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HTS cable market potential – a perspective from a tape supplier

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BASF New Business GmbH



BASF New Business

- Founded in 2001
- Reports directly to the Chief Technical Officer of BASF
- About 80 professionals worldwide (e.g. Boston, Fremont, Ludwigshafen, Hong Kong, Seoul, Tokyo)
- Team background: chemistry, business, biology, engineering etc.
- Build up business “beyond core” using Venture Capital and Start-up like structures

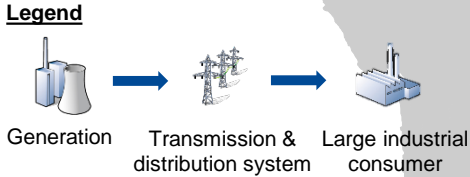
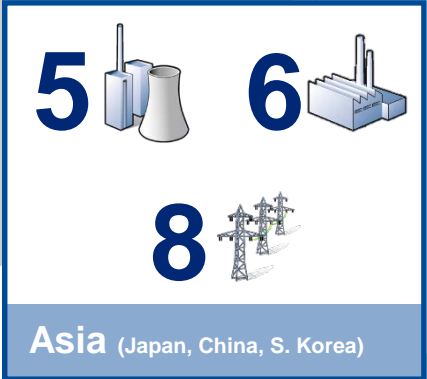
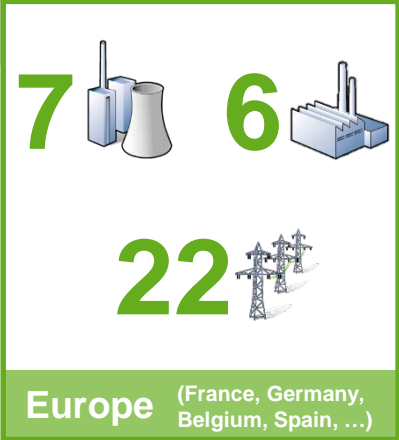
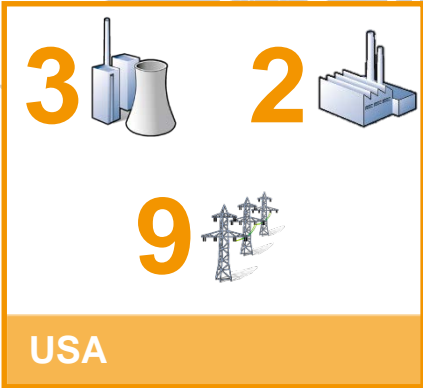
Introduction – the HTS cable market

Status quo:

- Market is not developing into a commercial direction as expected
 - ▶ ~10 cable projects over the last 13 years
 - ▶ Most of them have been demonstration projects (governmental, publicly funded)
 - ▶ No commercial projects finalized yet
 - ▶ Only few projects in the pipeline globally
- HTS cable system cost is an issue
 - ▶ Cost reduction of HTS tape is required but not sufficient to open the cable market
 - ▶ Other components need to reduce cost as well
 - ▶ Cost reduction requires development effort, investment and economy of scale

➤ **Is there a market need for HTS cables?**

Is there a market need for HTS cables? Interviews with ~70 companies



➤ Broad interview campaign over relevant regions and customers

Surprisingly homogeneous feedback along generation, utilities and end consumers

What are your **challenges**?

Decrease cost

Energy efficiency

Increasing consumption

Power supply safety

Integration of renewables

What **benefits** does HTS technology offer?

Space saving

Reduced losses

Increased capacity

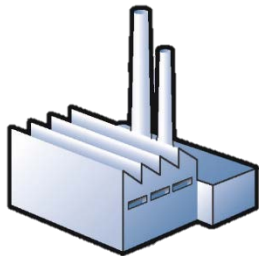
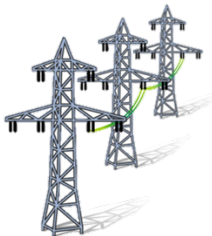
What are your **concerns** about superconducting technology?

Cost of HTS cables

**Cost & maintenance
of cooling system**

Reliability of HTS cable system

Customers see market need for HTS cable in selected areas



Generation
<p>No market need</p> <ul style="list-style-type: none"> ■ High investment cost for HTS seem to be an issue ■ No benefit seen ■ Very little interest

Transmission
<p>Niche potential for unique problems</p> <ul style="list-style-type: none"> ■ High investment and operating cost ■ Concern about cryogenic systems ■ Niche potential for unique problems

Distribution
<p>Potential in Megacities</p> <ul style="list-style-type: none"> ■ Growing demand in urban areas ■ HTS offers space saving ■ Projects are still experimental ■ Commercialization in 10-15 years

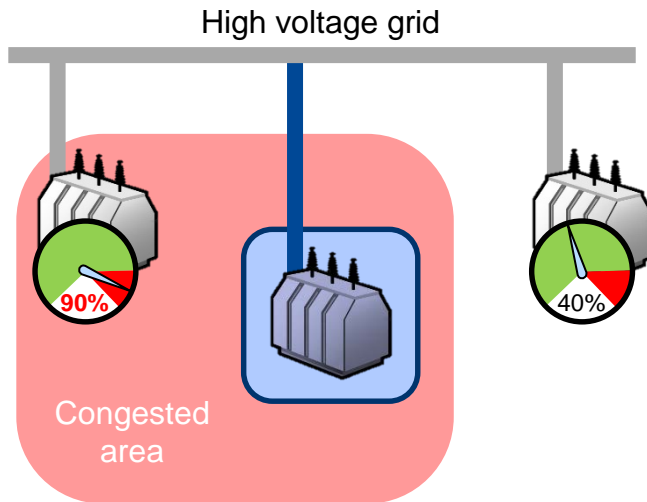
Large end consumer
<p>Niche potential only for large industrial consumers</p> <ul style="list-style-type: none"> ■ Increasing efficiency and decreasing cost of electricity ■ Customers are hardly aware of HTS ■ Short-term cost-benefit ratio important

HTS cables for Megacities

Use case: Demand growth in congested area

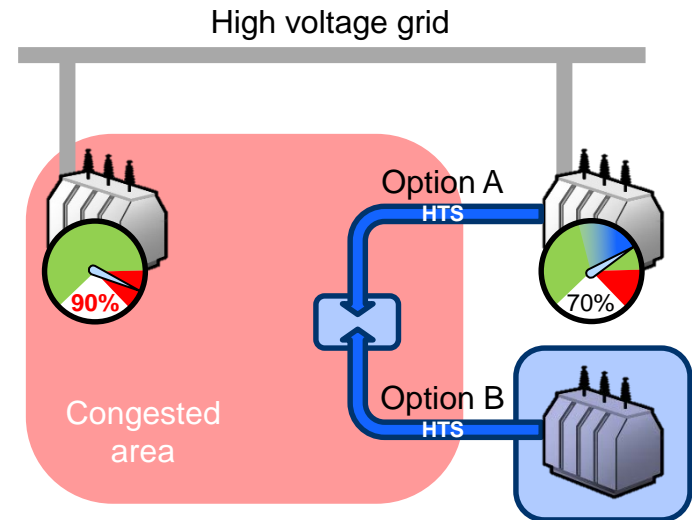
Conventional solution:

- Find space for new transformer station
- Install new high voltage transformer
- Lay new conventional high voltage cable



HTS solution:

- Find space for new switch gear station
- Lay new HTS medium voltage cable from:
 - A. Neighboring transformer with free capacity
 - B. New transformer station in suburb



HTS cables for Megacities

~40 Megacities (>10mio inhabitants) and ~200 large cities (>1mio inhabitants) globally

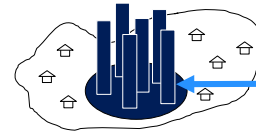
■ Megacities like Shanghai

- ▶ Large sky-scraper core
- ▶ Surrounded by dense urban area spreading out over city



■ “American” cities like Dallas

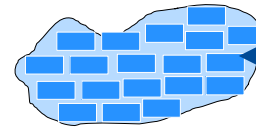
- ▶ Large sky-scraper core
- ▶ Surrounded by spacious housing



Up to 100.000 inhabitants / km²

■ Dense, flat cities like Barcelona

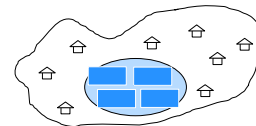
- ▶ Complete dense urban area
- ▶ Small/no sky-scraper core



> 10.000 inhabitants / km²

■ Spacious cities

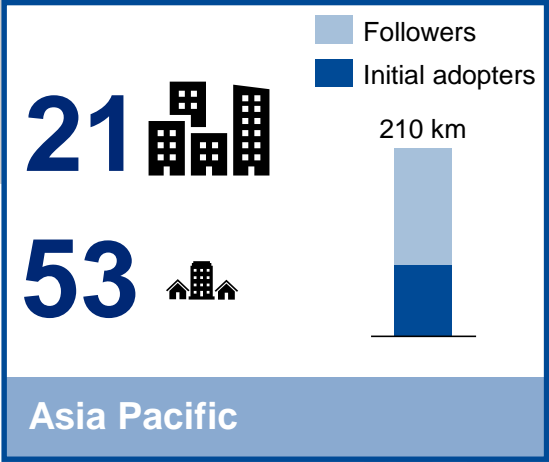
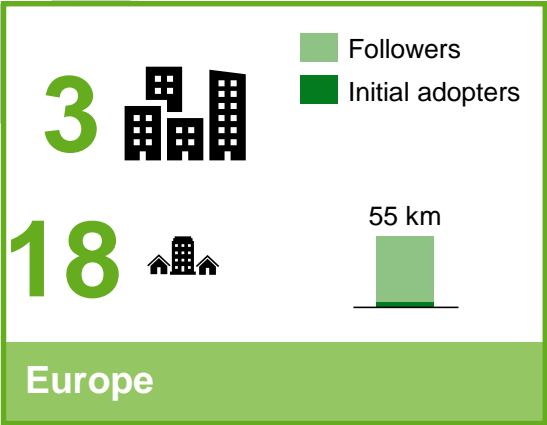
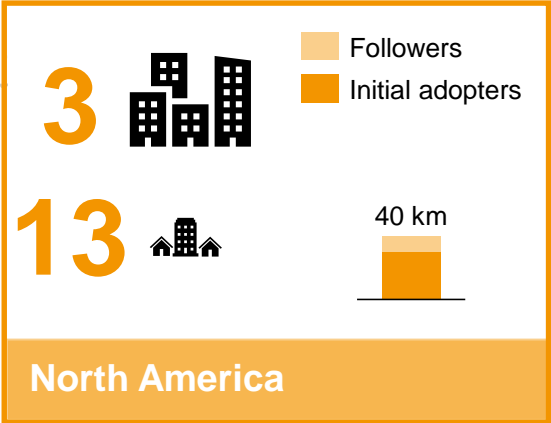
- ▶ Small dense urban core
- ▶ Surrounded by spacious housing





Legend:
Initial adopters
Followers

➤ Initial adopters of HTS cables are most likely densely populated city centers

Annual potential for HTS cables in megacities by 2035



 Megacity (>10mio inhabitants)
 Large city (>1mio inhabitants)

BASF-internal study
 Out of scope: South America, Africa, India, ...

Significant market potential for HTS cables in Megacities, but we need to overcome market hurdles

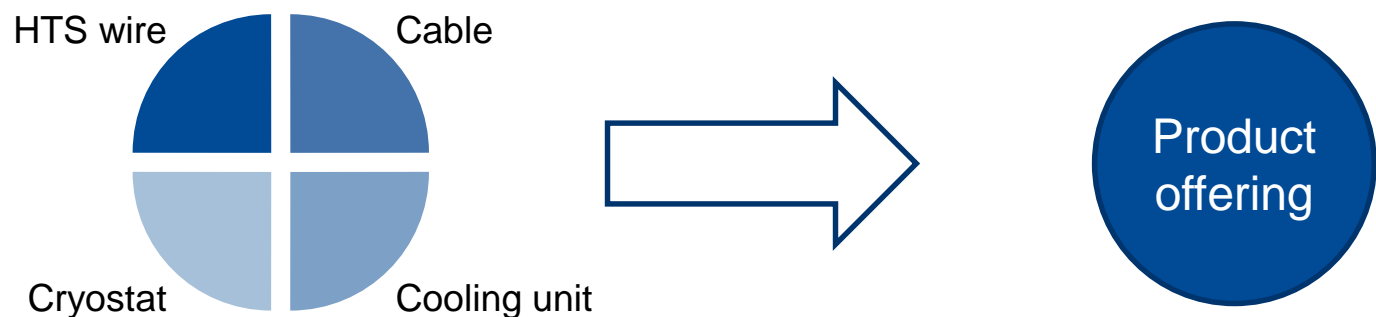
■ Potential for megacities

- ▶ Serving load growth with conventional technology is difficult in congested areas
- ▶ High capacity HTS underground cables serve unmet need
- ▶ Market potential of 1-1.5 billion euros seen until 2035

■ Market hurdles

- ▶ Cost is the main unknown for potential users and the main hurdle (CAPEX)
- ▶ Business model for operation of the HTS cable system is unclear (OPEX)
- ▶ Reliability and lifetime of HTS cables is a concern due to a lack of commercial projects

Our hypothesis: HTS component suppliers have to collaborate stronger



- **Bundling of expertise in system house required to develop the market**
 - ▶ Acquire customers actively: Show benefits and initiate projects
 - ▶ Serve customer need and offer complete turn-key systems including maintenance
 - ▶ Reduce cost to approach competitive system price (Total cost of ownership)



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