Willkommen
Welcome
Bienvenue

Empa
Materials Science and Technology

Aerogel based materials for building industry

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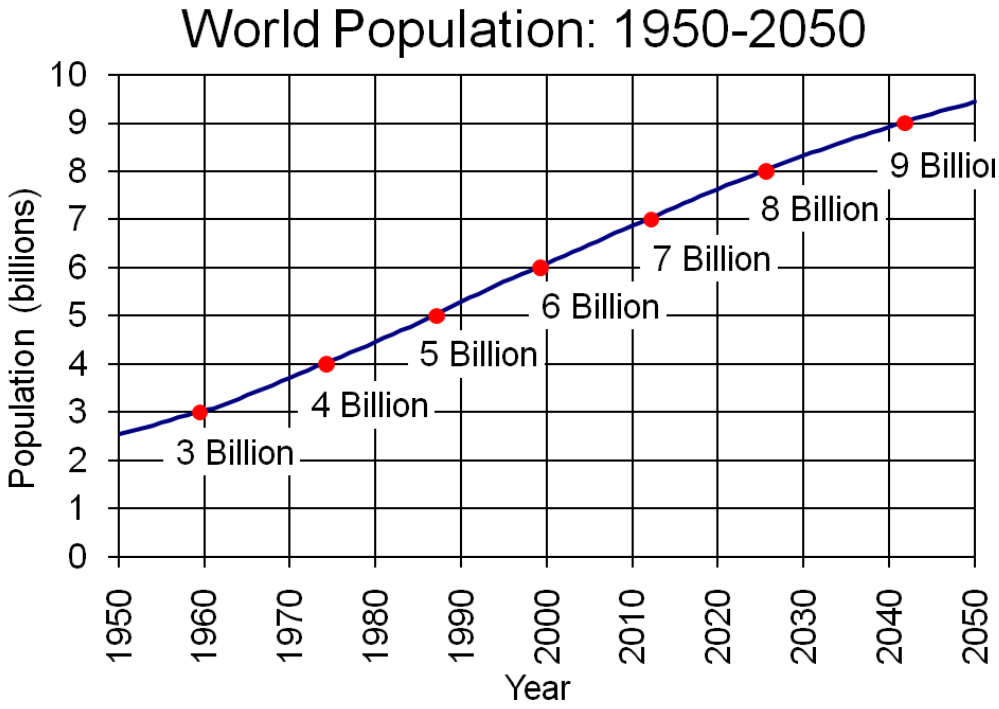
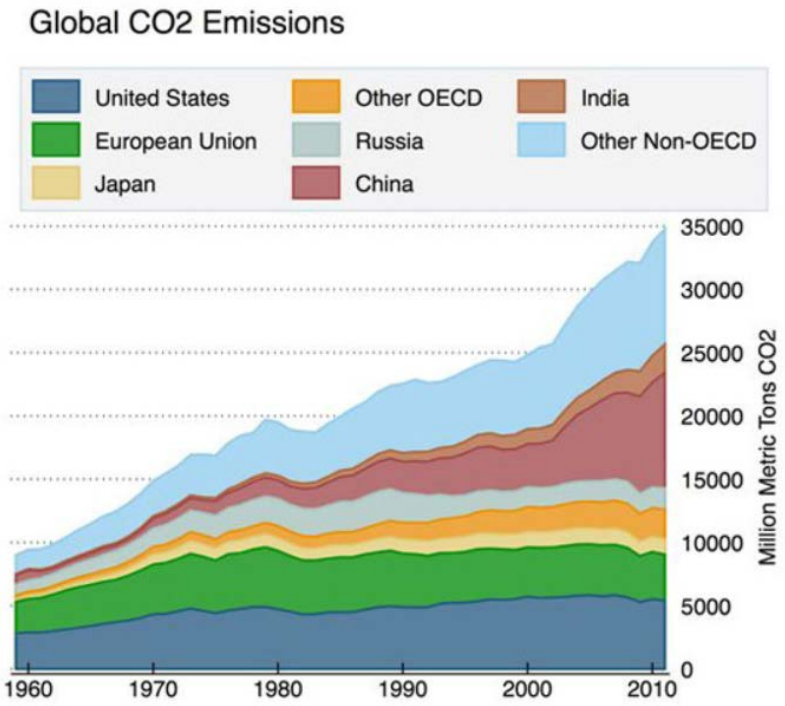
7.03. 2018, Bern, Switzerland

Building a sustainable future

World population/CO_2 emission

Building a sustainable future

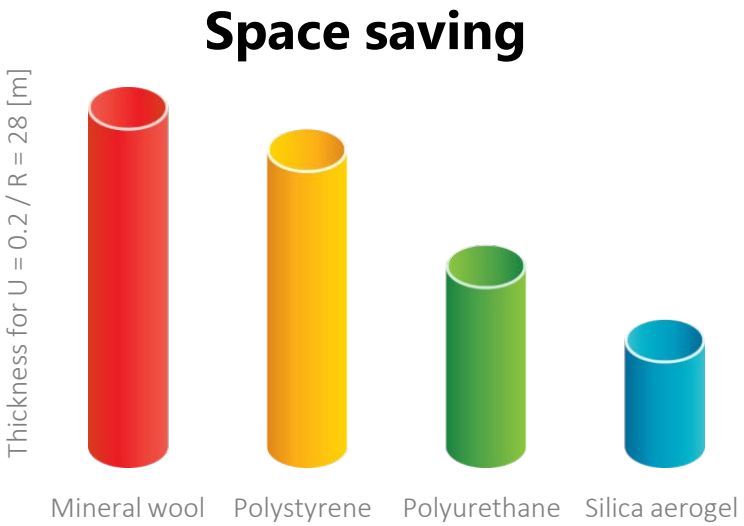


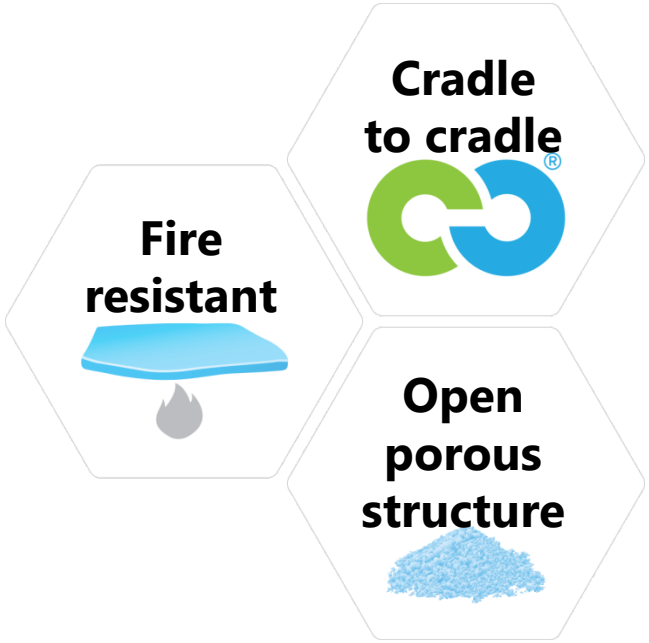


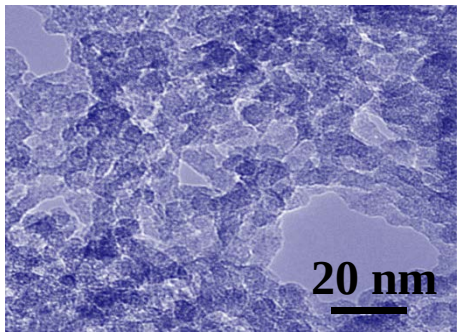
Source: U.S. Census Bureau, International Data Base, June 2011 Update.

Why aerogel insulation

Building a sustainable future







History of aerogels

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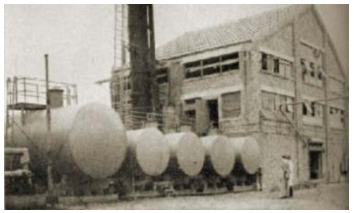
First Invention

Samuel Kistler

Monsanto



First Industrial production

Monsanto Chemicals

Alkoxide Aerogels

S. Teichner

1930 1940 1950 1960 1970 1980

Academic boom

~ 1200 articles RMF, PI, carbon, inorganic oxide aerogels etc.

Industrial rediscovery

Blankets, Granulate, boards, powders

1980 1990 2000 2010 2020

Aerogel products and markets

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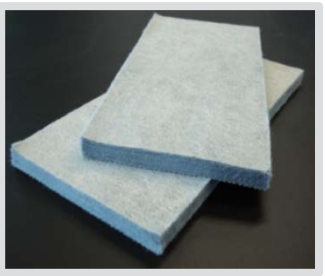
Products

Powders

Granulate

Blankets



Boards

Aerogel markets
CHF 265M in 2017, CAGR ~20%

Deap sea, oil&gas
160M (2017), 16% CAGR

Building insulation
20M (2017), 25% CAGR

Transportation
2.5M (2017), 45% CAGR

3 % market share
GAGR 24-27 %

Source: MarketsandMarkets
GLOBAL TRENDS & FORECASTS TO 2019

Synthesis of aerogel materials

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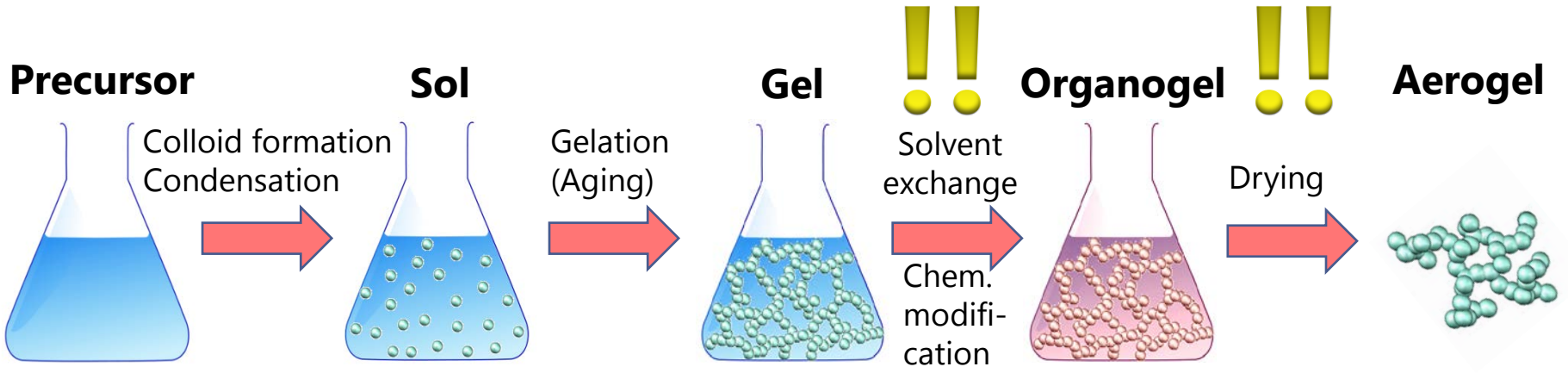

Challenges for manufacturing

- Raw materials cost
- Process complexity, solvent exchange
- Drying protocol

Our disruptive process

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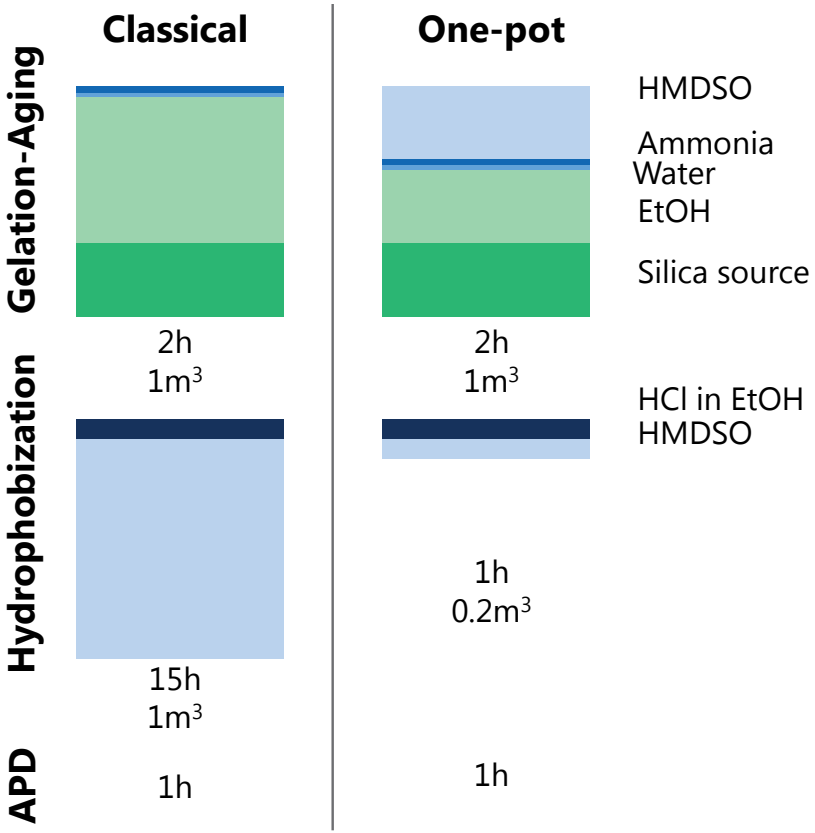
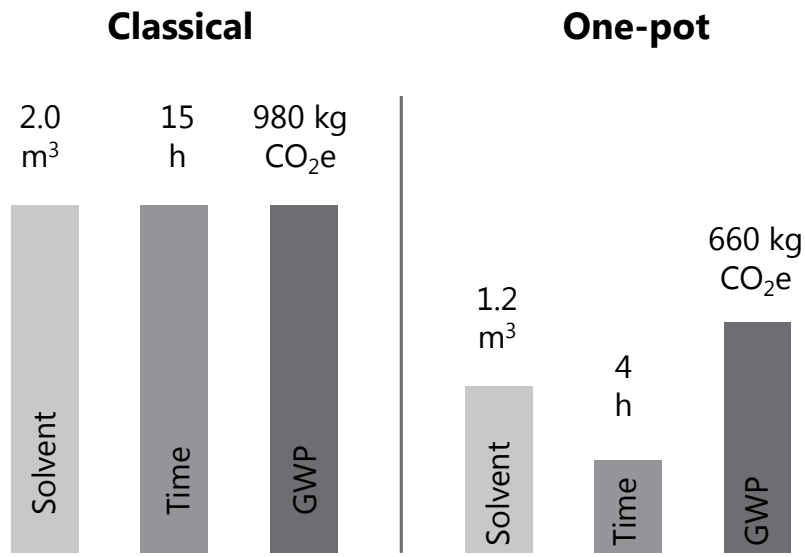
New minimal solvent APD process



Use of resources



Process upscale in Empa

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Granulate platform technology

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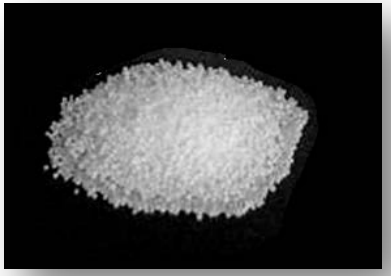
Silica source

Silica aerogel granulate

Aerogel insulation board

i) Raw materials → ii) Semifinished product → iii) Finished product



Polystyrene beads

Foamed polystyrene beads

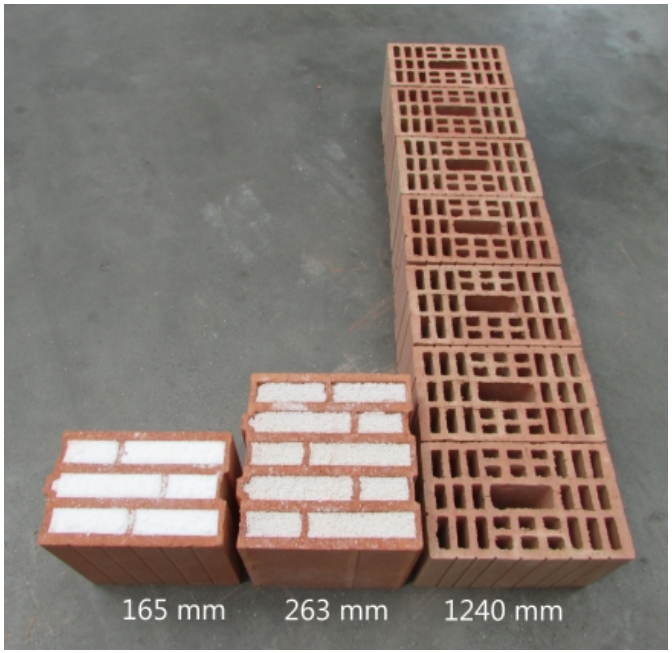
EPS insulation board

Fixit aerogel plaster

- Fixit 222 Aerogel is a high-performance mineral insulating plaster containing aerogel granulate
- Developed in collaboration with Empa

Empa aerobrick

A new type of brick filled with aerogel could make thin and highly insulating walls possible in the future – without any additional insulation layer!



https://doi.org/10.1016/j.egypro.2017.09.607

Application for aerogel insulation

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When there is “no” space:

- historic/listed buildings
- window reveals
- pipe/duct insulation
- roller shutter housing
- terraces
- dormer windows

Image: Emil Franov, Carbotech AG

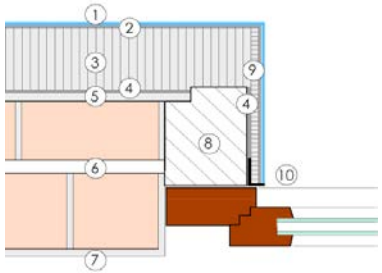

Image: AGITEC AG

Image: EVERTEC Solutions

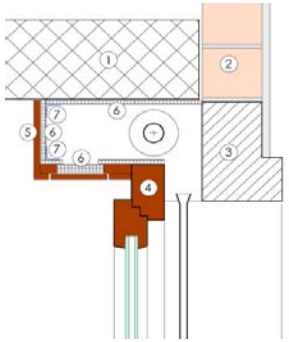

Image: AGITEC AG

Image: Alumat-Frey, Kaufbeuren

Image: ANKAWÜ - Eigenes Werk, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=19274854

Application of aerogel insulation

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When space is expensive:

- inner cities
- exclusive areas

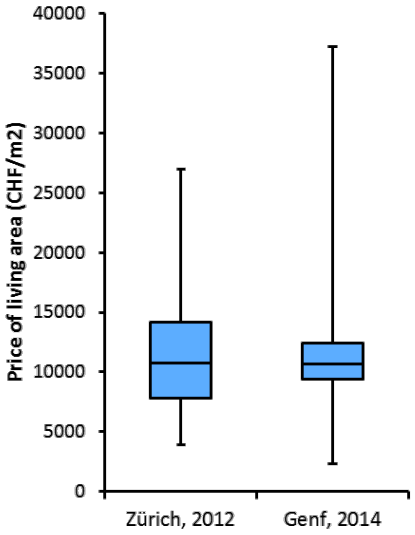
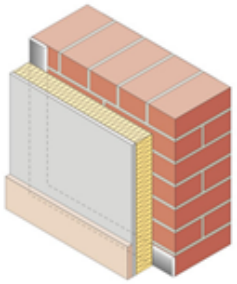


Image: Rita Palanikumar für Sweet Home (ZH Goldküste)

Image: zvg Stadt Zürich; Andrea Helbling

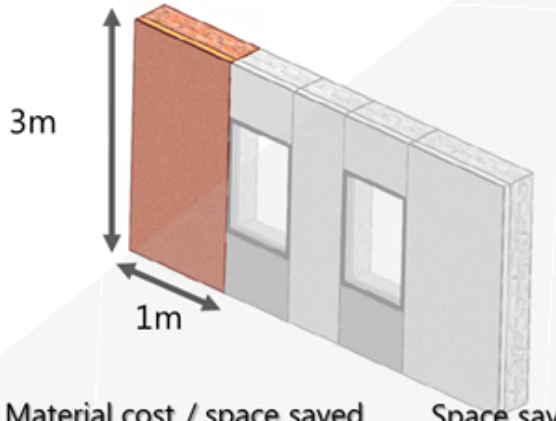
Economy of aerogel insulation

Design value wall:
U = 0.2 W/(m² K)



Brick wall 15cm
λ = 0.68 W/(m K)

Insulation material cost
vs. space savings (1m x 3m slab)



Insulation board	Insulation material price	Material cost / space saved	Space savings cost
XPS: λ = 30 mW/(m K) Thickness: 140mm	XPS: 100 CHF/m³	XPS: 0.42m³ / 42 CHF 0 m² savings	XPS: -
PUR/PIR: λ = 24 mW/(m K) Thickness: 115mm	PUR/PIR: 200 CHF/m³	PUR/PIR: 0.35m³ / 70 CHF 0.025 m² savings	PUR/PIR: 0 2800 CHF / m²
Aerogel: λ = 15 mW/(m K) Thickness: 72mm	Aerogel : 2500 CHF/m³	Aerogel : 0.22m³ / 550 CHF 0.068 m² savings	Aerogel 8000 CHF / m²

Demonstration project Hohlstrasse 100

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE

Kanton Zürich
Baudirektion

EK
Energiekonzepte AG

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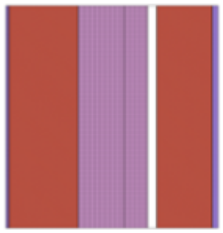
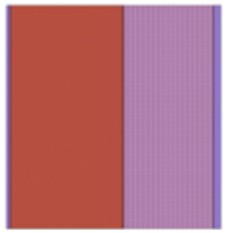
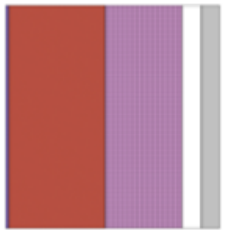
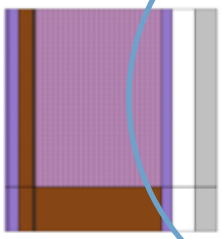
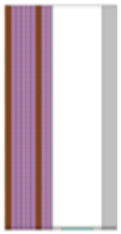
SCHWARZ | ARCHITEKTEN

INNOPLAN

GLASSX

Mehrschalen-MW mit Kerndämmung	Kompaktfassade mit Aussendämmung	Hinterlüftete Fassade	Holzelementbauweise	Fassadensystem Aerogel
				
46 cm	38 cm	44.5 cm	36.5 cm	24 cm

Including 80mm frame doubling (shutter blinds box)

Application examples

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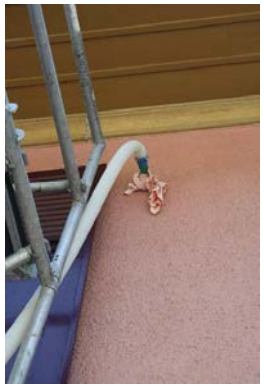


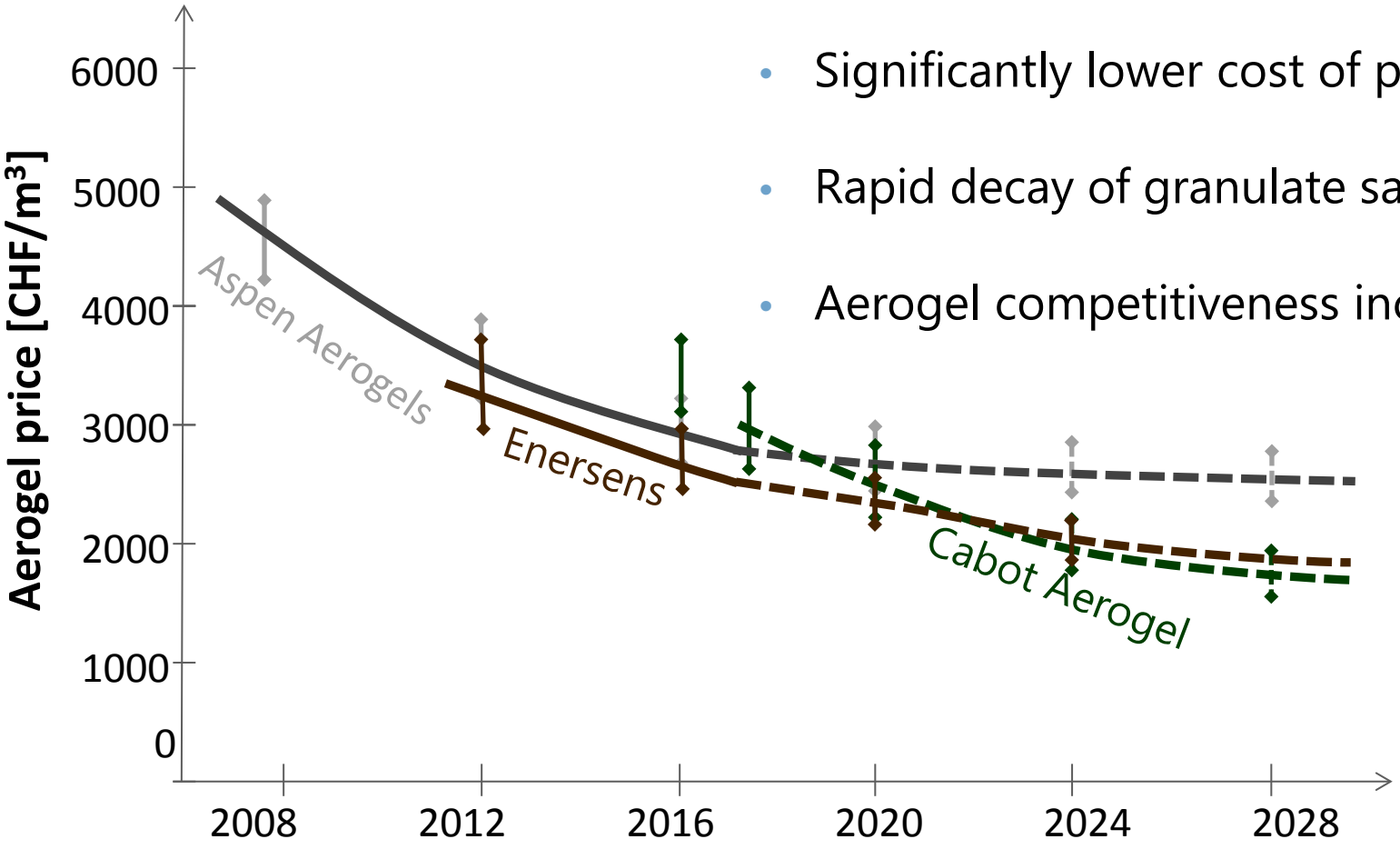



Overview aerogel products and applications: www.aerogelanwendungen.ch

Projected price development

New aerogel production technology should allow

- Significantly lower cost of production
- Rapid decay of granulate sales price
- Aerogel competitiveness increases



Conclusions

- Innovation in insulation has stopped
- Aerogels are great but still expensive
- Potential for 10-20% of insulation for aerogels if price is right
- One-pot ambient drying technology - large cost reduction potential
- Governmental and EU policies can contribute to an increase in the market demand
- Development of granulate based products necessary
  - Insulation materials: Boards, blankets
  - Building materials: Render, cement, sprayable, brick
  - Prefab elements: Cement, wood elements
- Need for demonstration objects

Vision nexAero

Building a sustainable future

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