

# The Linear Mirror

Physics&Art against CO<sub>2</sub>

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**UNIVERSITÀ  
DEGLI STUDI  
DI UDINE**  
hic sunt futura



SCIENCE IN THE CITY  
**FESTIVAL**  
TRIESTE 2020

[www.isomorph-production.it](http://www.isomorph-production.it)

# Motivation

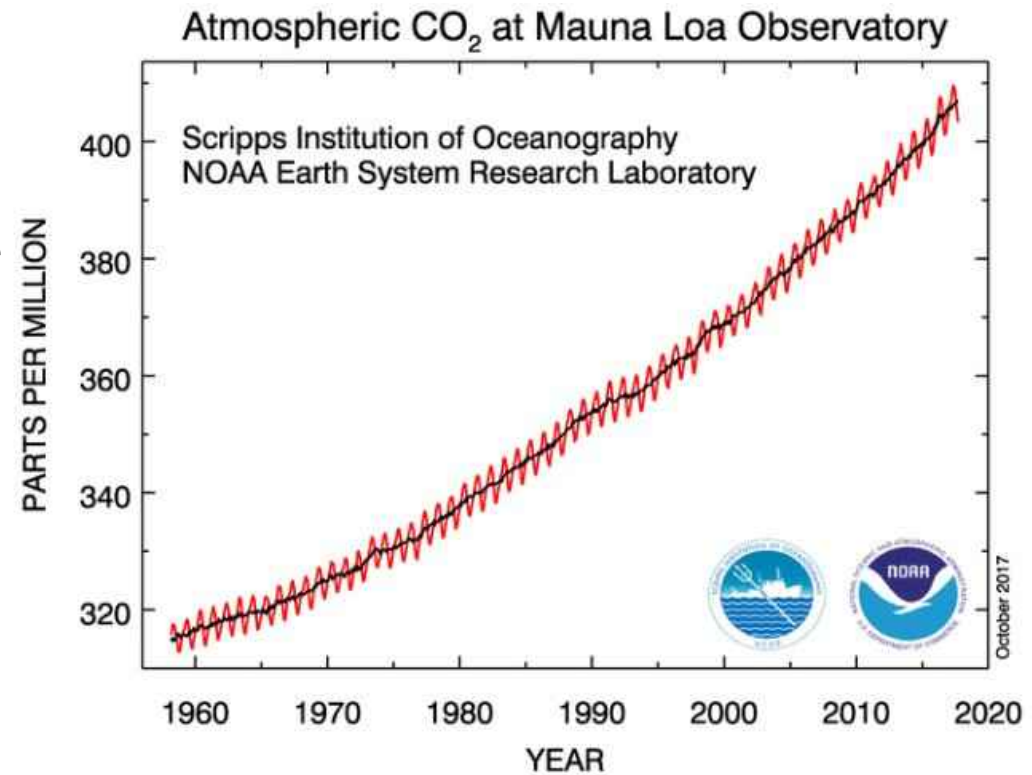
Already today, renewable energies provide a good part of electrical energy: photovoltaics, wind, water.

But only a few percent of heat energy come from renewable sources,

While instead our consumption of heat energy is larger than that of electrical energy.

=> in order to stop CO<sub>2</sub> increase,  
**New technologies for renewable heat energy are needed.**

Example:  
Helsinki Energy Challenge





A photograph of the Helsinki skyline at sunset. The water in the foreground reflects the warm orange and yellow light of the setting sun. Several buildings are visible, including a prominent modern building with a checkered facade. The sky is a mix of blue and orange.

# Helsinki Energy Challenge

The climate crisis is the most crucial challenge of our time, and cities have a key role in driving the shift to a low-carbon economy. Helsinki is one of the leading cities in the transition towards a sustainable future, with the goal of becoming carbon-neutral by 2035. But there is an issue to overcome. Currently, more than half of the city's heat is produced with coal. In order to achieve carbon-neutrality, we need radically new solutions to meet Helsinki's heat demand. And we are not alone. To fight climate change, sustainable heating solutions are needed in cities all over the world. Heating not just beyond coal, but also beyond burning biomass.

That is why we are launching the Helsinki Energy Challenge.

A global one-million-euro challenge competition to answer the question: How can we decarbonise the heating of Helsinki, using as little biomass as possible?

The organizers of the Helsinki Energy Challenge are right:

fundamentally new problems  
need fundamentally new solutions

And it is hard to imagine, how fundamentally new solutions  
should be found without physics.

Since the problem of global warming has been known for 50 years  
one should expect, that there are strong efforts in physics research for  
finding solutions.

As can be seen for instance from the program of ESOF2020, this is not  
the case.



Our society spends much money  
on weird technology.

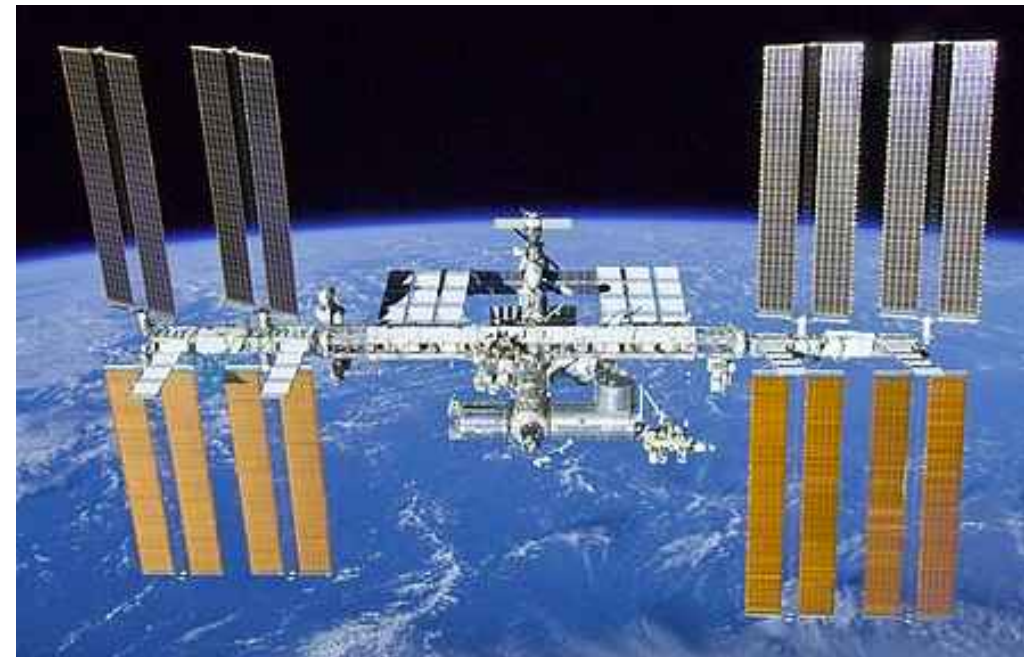
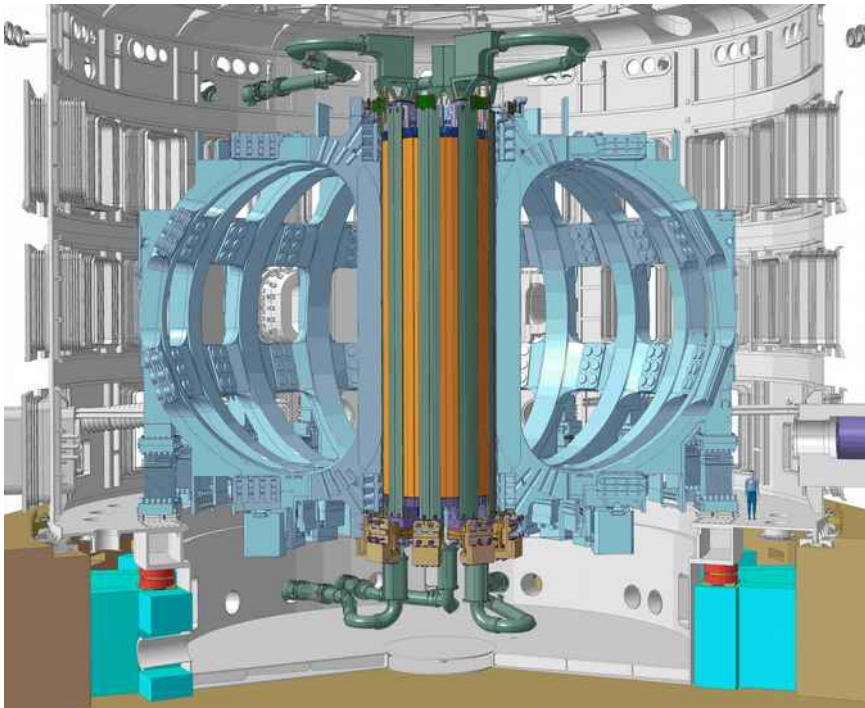
and for irrelevant projects.

But not for physics research



2.5 billion \$

20 billion €



160 billion \$

Also for solar energy a lot of money is being spent,  
**example Quarzazate**

2.67 billion €

But again for useless and weird  
technology:

- consumes 3 million tons of water per year
- creating humid air in desert:  
water is a green house gas,  
humid air over desert surface stops  
heat radiation from desert surface into  
universe.

Quarzazate makes only electricity, like  
photovoltaics, but is approximately  
5 times as expensive.




Quarzate was build by a big  company

which says on its web page, that it has trained local people to do simple physical work,

but it seems that there was no training or collaboration of local physicists or engineers.

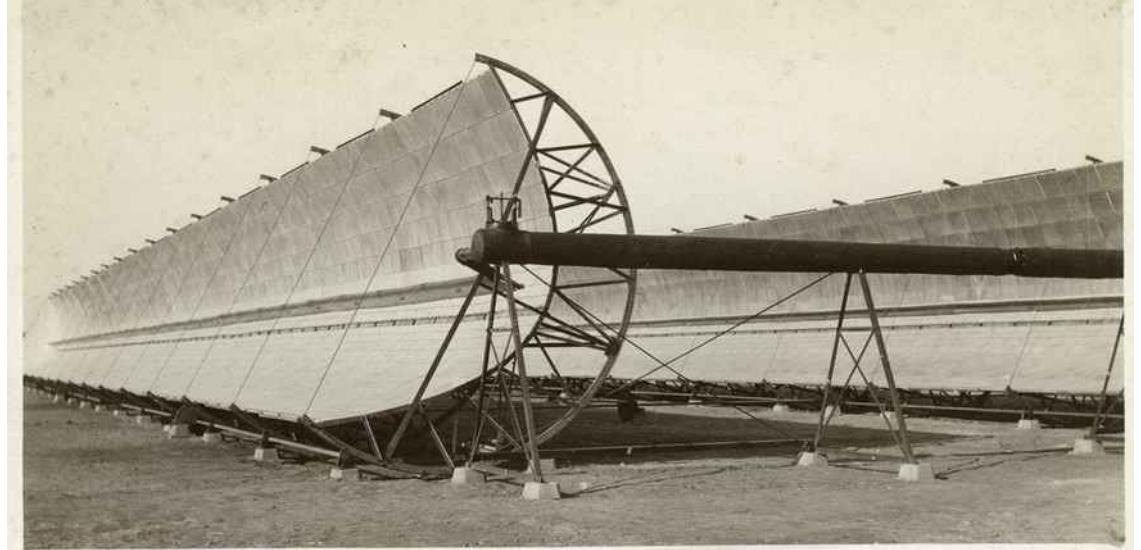
Therefore **Physics&Art against CO2** has created a collaboration with African physicists, too.

Yes, there are physicists in Africa, and they are very good and serious and the really want to do physics

If world bank and European Union would give only **1%** of the money they gave to the  company to our African colleagues and their students !

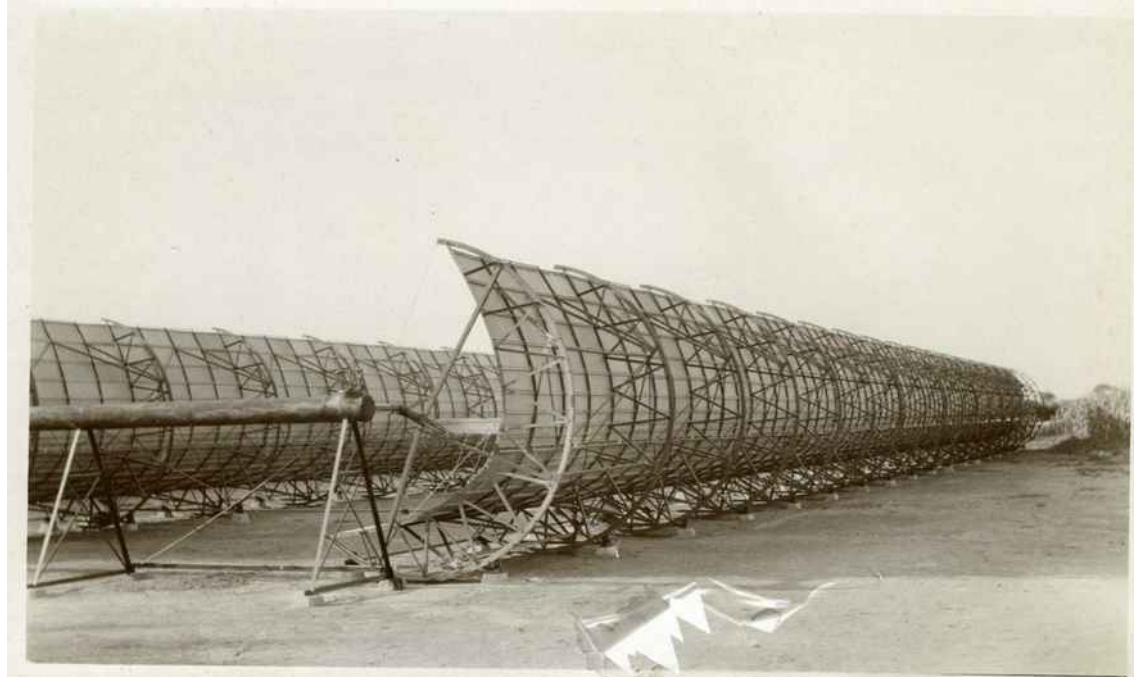


The technology used at Quarzazate in 2019  
was already used at Maadi, Egypt in 1912



In a functioning democratic  
society,  
television and newspapers  
should report about these  
things

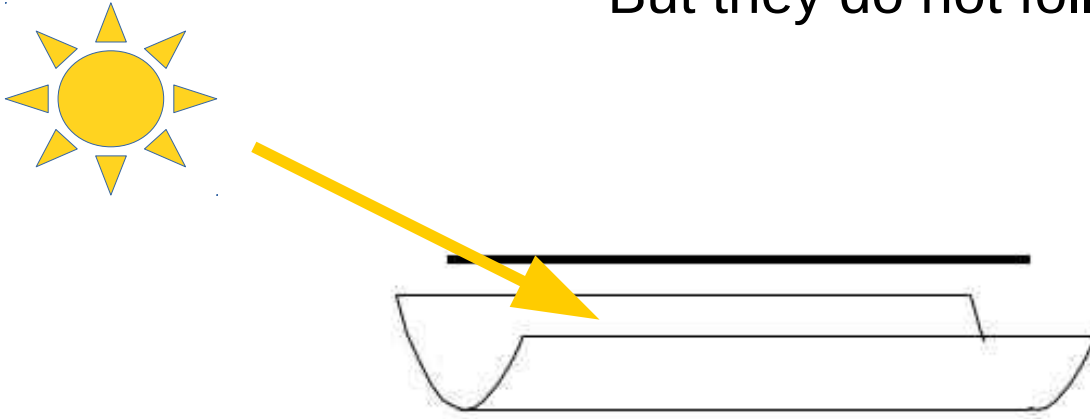
But they don't





From Google Maps you can see, that these parabolic trough are oriented towards south,  
So that they follow the sun in azimuth during the day.

But they do not follow the sun in Zenith



It is then evident, that north of Sicily for most of the year the sun shines on these troughs under a small angle. The device is efficient only in summer.

example: DD srl,  
Meret di Tomba (Udine)



# 2014 Caveja Nord srl (Udine, Ing.Causero) **Udine Solar** – intended investment **30 Millionen Euro**

chiesto in Regione la  
valutazione di  
impatto ambientale

La struttura è frutto  
di un brevetto  
del premio Nobel  
Carlo Rubbia

di Giacomina Pellizzari

Archiviata la discarica, a Modoletto (Cussignacco), il Consorzio dei cavaieri di ghiaccia "Caveja" punta su un impianto a concentrazione solare termodinamico denominato "Udine solare". Il progetto frutto di un brevetto del premio Nobel Carlo Rubbia, è stato presentato in Regione e in Comune per la Valutazione d'impatto ambientale (Via). L'obiettivo è produrre energia elettrica incamerando il calore del sole e riscaldare così gli edifici pubblici e privati di Udine Sud. L'investimento ammonta a 30 milioni di euro per un impianto destinato ad andare a esaurimento in 25 al massimo 30 anni. Il centrodestra, al quale la proprietà ha già illustrato il progetto, valuterà l'impatto con la cittadinanza nel corso di un'assemblea pubblica che organizzerà a breve.

Il progetto messo a punto dalla DD Srl di Mereto di Tomba partner di Caveja e fornitrice della tecnologia Csp (Concentrated solar power), prevede «l'utilizzo di specchi parabolici lineari in grado di inseguire la direzione del sole per focalizzare la radiazione solare su un tubo ricevitore posizionato lungo il fuoco della parabola. L'energia solare assorbita dal tubo ricevitore sarà trasferita a un fluido di lavoro (miscela di sali fusi). Il calore raccolto - si legge nella relazione - sarà utilizzato per la produzione del vapore che, a sua volta, alimenterà una turbina destinata alla produzione di energia elettrica. Parte del calore sarà stoccato in grandi serbatoi di accumulo, contenenti la stessa miscela salina, e utilizzato successivamente per la produzione di energia elettrica durante le ore di bassa o assente insolazione».

«Siamo in grado di coprire 224 mila metri quadrati di superficie e di eliminare 1.500 caldaie domestiche», spiega l'ingegner Mario Causero nel ricordare che questo sistema di teleriscaldamento contribuirà a ridurre l'inquinamento



## A CUSSIGNACCO

# Al posto della discarica una centrale solare

Il consorzio Caveja investe 30 milioni per realizzare il progetto a Modoletto  
L'obiettivo è produrre energia elettrica con un sistema di specchi parabolici

to da polveri sottili (Pm10) prodotto dalle caldaie domestiche. «L'accumulo del calore serve a compensare il giorno con la notte» aggiunge l'ingegnere nel ricordare che l'energia prodotta potrà essere venduta all'Enel, ma anche alla Ziu o alla Zau. Contatti per la stipula dei contratti sono in

corso con il Mercato ortofrutticolo. Si tratta di una tecnologia collaudata in Germania e in Austria dove l'acqua arriva nelle case a 80 gradi. E se per la casa singola l'adeguamento al nuovo impianto non è facilissimo, lo stesso non si può dire per i condomini che, una volta adeguati all'impianto di teleriscaldamento, risparmieranno

tutti i costi di gestione e di manutenzione delle caldaie. L'obiettivo sarà estendere il nuovo metodo di riscaldamento nel depuratore, nell'impianto di trattamento rifiuti Net, all'ex Cogelo e al canale. Ma anche al bocciodromo e agli impianti sportivi di Cussignacco.

«L'impatto ambientale non esiste - sottolinea l'architetto Luciano Snider -, visto che l'impianto non modifica il terreno che resterà coltivato a prato. I pannelli, infatti, saranno installati a un metro e mezzo da terra e quando l'impianto sarà esaurito, si smontano senza creare alcun problema».

Il progetto sta facendo discutere favorevolmente anche se a palazzo D'Aronco sono in corso alcuni approfondimenti urbanistici per capire se un'area verde può essere trasformata in una centrale di produzione di energia elettrica.

ESPRESSO/COMPTON

**L'INTERROGAZIONE**

**Della Rossa: un forno nel cimitero di Paderno**



«Installiamo un forno crematorio anche nel cimitero di Paderno». Ad avanzare la proposta è il vice presidente del consiglio comunale, Franco Della Rossa, preoccupato per i disagi che stanno provocando alle famiglie dei defunti le continue interruzioni dell'impianto installato, nel 1992, nel cimitero di San Vito. Allo stesso modo, Della Rossa, sollecita la realizzazione di una decina di obitori sempre nel camposanto di Paderno. Il vice presidente del consiglio comunale ha presentato un'interrogazione per chiedere al sindaco, Furio Honselli, l'illustrazione degli investimenti dedicati ai cimiteri

cittadini. «Considerate le continue sospensioni del servizio e i costosi interventi effettuati finora per garantire la manutenzione ordinaria e straordinaria dell'impianto di cremazione, valutiamo se realizzare nuovi obitori e un altro forno nel cimitero di Paderno dove, negli anni scorsi, è stata inaugurata la sala per le cerimonie religiose e laiche» insiste Della Rossa nell'evidenziare che, da tempo, molte famiglie per evitare di rimanere in coda sono costrette a rivolgersi altrove. Anche fuori provincia. Non va dimenticato, infatti, che sempre più persone decidono di farsi cremare.



FINO AL 30% DI SCONTO SU  
TUTTA LA GAMMA BMW Km/0

MessaggeroVeneto



The Udine solar plant would have used liquid salt (C.Rubia)

=> absorber and circuit must always remain above 350 °C  
in order to keep salt liquid

=> when there is no sun, it must be heated by a big gas flame.

The plant would be fully efficient only during lunch time in summer  
For the arguments explained above

And as confirmed by the results from the pilot plant of DD srl (private  
communication, never published)

This kind of plant was suggested for many years by ENEA



When we told Ing.Causero about these technical details, he gave up on the project, avoiding a loss of 30 million €.

14 plants like this were planned in Italy until Feb. 2020 when the lobby group pushing for them finally dissolved



Sole24ore  
3. Feb.2020

**Sole24ore** did not report about the technical impossibility of this nonsense technology,  
pushed by public administration for many years  
(and finally built at Quarzazate)  
quite in contrary:

>> Il settore industriale del solare termodinamico in Italia è morto ancora in fasce, senza essere riuscito a costruire nemmeno una centrale, ucciso ancora bambino da politici assetati di consenso, da comitati nimby del no-a-tutto, da funzionari pubblici corrivi, da norme contraddittorie e tardive, da piani energetici, climatici e ambientali pieni di verbi coniugati nel modo condizionale del periodo ipotetico dell'irrealtà.<<

Texts like this are the cultural equivalent of burning down the library of Alexandria.

So we again see, that physics cannot be done in a society without culture.

=> a solar plant should not be installed in the horizontal plane or it should follow the sun in two directions

For example heliostat field: follow sun in two directions



But now a different problem shows up:  
2 motors for each mirror => expensive

All of these megatechnology projects are free of new ideas and therefore free of physics

Maybe it is true, that who understands only about physics does not understand anything about physics?

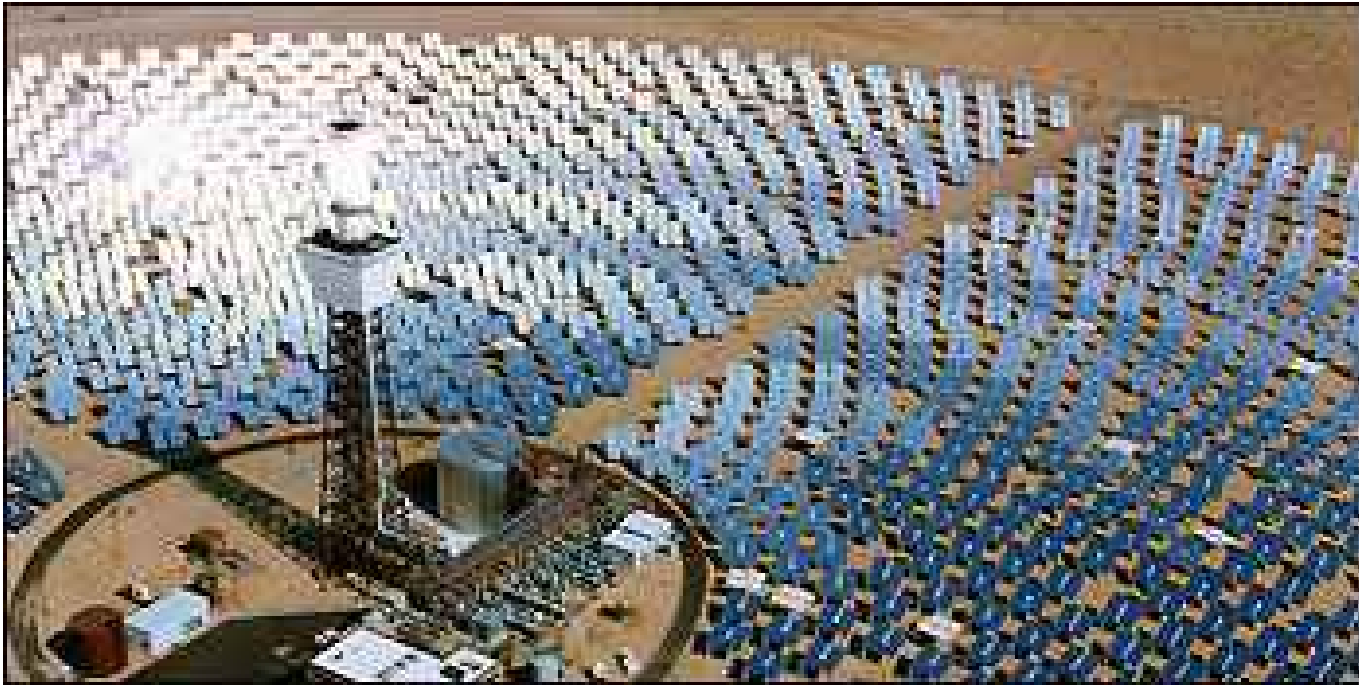


What happens, if you do physics in its natural habitat, as part of human culture - if you really do physics?



At ESOF it is allowed to ask this question, since ESOF is about the connection of science to society as confirmed by Prof.Fantoni at his presentation at our project on 31.7.2020.

For instance you would find, that heliostat fields are based on traditional information theory (Shannon, Turing, Microsoft, Apple...) where information is processed by algorithms, and since the position of each mirror is described by an gwo algorithm of its own, it must have two motors



And that present information theory is not a physics theory at all.



In nature there are no algorithms, and information processing is fundamentally concurrent or “parallel”

Zero pixel

Zero bit (described in library of Alexandria)







Valentin von Braitenberg

All physics information processing  
can be done with messages of finite length  
since the number of micro states of the Universe is finite

Therefore, from a theoretical point of view,  
Input and output can be connected through a look up table,  
Which is a particularly simple matrix

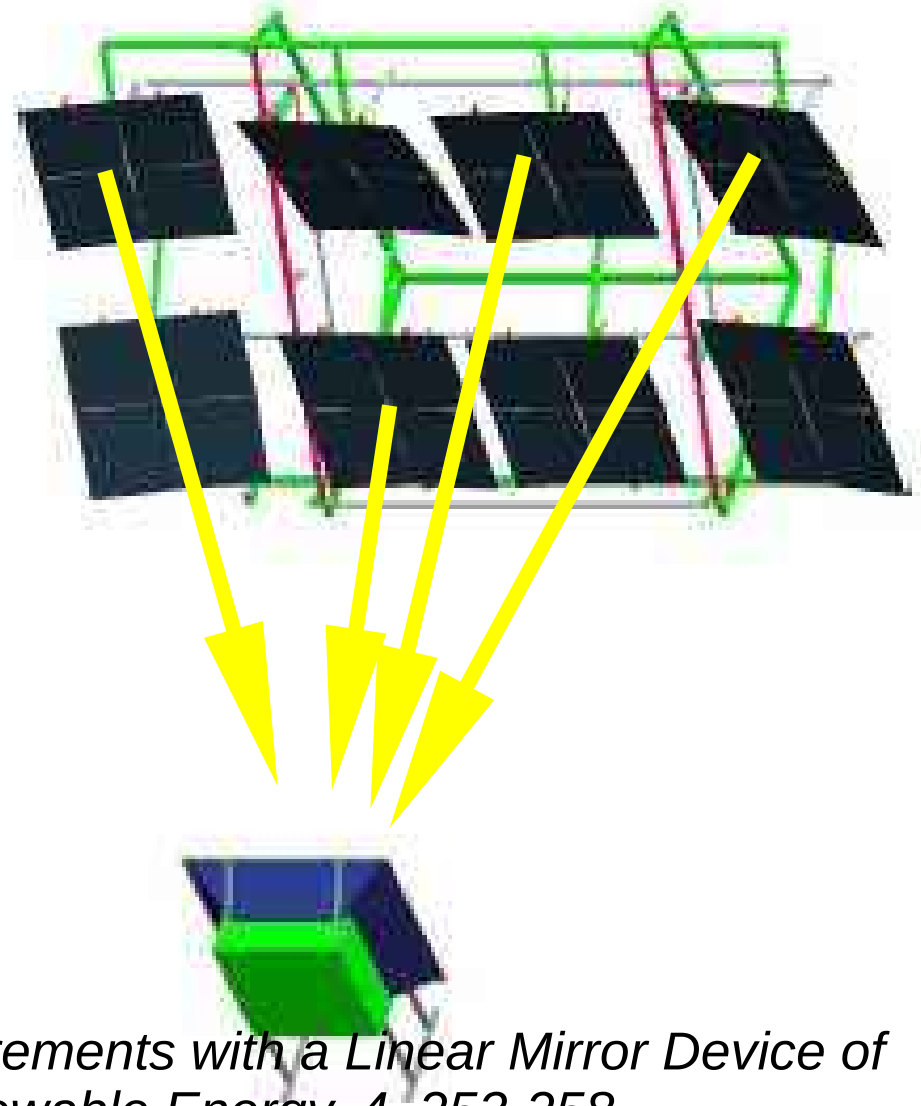
so all information processing can be made linear,  
and is inherently parallel

The practical question then becomes of how to implement this  
lookup table  
an algorithm can do this, but it is only one of many possibilities

# Also the Linear Mirror is a zero bit calculator

Its mirrors move concurrently,  
in principle they can be operated by only one motor (clock)  
For technical convenience 3 little motors are used (mean consumption 2 W)

Heat exchanger remains in  
fixed position



*Grassmann, H., et al. (2013) First Measurements with a Linear Mirror Device of Second Generation. Smart Grid and Renewable Energy, 4, 253-258*

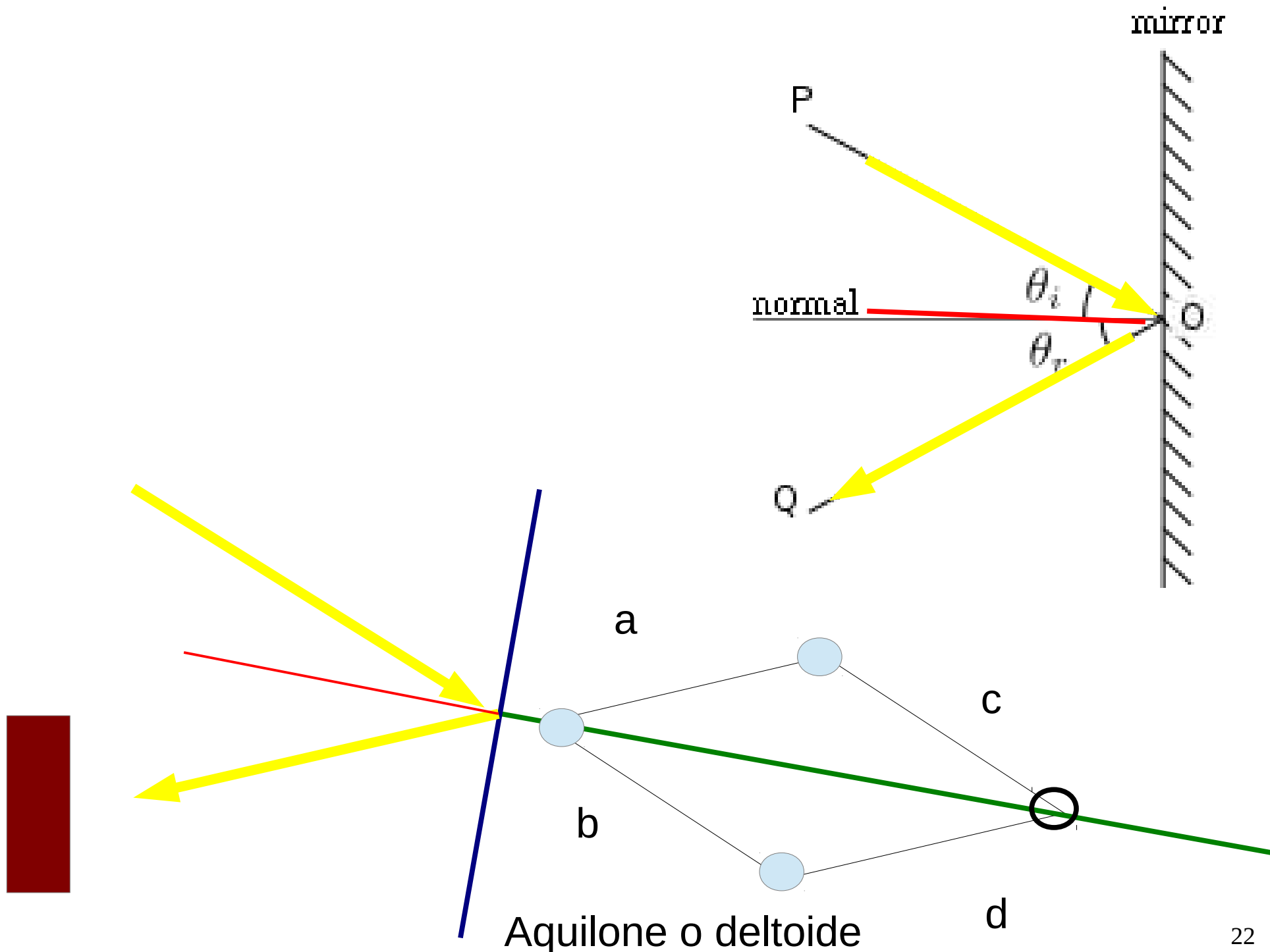


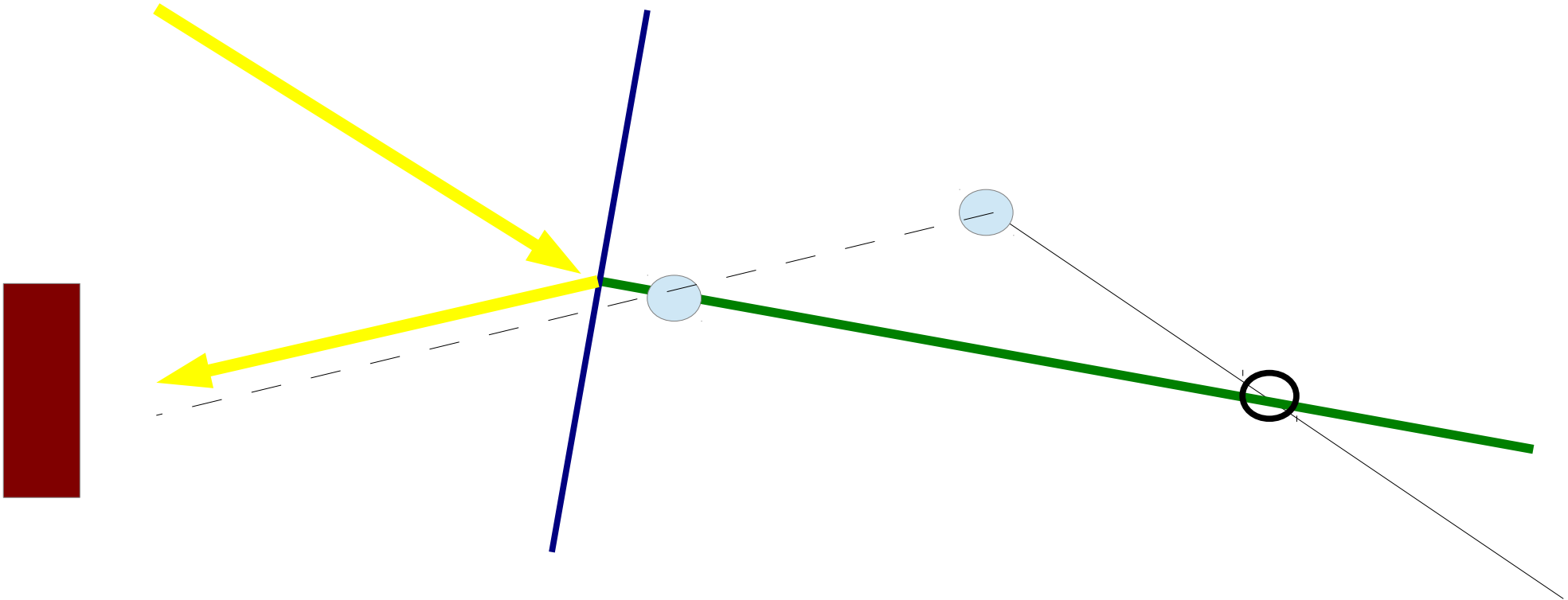
The Linear Mirror works well also north of the Alps



Germany (Puettlach)

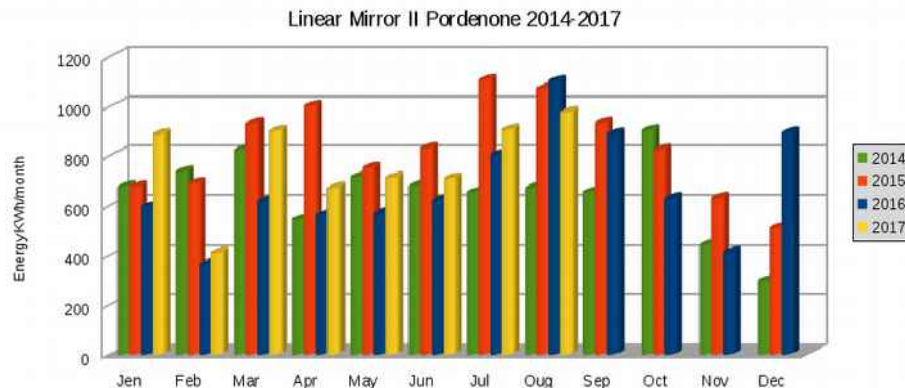
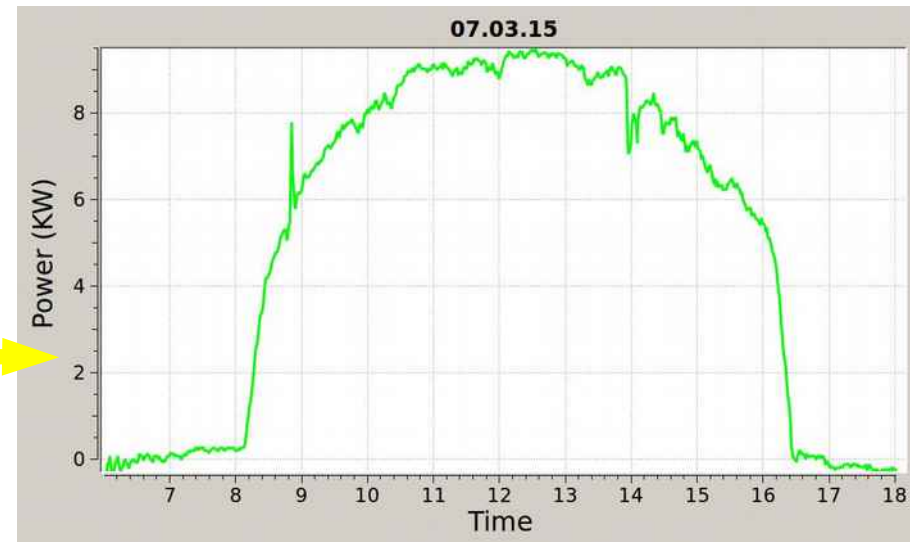
Certified industrial product: Solar Keymark







The first Linear Mirror was installed in 2014 at the hotel “Il Cavaliere” at Pordenone (Italy). The owner is very satisfied, the installation can be visited. Its performance has been published.



The installation has been working by now for 6 years, without problems, and can be visited.



# Economics

One Linear Mirror has up to 8 kW thermal power  
substitutes 1000 l of heating oil per year



Up to now we are producing single pieces  
In our workshop at Gorizia

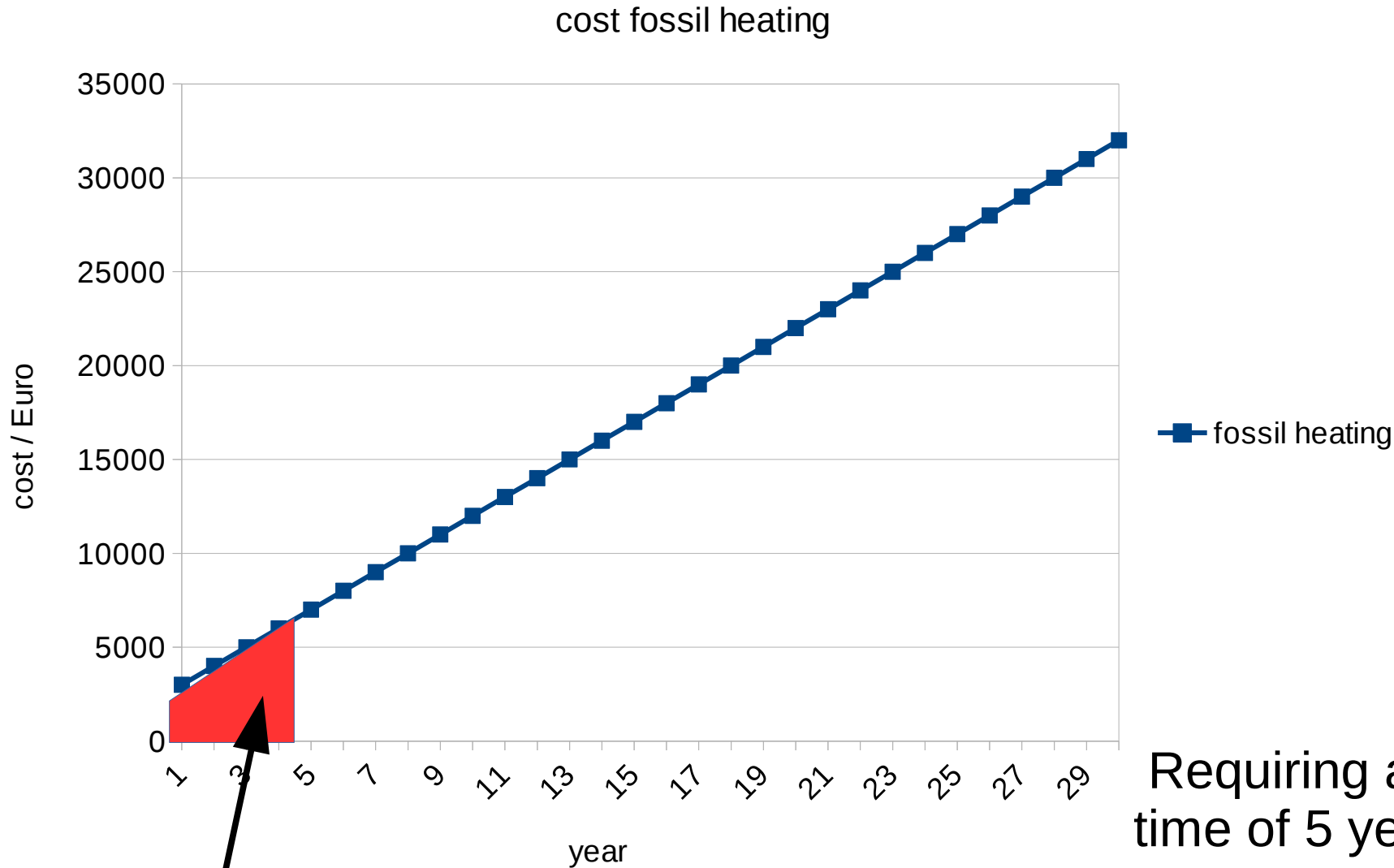
=> therefore still a price of **8.500 Euro** +tax, trasport, Installation

Future: industrial production, lower price.

When it comes to renewable energies, everybody requires that the installation must pay back within 5 to 7 years as if it were a car or a machining tool.

Nobody has ever made this requirement for a fossil heating system. the payback of a fossil heating system is equal to its live time, which is typically 30 years.

# Cost of an oil heating system over its live time of 30 years



Requirement of 5 year pay back time for renewable energy plant

Requiring a pay back time of 5 years amounts to saying, that renewable energy must be 5 times cheaper than fossil energy in order to be acceptable.

The Linear Mirror is made of hot galvanized steel and aluminum  
and it does not move more than a sun flower  
so it must have a very long life time.

Presumably with the help of experts (material science)  
a Linear Mirror with a life time of a few hundred years would be possible

For instance, one could drive it with a mechanical clockwork,  
Instead of electrical motors

In our cathedrals there are clocks which have been running for hundreds  
of years

So a totally new kind of economy becomes possible

Not based on continuous consumption and disposal

But based on physics, nature and art



1

B170603

TRADUZIONE DEL TESTO DEL BREVETTO EUROPEO N. 2 901 090

Disposizione di riflettori solari e procedimento per l'orientamento dei riflettori.

Isomorph S.r.l.,

con sede a Duino-Aurisina (Trieste)

\* \* \* \* \*

## D E S C R I Z I O N E

La presente invenzione si riferisce ad una disposizione di riflettori solari per la deviazione di raggi solari incidenti su un obiettivo comune, ad un supporto dei riflettori per una simile disposizione dei riflettori solari ed un corrispondente procedimento per la deviazione di raggi solari incidenti sull'obiettivo comune.

# High temperatures

In its standard version – Solar Keymark certified – the Linear Mirror heats water up to 100°C.



But the Linear Mirror can provide also much higher temperatures, As are required by many industrial application (process heat), also for solar cooling.

# Heat exchanger sun-air

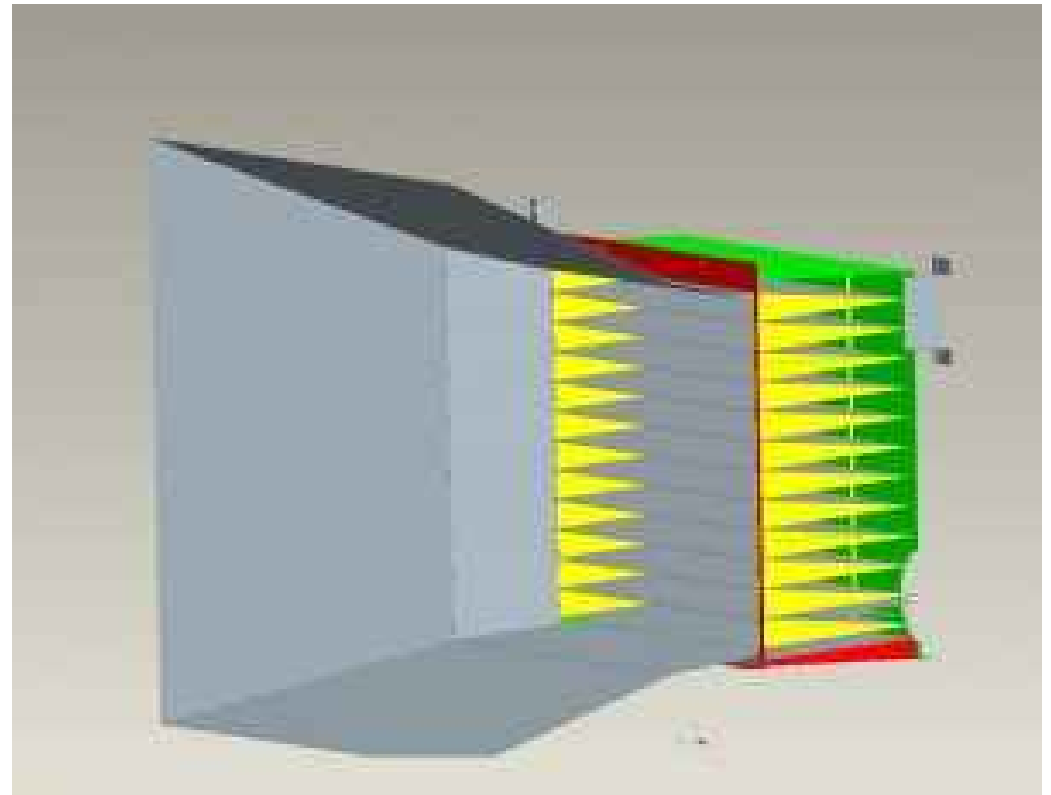
In order to make the provision of higher temperatures for industrial processes easy, we have developed a totally new kind of sun-air heat exchanger.

The selective surfaces of normal solar heat exchangers usually are not suited for high temperatures.

Therefore we have developed a new technique – an absorbing surface, which is selective not with respect to wavelength, but with respect to the spatial direction.

Described in:

*Development and Test of a New Solar-Air Heat Exchanger for the Linear Mirror II System, Hans Grassmann, Marco Citossi, Smart Grid and Renewable Energy, 2019, 10, 155-164*

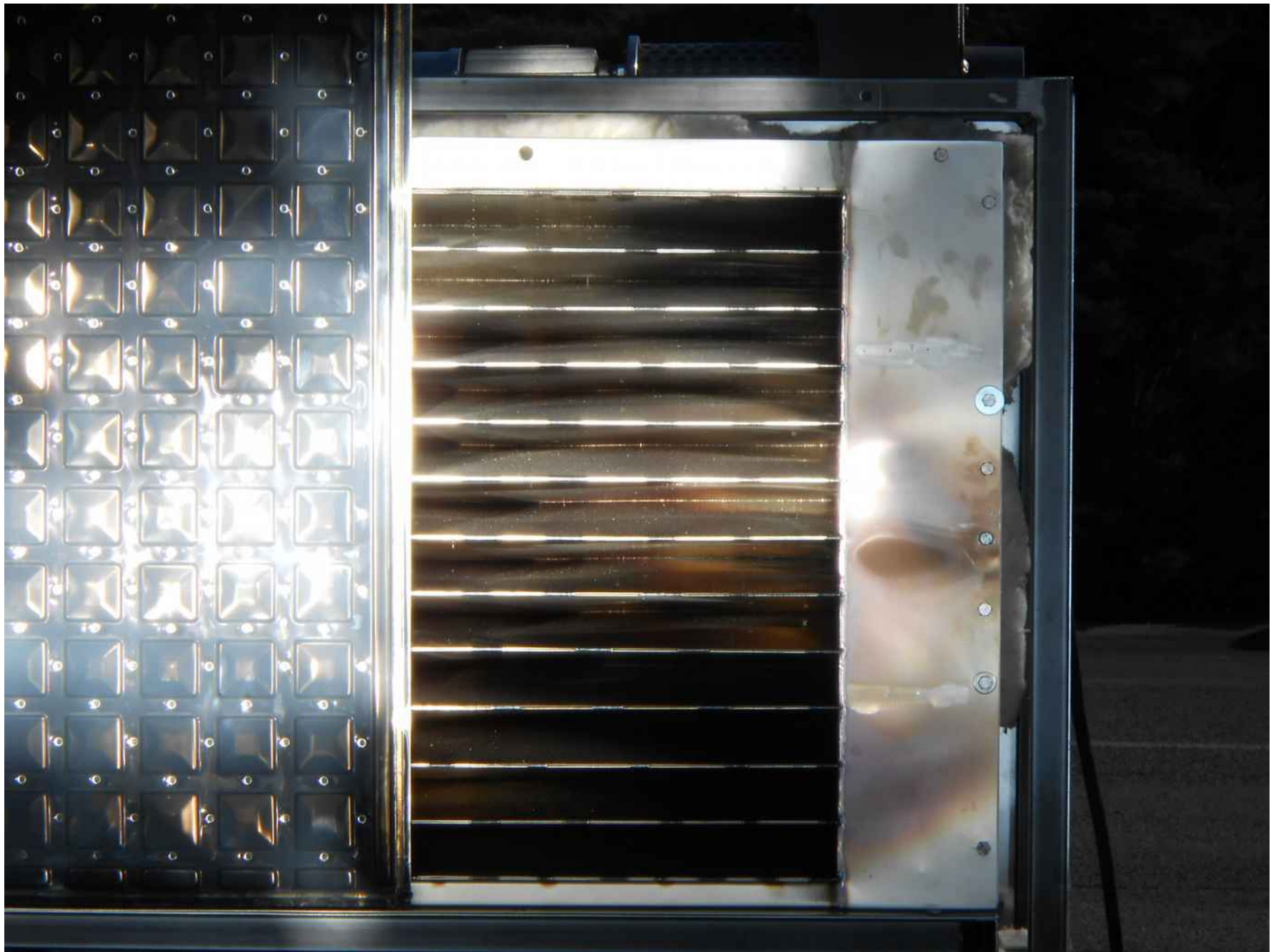


The surface of the absorber is made of polished steel.

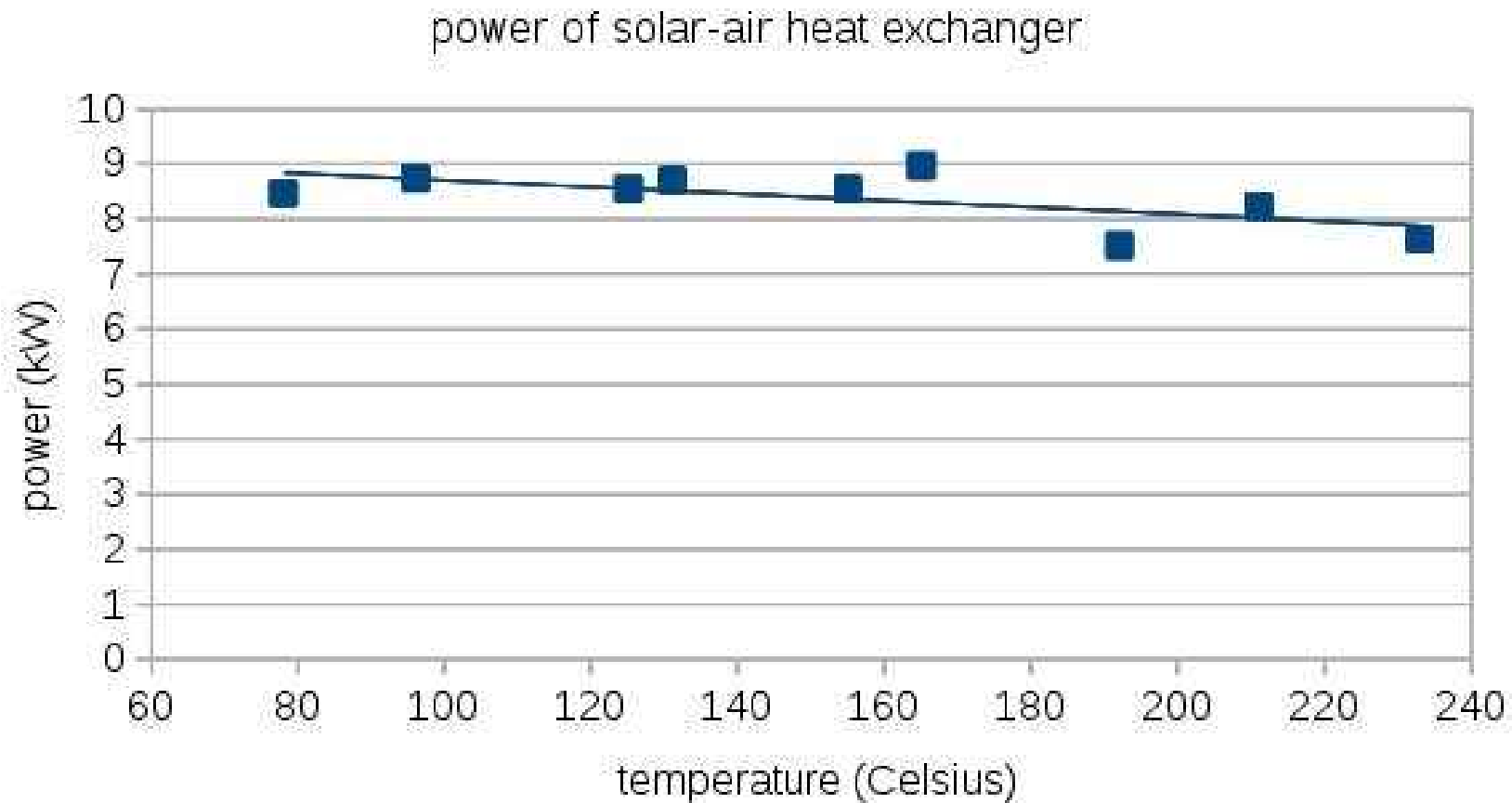


The heat exchanger can operate in open or closed circuit.





The absorption of its mirror plates (polished steel) is better than that of a conventional black sun-water heat exchanger.



sun-air heat exchanger at high temperatures (200°C) as efficient as sun-water heat exchanger at lower temperatures (100°C)

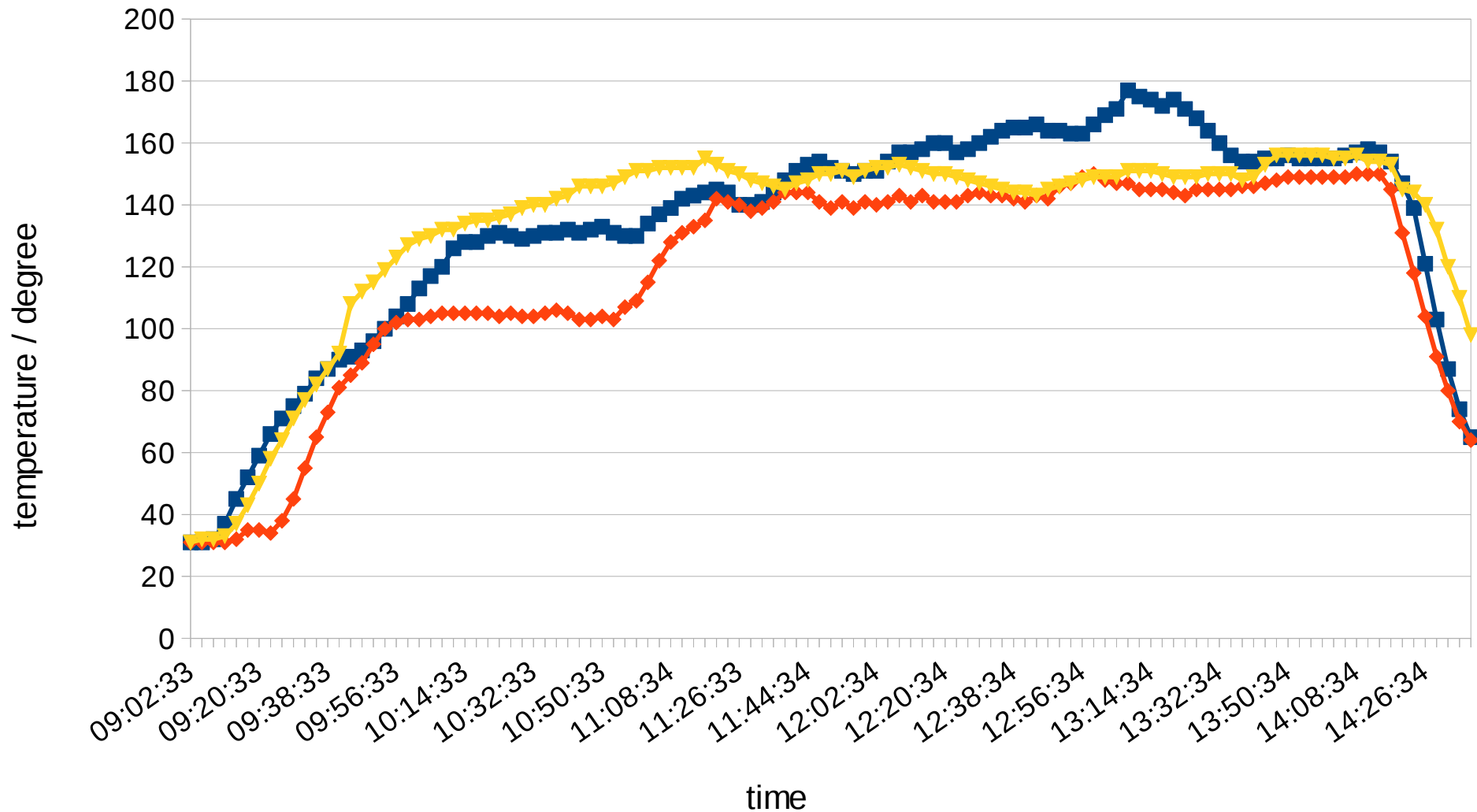
Still higher temperatures can be reached efficiently by increasing the number of reflectors of the Linear Mirror, which is easy.

With hot air, new renewable technologies become possible, like for instance solar torrefaction of waste biomass => solar carbon



about 30 tons of solar carbon per year, equivalent to 15 tons of fossil oil.

## Air Temperature



The first test runs were very successful:

The plant is very stable and delivers 25 kW of hot air

Heat losses are small and correspond to theoretical expectation,

Each of the 3 ventilators consumes less than 20 W (!)



We will participate at the Helsinki Energy Challenge

We are of course not well informed about the other potential participants, but the only one we have seen up to now

is a Chinese company, who wants to build an nuclear power plant at Helsinki

# Future: Europe

In the current paradigm CO2 production can be stopped only by sacrifice:

Less mobility, less consumption,  
less income, more public spending,  
entire industries are to be wiped out  
(coal power plants,  
internal combustion engine)

The current paradigm is based on  
current technology.



Our technology is Innovative, makes economic sense, is competitive with  
fossil fuels, can be integrated with existing technologies

Therefore it is able to stop global warming without creating poverty.  
Rather it offers the chance of economic growth in harmony with culture  
and nature

in perfect accordance with the ideals presented by ESOF