European Sustainable Phosphorus Platform

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SMART-Plant

ECOMONDO
THE GREEN TECHNOLOGIES EXPO
22ª Fiera internazionale del recupero di materia ed energia e dello sviluppo sostenibile

Green & Circular Economy
6-9 Novembre 2018
Rimini Italy
IN CONTEMPORANEA CON
KEY ENERGY

From discussion to implementation

P recovery from sewage sludge/ash

Dr. Christian Kabbe – Isle Utilities

isle

3rd EUROPEAN NUTRIENT EVENT @ ECOMONDO 2018

8 - 9 November 2018, Rimini, Italy

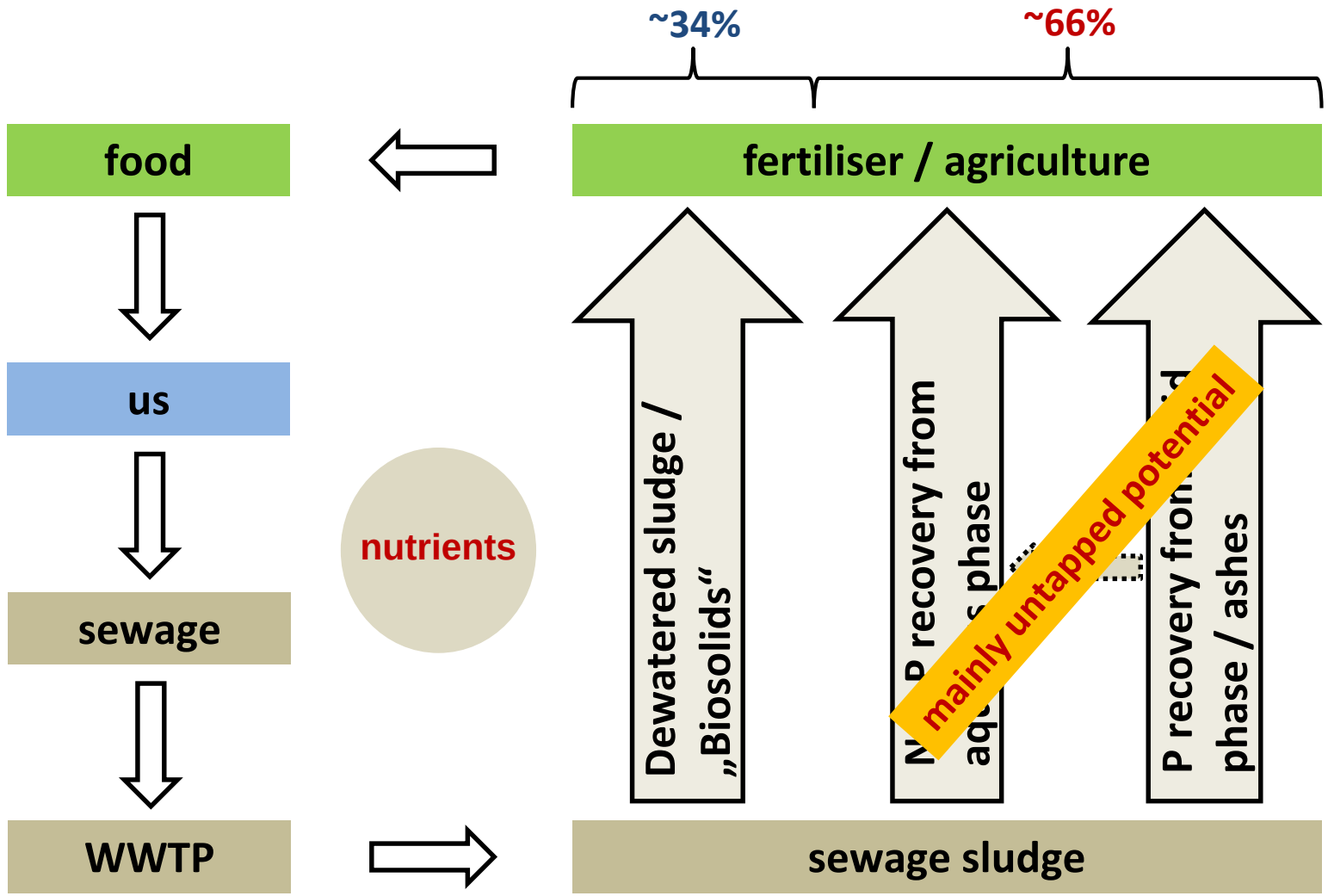
www.smart-plant.eu/ENE3

Sewage (sludge) is a renewable nutrient resource still waiting to be tapped to it’s full potential in a sustainable way

Intro – Germany and future sewage sludge management

- 2017 – the year of change and shortage
- Stricter requirements (nutrient load limitations, shorter time windows for land application, more monitoring efforts)
- Lack of both, land and incineration capacities
- Regional cost explosion for sludge disposal
- Collateral impacts on Germany's neighbours
- Utilities start reacting on future proof concepts

Pillars of Nutrient Recovery & Recycling in Germany



Long-term security for disposal

Concerns

Acceptance

Hygiene

Contaminants

Heterogenity

Uncertainties

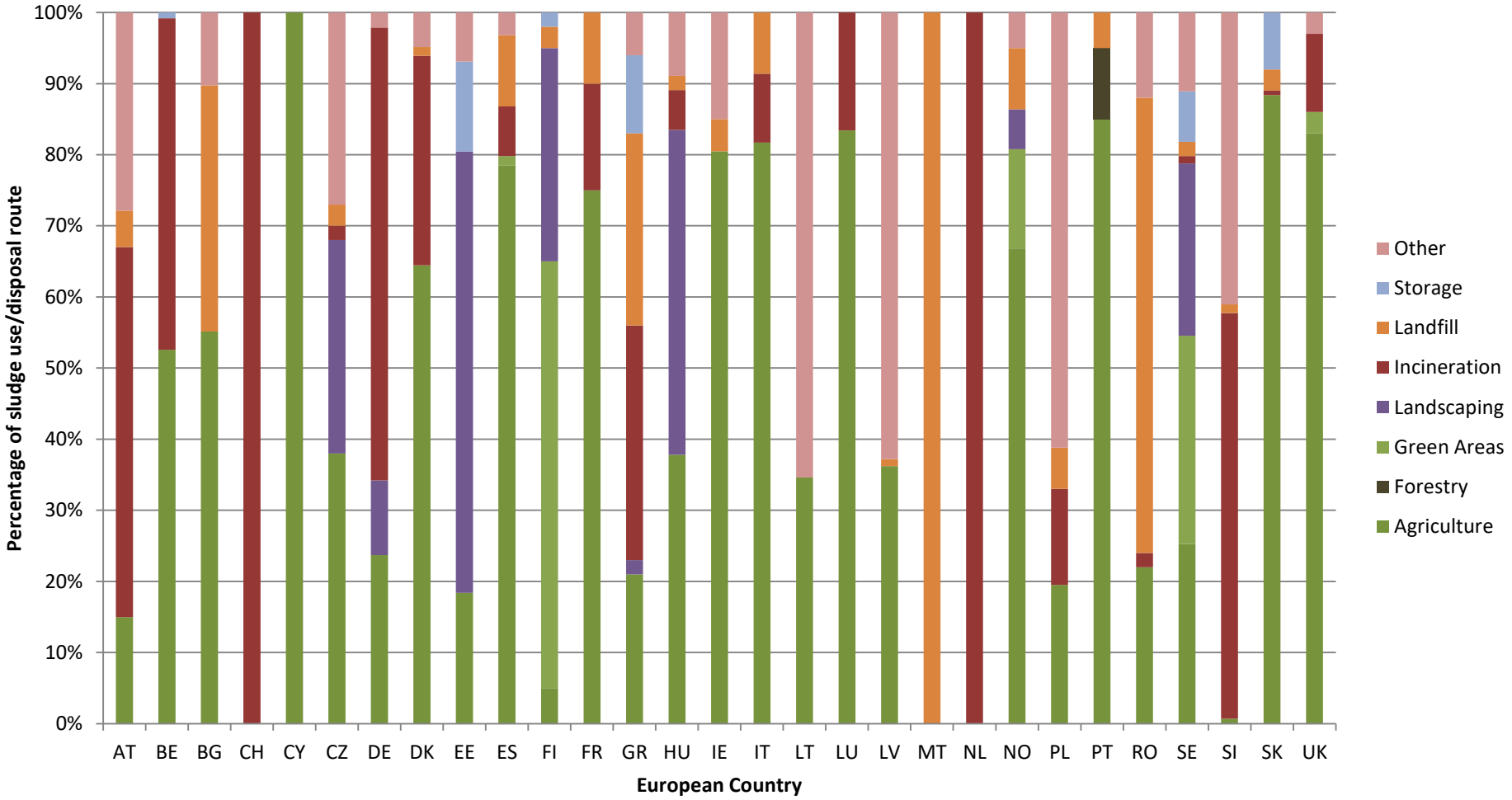
Monitoring Cost

Surplus manure

Transparency

Challenge: Enabling techn. alternatives to complement /compensate traditional route!

Sewage Sludge - Destinations in Europe - Diversity



Sources: EurEau 2016, EUROSTAT 2016, DESTATIS 2016, BAFU 2016

Total sludge quantity covered: appr. 10 million tons of dry solids per year!

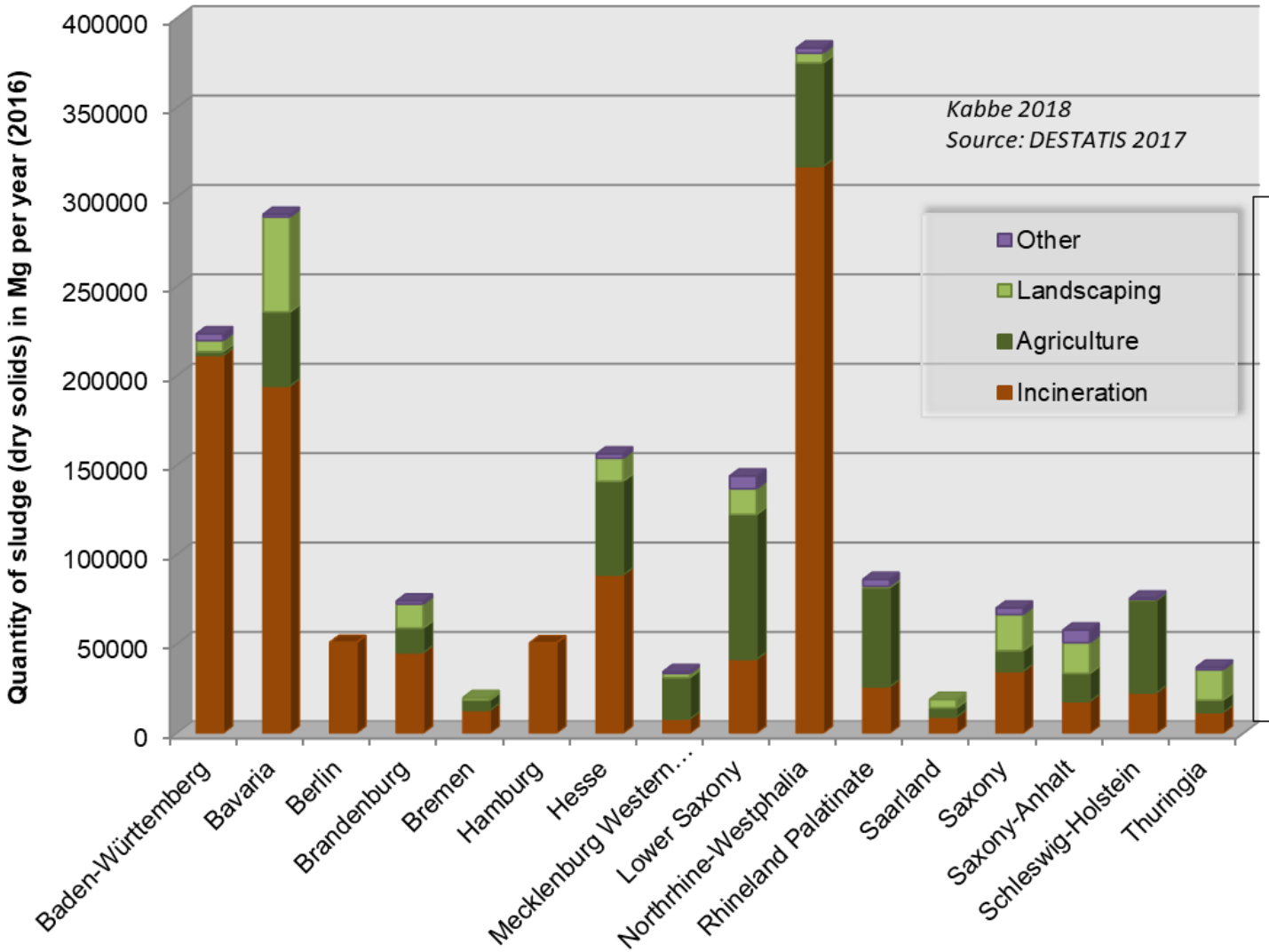
Germany 2017+: a template to adapt, but not just to copy as is

- 2017 – new fertilising ordinance (DÜV) limits nutrient loads applied to land and acutely reduces sludge disposal capacities -> co[illegible] explosion!
- new fertiliser ordinance (DÜMV) sets stricter qualit[illegible] (less sludge conform) – monitoring cost
- 2017 – new sewage sludge ordinance ([illegible]) enters into force
  - 2023 – all WWTP have to submit sludg[illegible]ent concepts considering P recovery
  - 2029 – P recovery oblig. for all [illegible]e 100,000 p.e. (ban from land application)
  - 2032 – P recovery oblig. fo[illegible] 50,000 p.e.
    - Even smaller WWT[illegible]cover P, if no land application possible
    - On-site WWTP[illegible] to deplete below 20 g P/kg DM or at least by 50%
    - After therm[illegible]ment recoverable separate storage of ash/concentrate or recove[illegible]ith >80% recovery rate

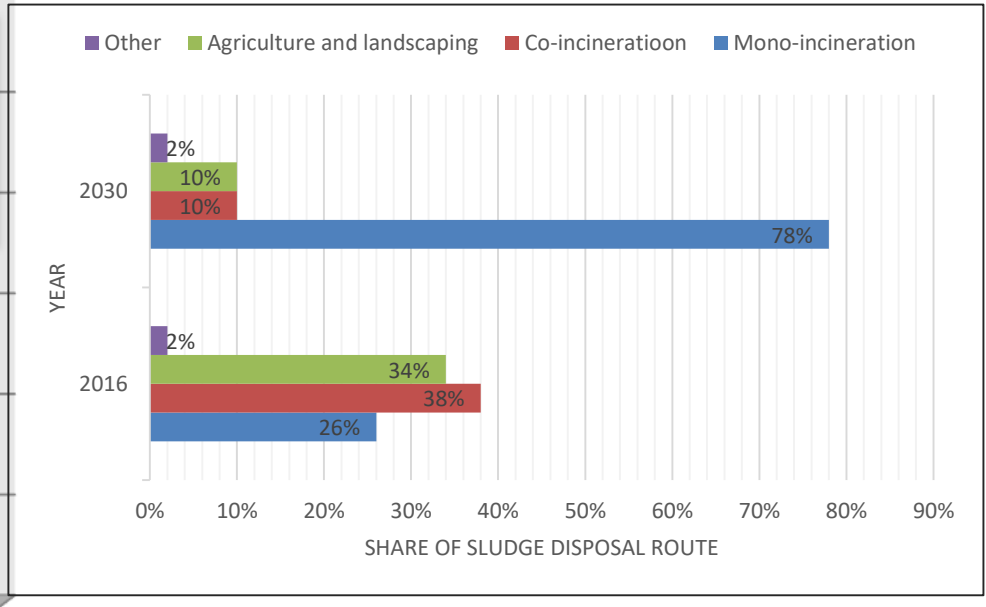
Sludge mono-incineration is favoured and will double in coming years!
Sludge disposal cost have already been doubled regionally last year!

    - [illegible]ssing?
    - [illegible]rketable recycling concepts included
    - [illegible] measure to secure proper ash quality (all sludge can be inc. in mono-inc.)
    - Reverence value for P should refer to mineral sludge phase, not to DS
    - Who pays for what? (Inc. and recovery from ash monopoly?)

Sewage Sludge - Destinations in Germany 2016 and 2030



Estimated trend for future disposal routes by 2030



Total municipal sludge quantity: 1.77 million tons of dry solids per year!

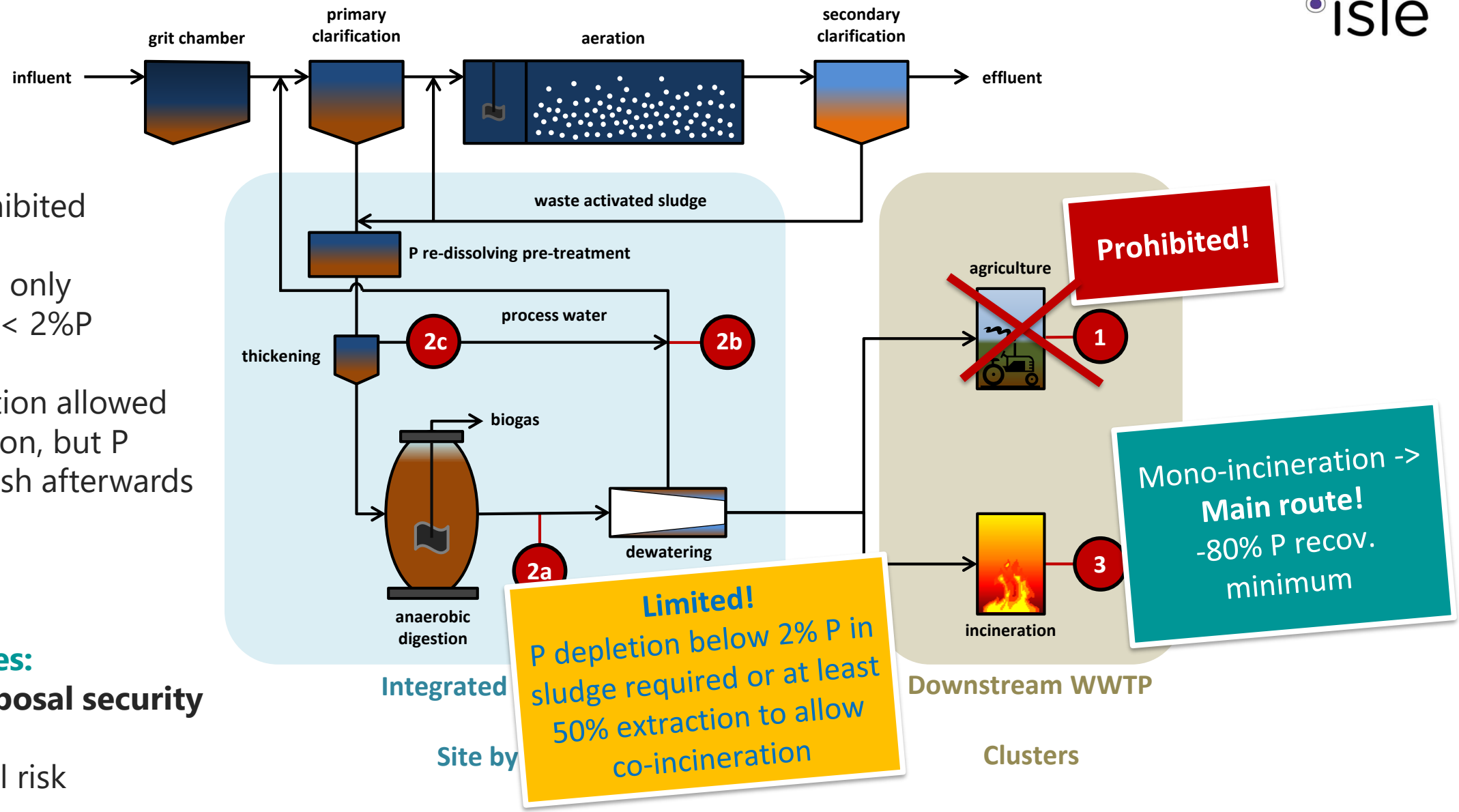
Hotspots for P recovery & Recycling for WWTP > 50.000 p.e.

2029/32+

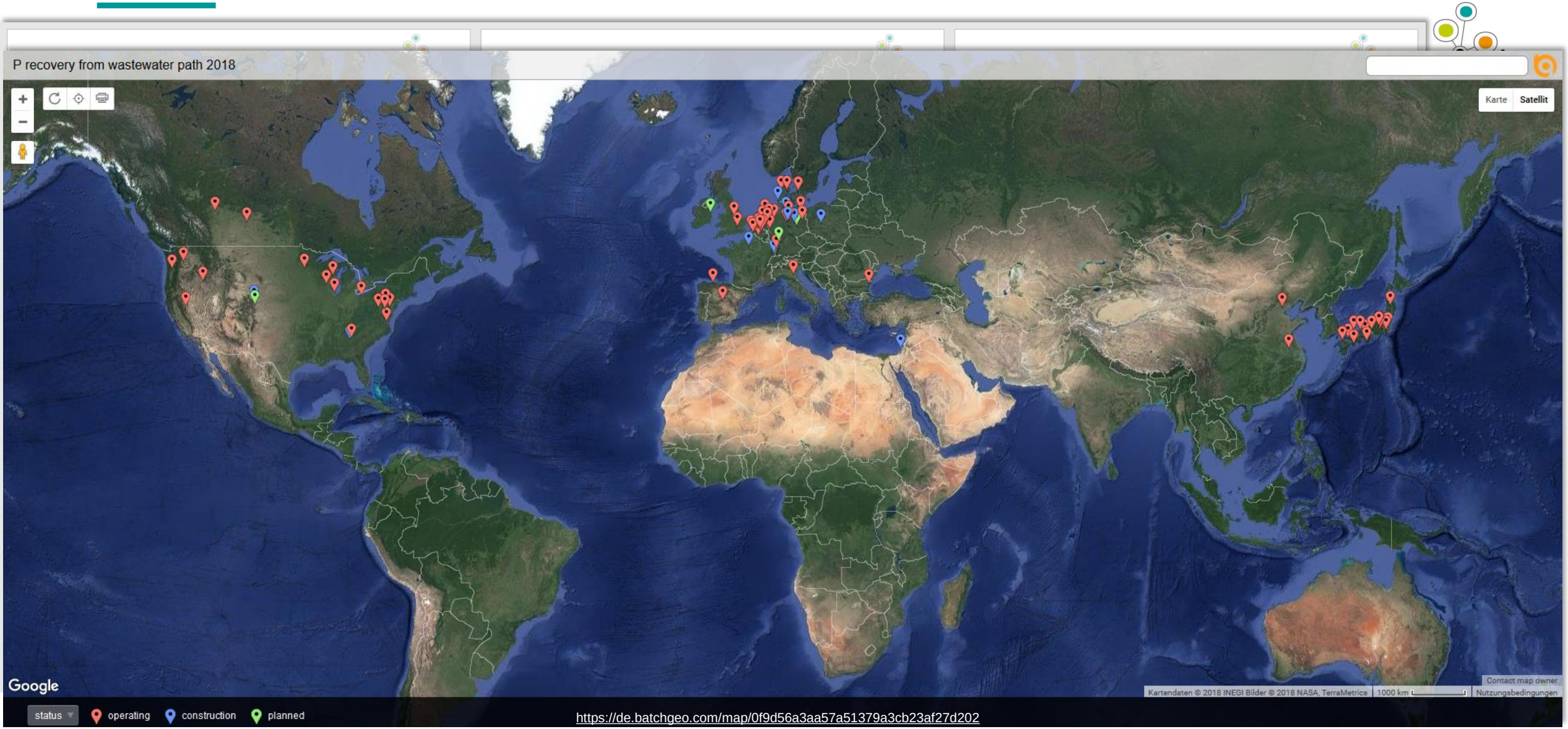
- Land appl. prohibited
- Co-incineration only for sludge with < 2%P
- Mono-incineration allowed without restriction, but P recovery from ash afterwards required

Priority for utilities:

- **Long term disposal security**
- Cost control
- Lowest financial risk

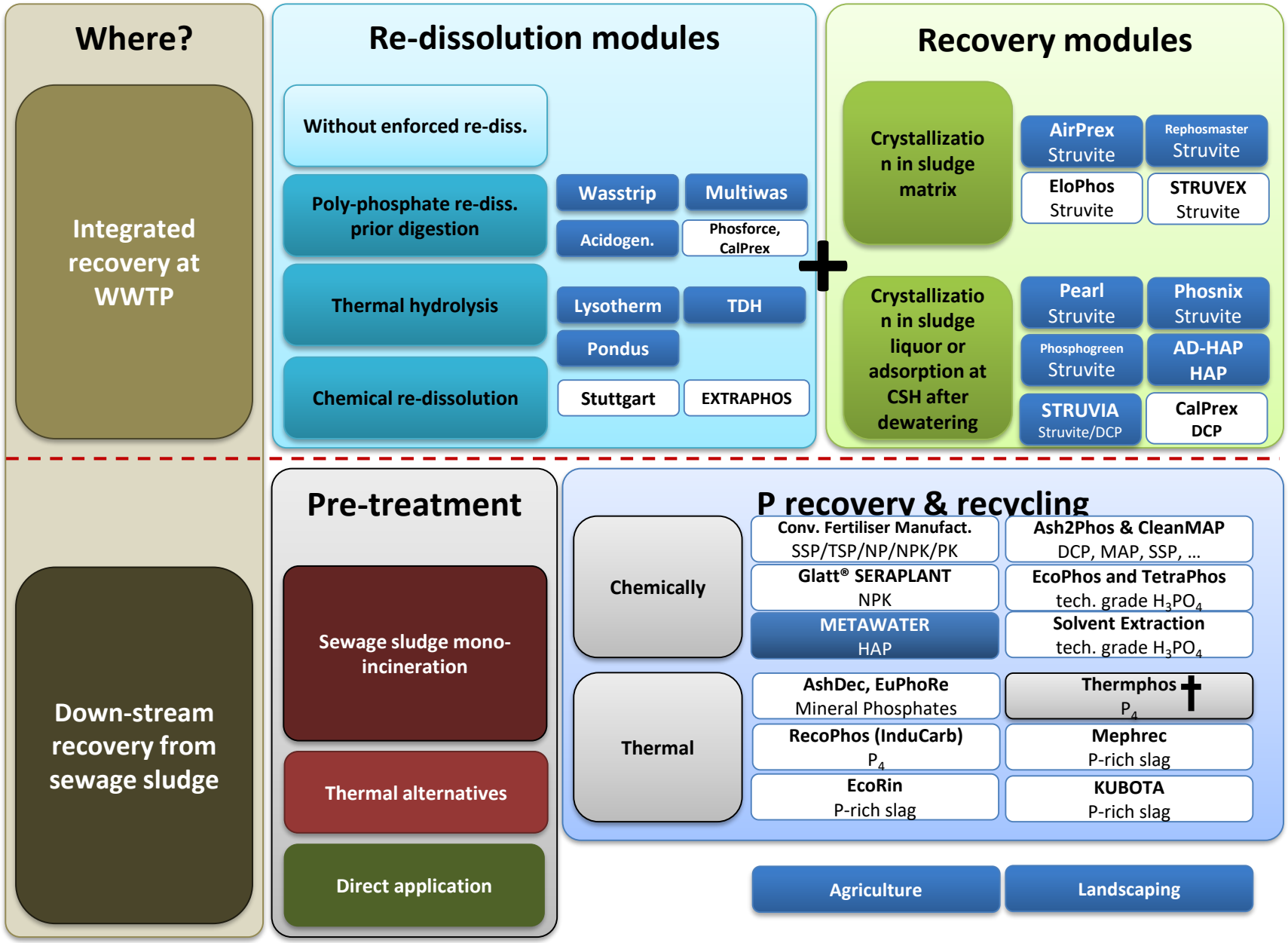


Global implementation – without law enforcement just to recover as such?



More than 100 full-scale plants operational world-wide! > 80 recover Struvite (> 60 are municipal)

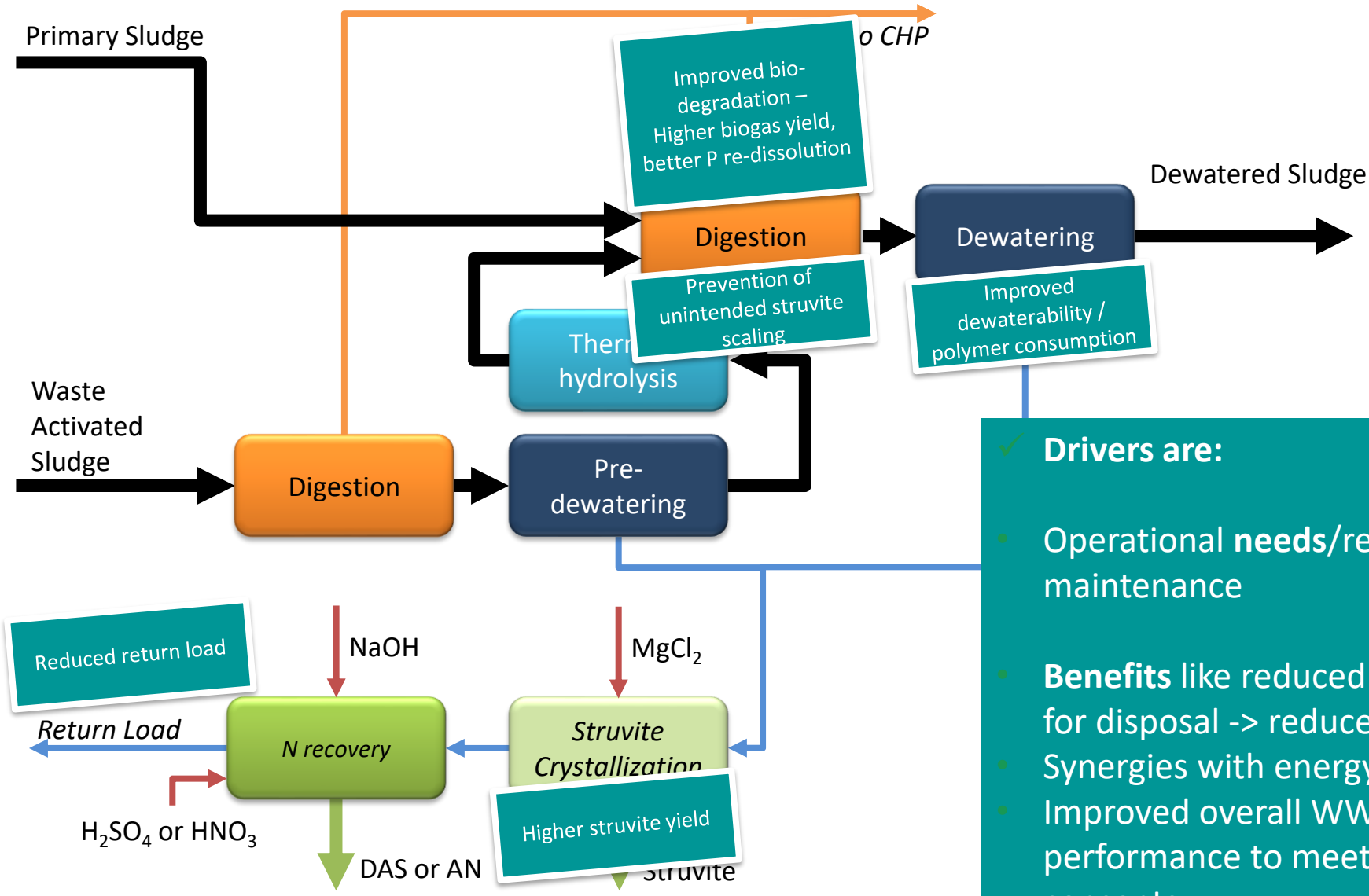
Availability of Solutions? … Yes! there are …



Amended from P-REX® and Kraus

Full-scale | Demo/Pilot

Nutrient Recovery Cascades for P & N + Energy are state of the art!



- **Drivers are:**
- Operational **needs**/reduced maintenance
- **Benefits** like reduced sludge volume for disposal -> reduced cost
- Synergies with energy recovery
- Improved overall WWTP performance to meet stricter P consents

Source: amended from Kraus 2016

Challenges and keys to Success and Sustainability?

Only technologies, yielding **homogenous products** or raw materials, **independent from input material quality** and mutually meeting both criteria, **energy efficiency** and **resource efficiency** will have a chance for wide-spread application under sustainability aspects.

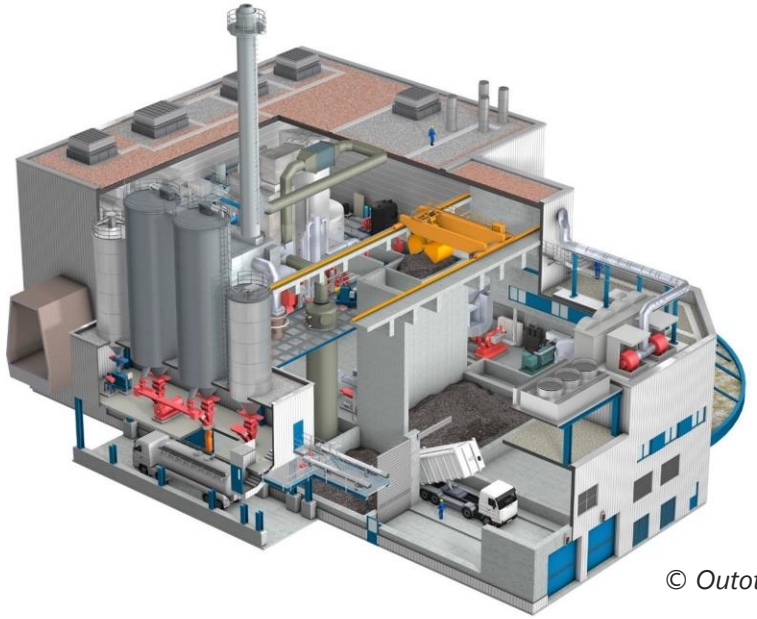
Keys:

- ✓ Heavy metal depletion (high quality products)
- ✓ Moderate energy (and chemicals) consumption (cost)
- ✓ Market for "known" recovered P (commercial products) (real value and price)

Germany 2017+ substantial increase of mono-incineration

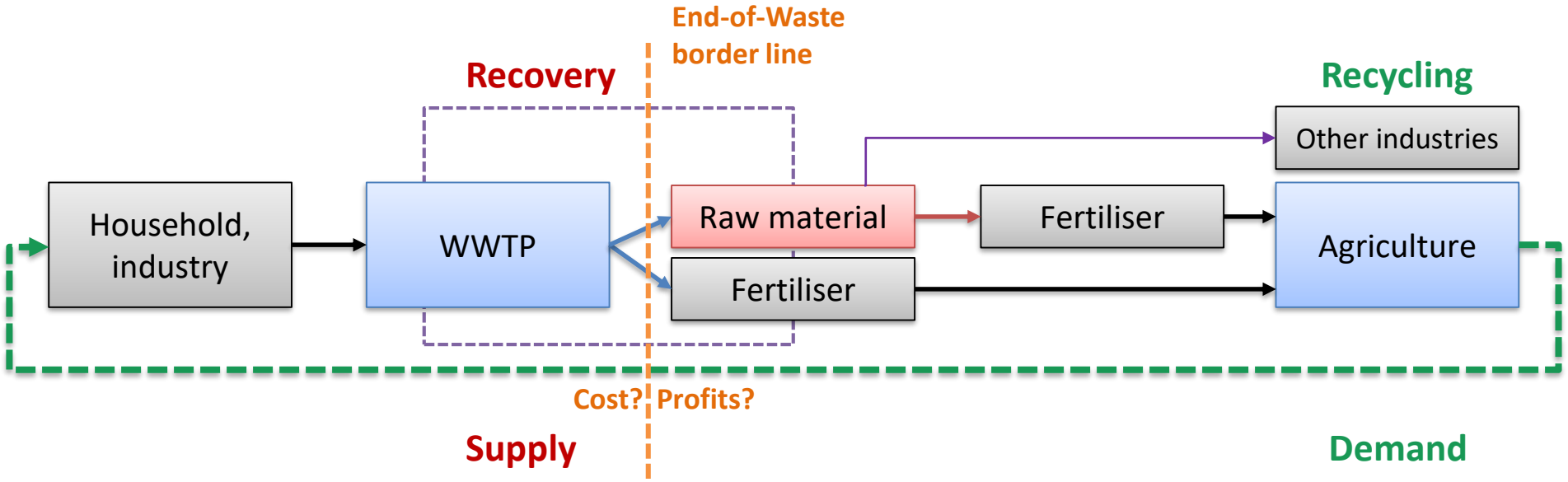
- Currently appr. 668 kt DS mono-incineration capacity 2017 (municipal sludge)
- After 2029/32 at least 1.200.000 Mg DS capacity needed to comply with sludge reg (Ecoprog 2017) … likely more
- Most new capacities between 2022 and 2027 (already +600 kt DS in prep. announced)

-> future SSA quantity > 500.000 Mg/a (>45.000 Mg P/a)



© Outotec

No Recycling without Value Chains



Waste, raw material or product? -> Question of volume, homogenity and <u>still</u> of origin!

Commodities

- Sludge – organic fertiliser
- Struvite – NP fertiliser with proven good fert. eff., very interesting for organic farming
- DCP – approved P fertiliser (component)
- Ash – generally barely plant available, rather raw material – processing needed
- MAP/DAP – main N&P components in fertiliser production (commodities)
- MGP / P_4 – commercial products with broad application (commodities)

(Biochar) – actually Pyrochar! No fertiliser!

Wisdom just written on paper will
be dust one day;
Only the wisdom applied will shape
our future!

Wrap-up & Outlook

- Shortage in legal sludge disposal capacities will remain until mid-to end-2020-ies
- Manure is key competitor for land application and farmers first choice!
- New German legislation fosters sludge mono-incineration and therefore drying as well -> co-incineration capacities declining … as capacities for imported sludge
- German sludge first, imported sludge not even second! Disposal cost already did and will raise substantially! Re-normalization not before 2030 expected!
- Site-by-site P recovery on-site WWTP needs to be linked with operational needs and benefits and will play a limited complementary role
- Ash-based route will become the major route for P recovery from sewage in Germany (>500.000 Mg SSA, > 45.000 Mg P) -> lowest risk for invest. and sludge disposal route
- Known materials easier to integrate in market! Recyclates need to fit into existing markets, not the other way around!

Thank you

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