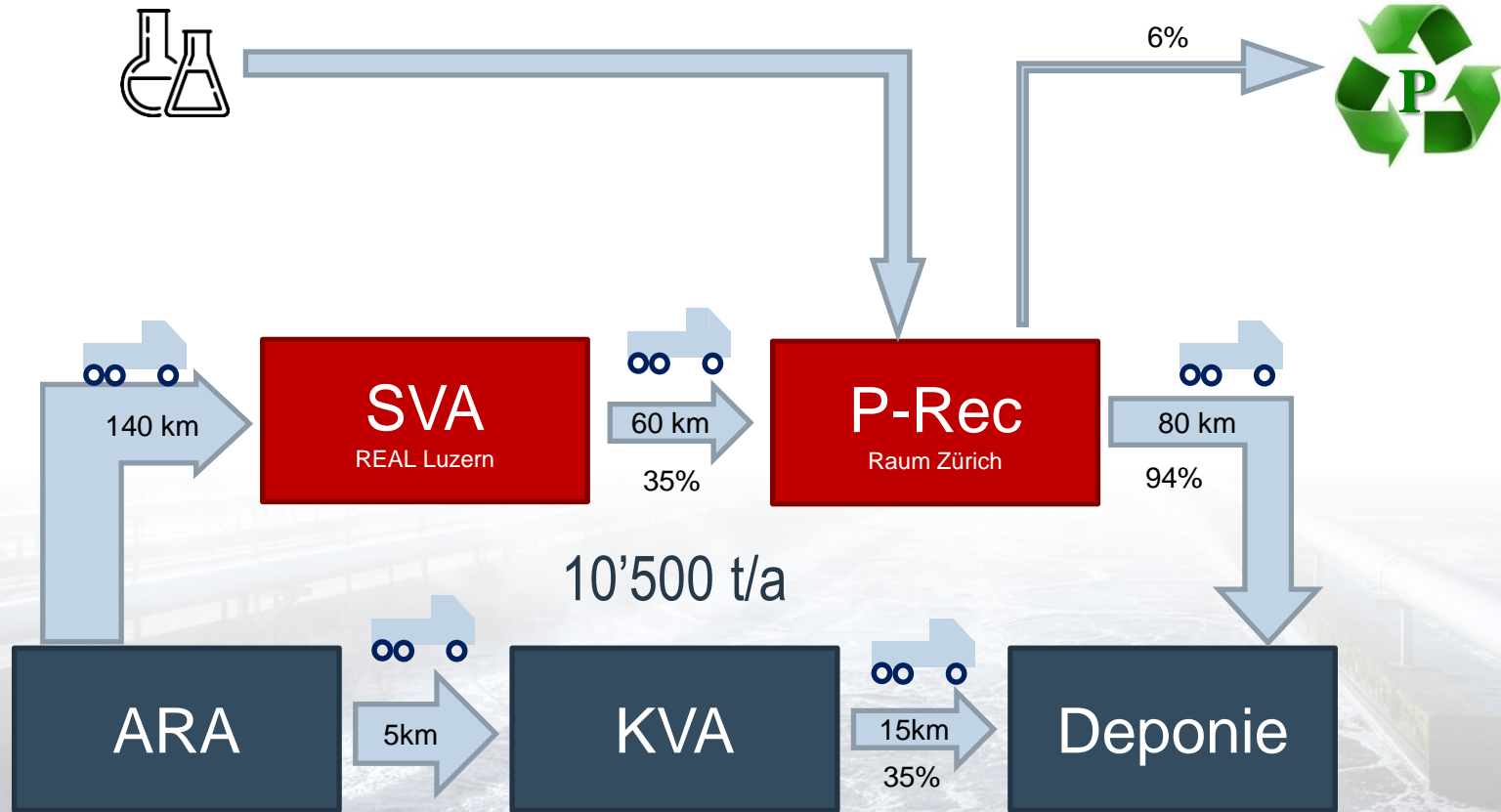
- Geringerer Fällmittelverbrauch → weniger Graue Energie
- Eher hohe Gasausbeute durch ÜSS mit hohem Glühverlust
- Geringere Schlamm-mengen zur Entsorgung



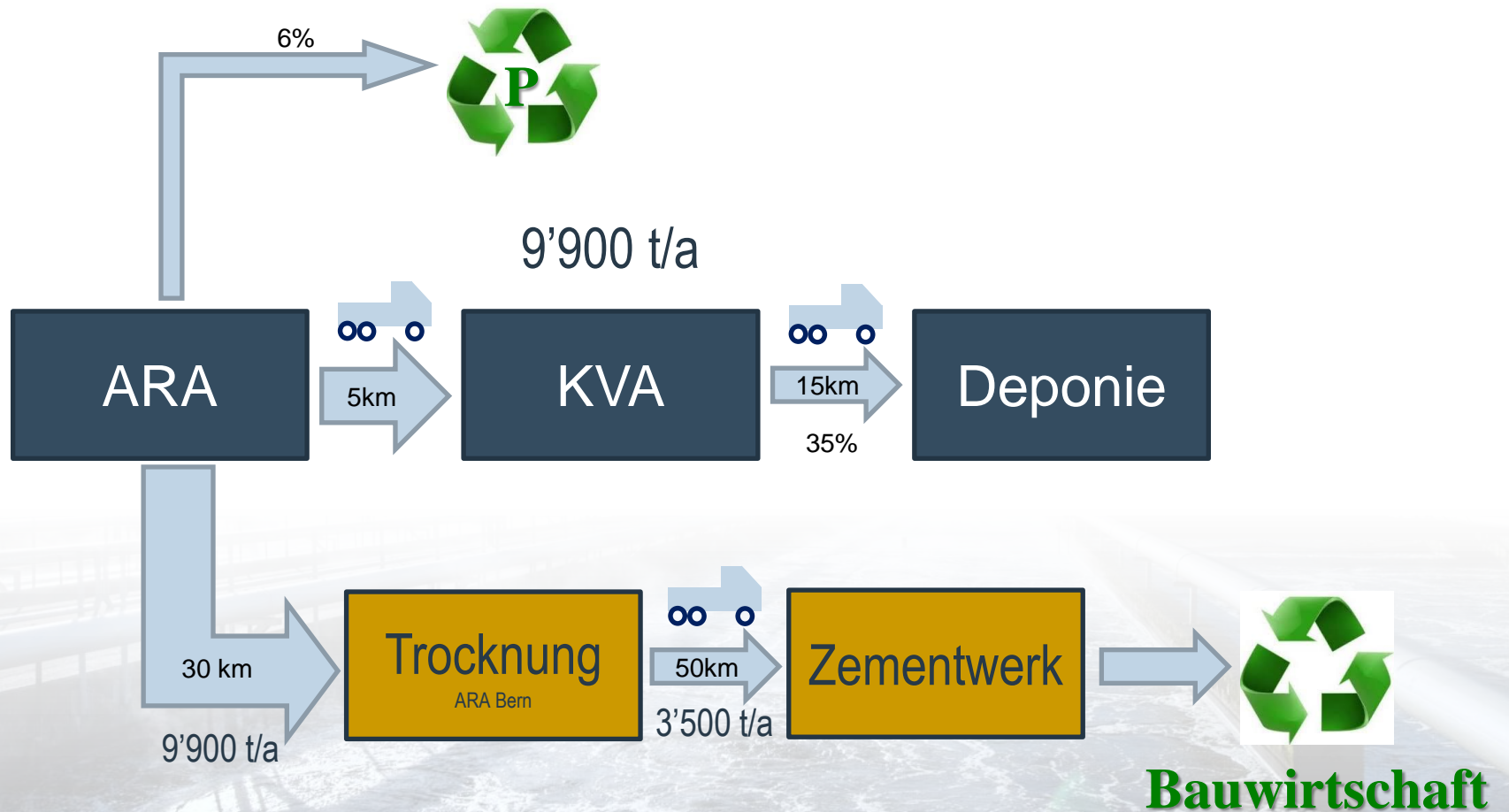
Bisheriger Entsorgungsweg



Entsorgungsweg mittels Ascheverfahren



Entsorgungsweg Nassverfahren



Verfügbares Wissen

Overview of phosphorus recovery from the wastewater stream facilities operating or under construction (© C. Kabbe/March 2018)

Technology	Location and operator	Operational since	Recovered material or product
Onsite wastewater treatment plants			
AirPrex*	MG-Neuwerk (DE), Niersverband	2009	
	Wassmannsdorf (DE), Berliner Wasserbetriebe	2010	
	Echten (NL), Drents Overijsselse Delta	2013	
	Amsterdam-West (NL), Waternet	2014	
	Salzgitter Nord (DE), ASG	2015	Struvite
	Uelzen (DE), SE Uelzen	2017	
	Wolfsburg (DE), SE Wolfsburg	2017	
	Tianjin (CN), Tianjin CEPG	2016	
	Liverpool, OH (USA), Medina County	2018	
	Little Patuxent WRP, MD (USA), Howard County	2018	
ANPHOS (Colsen)	Odillapeel (NL), Peka Kroef (potatoe)	2005	
	Kruiningen (NL), Lamb Weston Meijer (potatoe)	2005	
	Bergen op Zoom (NL), Lamb Weston Meijer	2007/16	Struvite
	Budrio (IT), Pizzoli (potatoe)	2010	
	Oosterbierum (NL), Lamb Weston Meijer	2016	
Den Bosch (NL), Waterschap Aa en Maas	2017		
Crystalactor*	Nanjing (CN), Royal Haskoning DHV	2010	Struvite
EloPhos*	Lingen (DE), SE Lingen	2016	Struvite
EXTRAPHOS® (Budenheim)	Itzehoe (DE), Kommunalservice Itzehoe	2018 (demo)	DCP
Gifhorn	Gifhorn (DE), ASG	2007	Struvite/CaP
Hitachi-Zosen (Unitika)	Matsue (JP)	1998	Struvite
	Senboku (JP), Senboku City	2009	HAP
J-Oil	Yokohama (JP), J-Oil Mills Co.		HAP
JSA	Kawasaki (JP), Japan Synthetic Alcohol Co.	1998	HAP
KURITA	Fukuoka (JP), 3 plants	1997	Struvite
Kyowa Hakko	Hofu (JP), Kyowa Hakko Bio Corp.	2006	HAP
Multiform™	Yakima, WA (USA)		
	Boise, ID (USA)		
	Massey, MD (USA), Jones Family Farms (dairy)		Struvite
	Green Bay, WI (USA)		
NASKEO	Castres (FR)	2015	Struvite
	Harelbeke (BE), Agristo	2008	
NuReSys*	2x Niewkuerke (BE), Clarebout Potatoes	2009/12	
	Waasten (BE), Clarebout Potatoes	2012	
	Geel (BE), Genzyme	2014	
	Leuven (BE), Aquafin	2013	Struvite
	Schiphol Airport (NL), Evides	2014-2015	
	Land van Cuijk (NL), Logisticon	2015	
	Apeldoorn (NL), Vallei & Veluwe	2016	
	Braunschweig Steinhof (DE), SE BS / AVB	2018/19	

Ernst Basler + Partner



PEARL* (OSTARA)	Tigard, OR (USA) Clean Water Services	2009		
	Suffolk, VA (USA) Hampton Roads Sanit. District	2010		
	York, PA (USA), City of York	2010		
	Hillsboro, OR (USA) Clean Water Services	2012		
	Slough (UK), Thames Water	2012		
	Saskatoon, SK (CDN) City of Saskatoon	2013		
	Madison, WI (USA) Madison Metro. Sew. Distr.	2014	Struvite	
	Burford, GA (USA) Gwinnett County	2015	(Crystal Green*)	
	Amersfoort (NL) Vallei & Veluwe	2015		
	Edmonton, AB (CDN) EPOR Water Services	2015		
PHORWater	Stickney, IL (USA) Metro. Water Recl. Chicago	2016		
	Reno, NV (USA) Cities of Reno and Sparks	2016		
	Madrid (ES) Canal de Isabel II	2016		
	Winchester, VA (USA) F. Winchester Service A.	2016		
	St. Cloud, MN (USA) City of St. Cloud	2018		
	Calahorra (ES), El Cidacos	2015 (demo)	Struvite	
	PHOSPAQ™	Olburgen (NL), Waterstromen	2006	
		Lomm (NL), Waterstromen	2008	
		Nottingham (UK), Severn Trent Water	2014	Struvite
		Tilburg (NL), Waterchap de Dommel	2016	
PhosphoGREEN (SUEZ)	Aaby (DK), Aarhus Water	2013		
	Herning (DK), Herning Water	2016		
	Marselisborg (DK), Aarhus Water	2018	Struvite	
	Villiers Saint Frederic (FR), SIARNC	2020		
Sausheim (FR), Mulhouse	2020			
REPHOS* (delivered by NuReSys)	Altentreptow (DE), Remondis Aqua (dairy)	2006	Struvite	
STRUVIA™	Helsingør Southcoast (DK), Forsyning Helsingør	2015	Struvite	
Stuttgart	Offenburg (DE), AZV	2011 (demo)	Struvite	
	MSE Mobile Schlammwässerungs GmbH	2015 (mobile)	(after acid leaching)	
Swing	Kobe (JP), Swing Corp.	2012	Struvite	
Downstream wastewater treatment plants and ash treatment				
Ash2°phos	Helsingborg (SE), EasyMining	2018 (demo)	MAP/DAP/DCP	
EcoPhos	Varna (BG), DecaPhos	2016	H ₃ PO ₄ /DCP/ MCP	
	Dunkerque (FR), EcoPhos	2018		
Fertiliser industry	Various companies already apply or consider use of secondary P sources	tested and intended	Commercial fertiliser	
MEPHREC	Nürnberg (DE), SUN	2016 (demo)	P-slag	
METAWATER	Gifu (JP)	2010		
	Totoni (JP)	2013	HAP	
Nippon PA	Chiba (JP), Nippon Phosphoric Acid	2009	H ₃ PO ₄	
TetraPhos*	Hamburg (DE), Remondis Aqua	2020	H ₃ PO ₄	

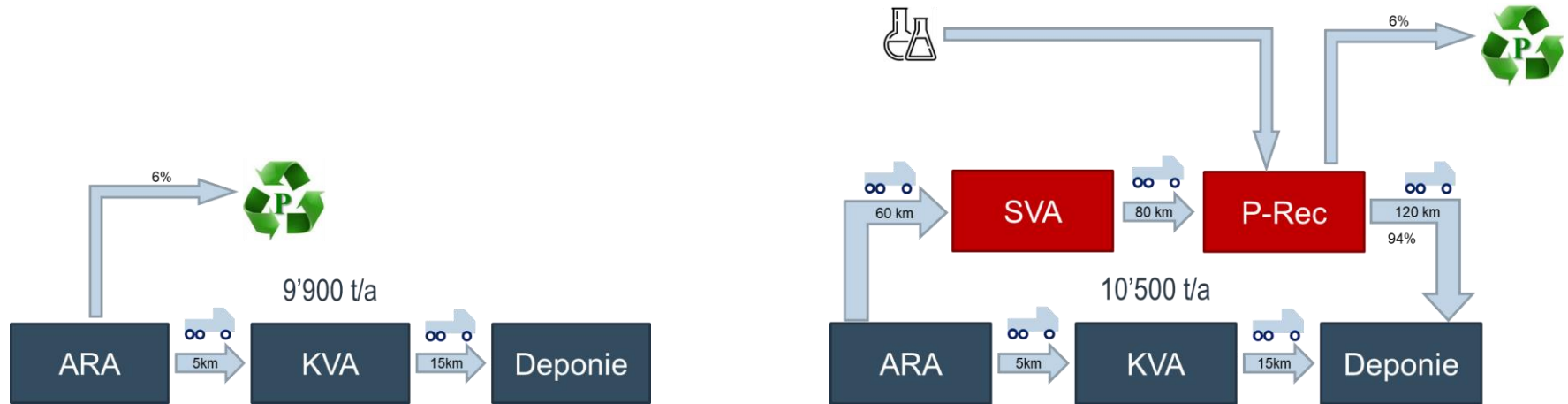
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- Die meisten Verfahren sind nur im Labormassstab realisiert
- Ausnahme bilden Verfahren in Bio-P-ARA
- Diese Bio-P-Verfahren habe jedoch andere Rahmenbedingungen

=> weiteres Wissen muss aufgebaut werden

Vergleich Entsorgungsweg



Ökologische Gesamtbetrachtung

- Energie-Input Verfahren?
- Transporte?
- Graue Energie?
- Landschaftsschutz?