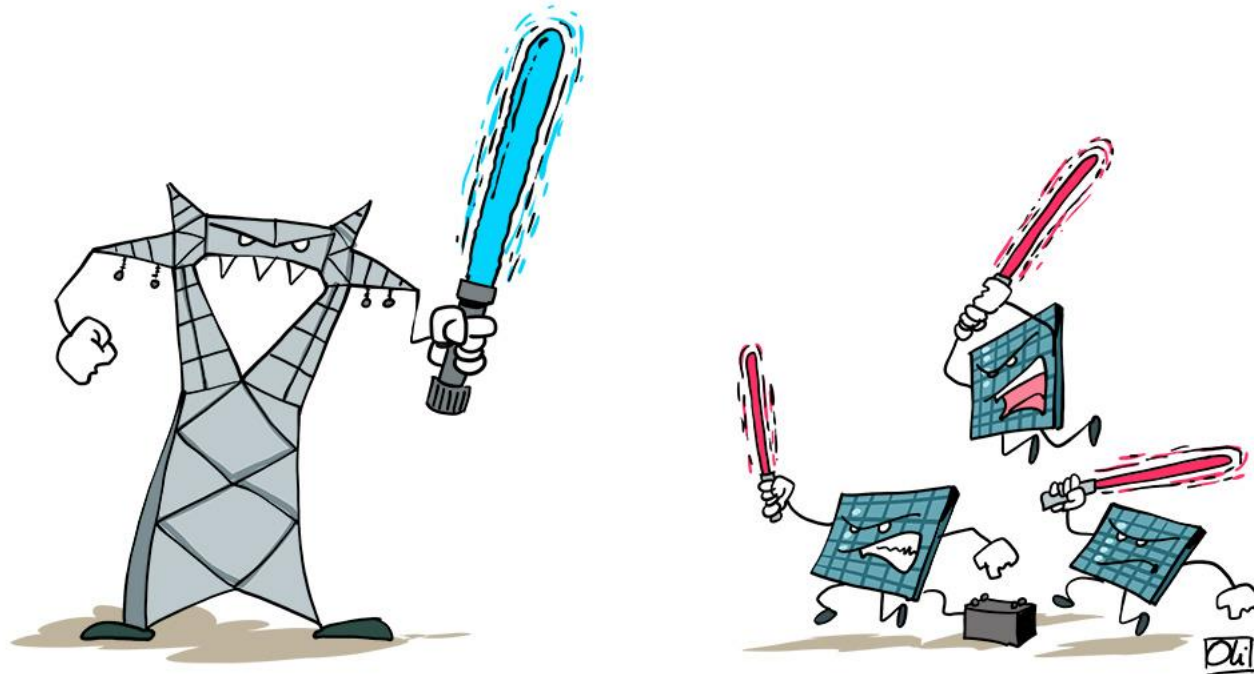


Global Grid(s) versus Microgrids



Prof. Damien Ernst - University of Liège
ELIA Stakeholders' days

Towards larger and smaller electrical networks

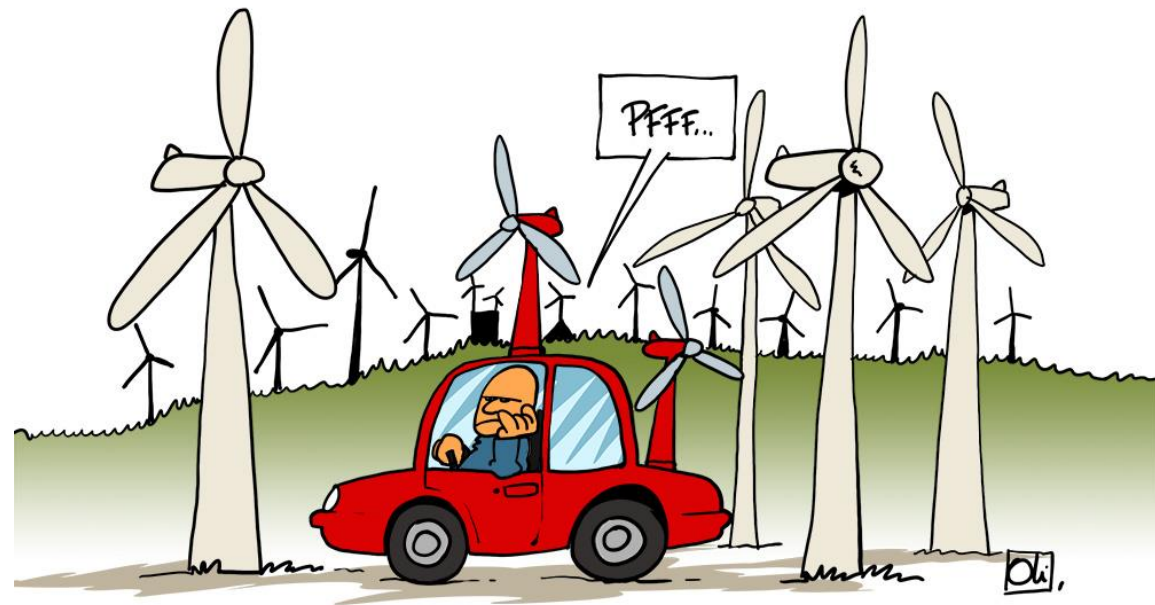
The (electrical) sector has seen two opposing trends these last few years:

- 1.** Huge investments in the transmission network that may eventually lead to a global grid, a grid connecting most of the power plants in the world together.
- 2.** The rise of microgrids, i.e. small electrical systems including micro-generation, which can be operated in parallel with, and/or separated from a broader utility grid.

The economic justifications for a larger grid (in a world powered by renewable energy)

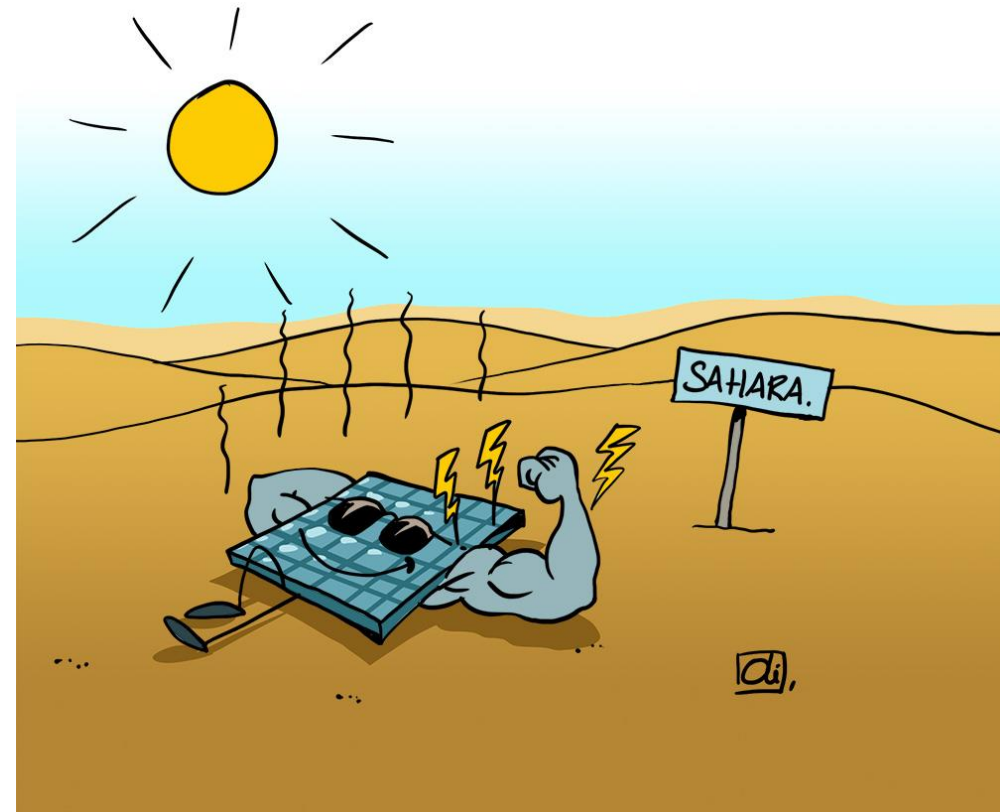
1. Not enough good locations for harvesting renewable energy are currently located next to existing electrical networks.

Example - wind energy: very few good on-shore locations are available in Belgium for harvesting wind energy. If there were no constraints on good locations, the case for extending ELIA's grid off-shore would fully collapse because off-shore wind energy (around 140 €/MWh) is much more expensive than on-shore wind energy (around 85 €/MWh).



2. The larger the area over which you collect renewable energy, the less the total amount of harvested energy will vary over time. The problem of fluctuation of renewable energy sources would virtually disappear in a global grid environment.

3. Accessing places located far from major existing electrical networks where there is ample sun or a lot of wind and, hopefully, cheap renewable energy.



The driving force behind microgrids

The price of producing electricity next to the load is becoming lower and lower. It is already smaller than the retail price of electricity.

Two striking numbers: Retail price of electricity in Belgium is around **250 €/MWh**. Price for producing electricity locally with PV panels in Belgium: **83 €/MWh**.

The « death spiral » story: microgrids are built => high fixed costs of existing electrical networks are covered by fewer and fewer consumers => retail prices increase => the business case for microgrids improves => more of them are built => ...

Data used for computing the Levelized Electricity Cost (LEC) for PV electricity : 1.2 €/Wp, lifetime of 20 years, no operational costs.

The complaints of big utilities #1

Big utilities: “Microgrids do not pay all these taxes that are included in the retail price of electricity. We are facing unfair competition! ”

My answer: Well, you are right, but it is also the first time that DSOs and TSOs are really facing competition. Are you prepared for it?

The complaints of big utilities #2

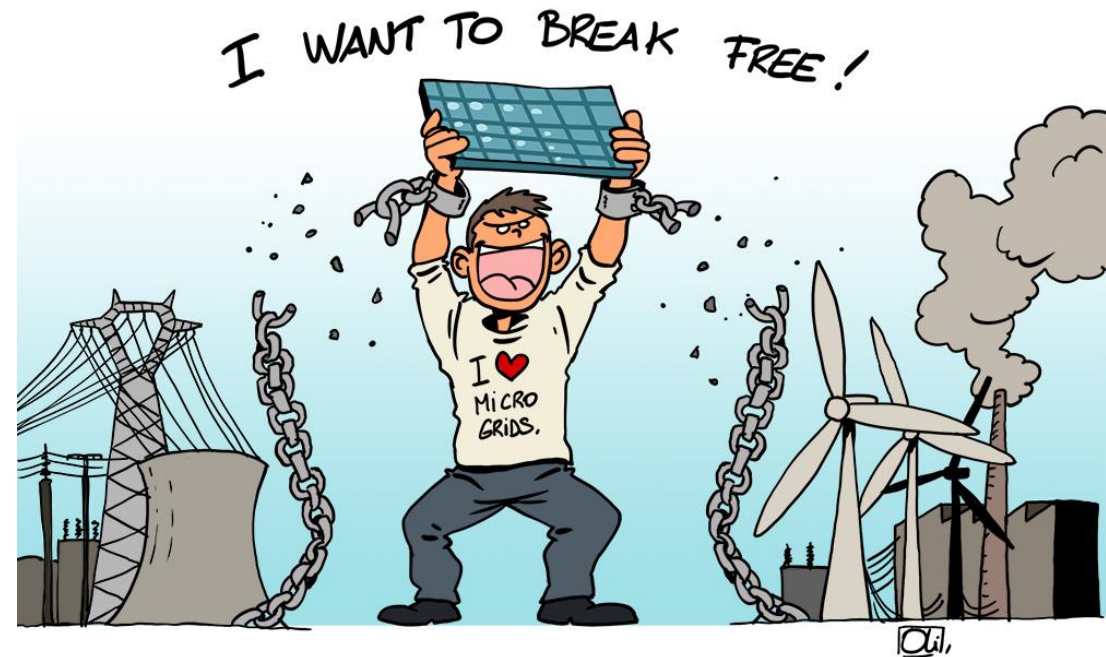
Big utilities: “Microgrids do not pay a fair price for transmission and distribution networks. Governments should adopt a capacity-based tariff or something else that protects us from those pirates of the grid.”



My answer: I may agree, but capacity-based tariffs or other kinds of adversarial tariffs towards microgrids may not protect you for long because if tariffs become too adversarial, microgrids **may go fully off-grid**.

Going FULLY off-grid

Going fully off-grid becomes more and more accessible. LEC in fully off-grid microgrids with PV, batteries and a diesel generator in 2015: in Belgium 240 €/MWh, in Spain 140 €/MWh; LEC in fully off-grid microgrids with PV and batteries: in Spain 185 €/MWh, in Belgium 565 €/MWh.



Data used for computing the LEC for fully off-grid microgrids : 1.2 €/Wp for PV panels, cost of batteries: 400 €/kwh, cost of diesel generator 2000 €, cost of diesel 1 €/l, efficiency of the diesel generator: 25%; Value Of Loss Load (VOLL): 2 €/l, typical residential load profile chosen for the computation.

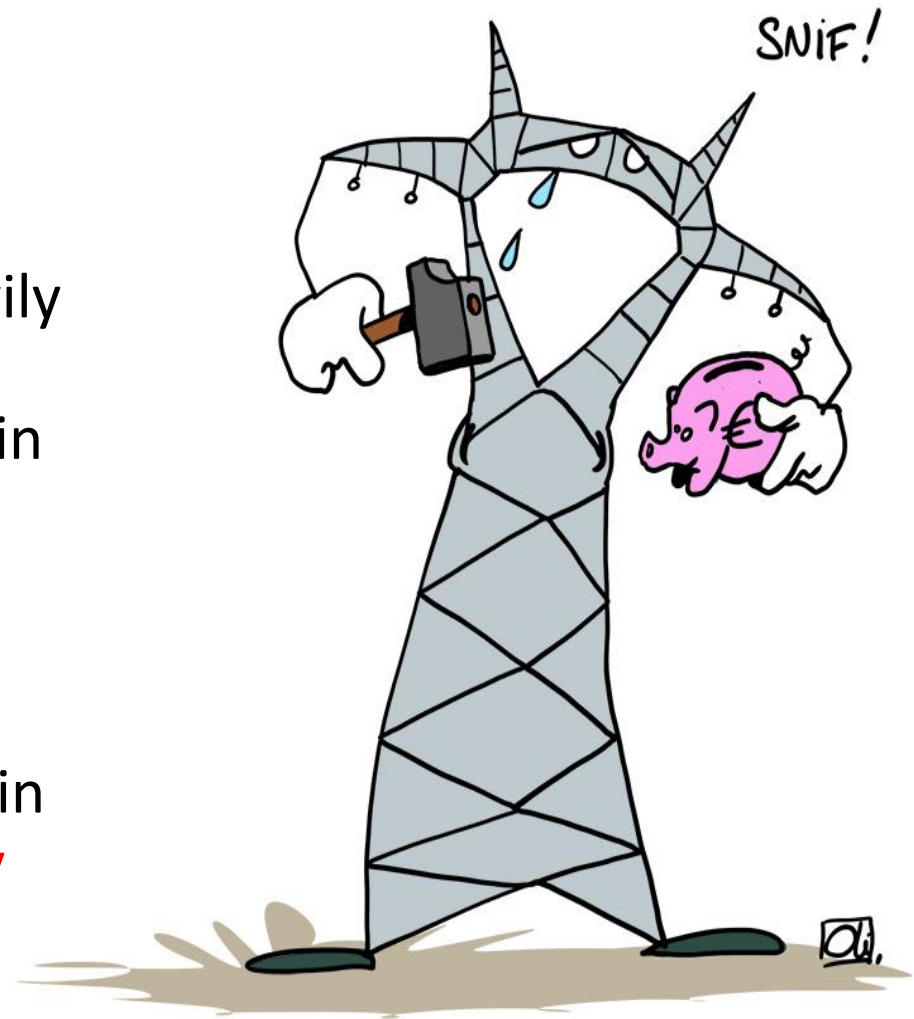
Those microgrids that could also complain

Microgrids: “We are happy with paying taxes and a fair price for the network. But a fair price for the network does not necessarily mean that we should pay more for it than industrial consumers directly connected to higher voltages. A tariff structure based on the “cascade” principle (i.e. companies/individuals connected to lower voltages are using more the electrical grid and should therefore pay more for it) is totally unfair to microgrids connected to lower voltages.”

My answer: You are right. Actually you could even argue that if your net energy consumption is negative, you should pay less for the grid than big industrial consumers which actually depend on you for their power supply.

Challenge #1

TSOs in Europe, and ELIA in particular, together with DSOs are investing heavily in their grids. This will lead to an increase in retail prices for electricity, in a context where microgrids become more and more competitive. These new investments are safe and we can exclude the fact that we may have to proceed to a write-off of these assets in the years to come. [Fully agree to fully disagree]



Bigger and stronger grids are no end per se

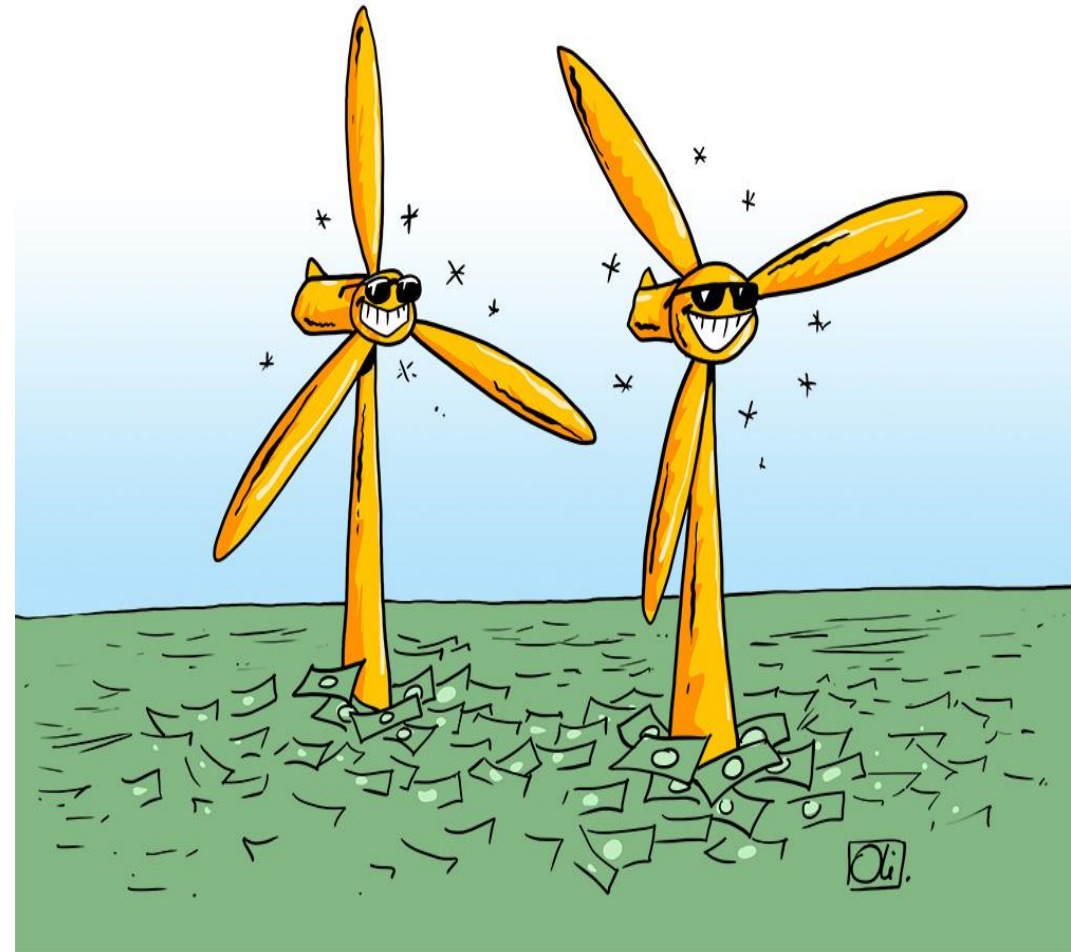
Economic reasons for building a bigger and stronger grid may exist (as discussed before).

But, new grid investments should also maintain a retail price as low as possible even if part of the electricity has to come from green energy sources. This is even more true in a context where (fully off-grid) microgrids become very competitive.

Bigger and stronger grids just for the sake of being bigger and stronger makes no sense.

Challenge #2

Building an off-shore grid in the North Sea makes sense knowing that (i) off-shore wind energy has a cost of 160 €/MWh when coming ashore (ii) the 2,400 MW of planned off-shore wind farms will increase the retail price for electricity in Belgium by more than 10 €/MWh. [Fully agree to fully disagree]



Grids and society

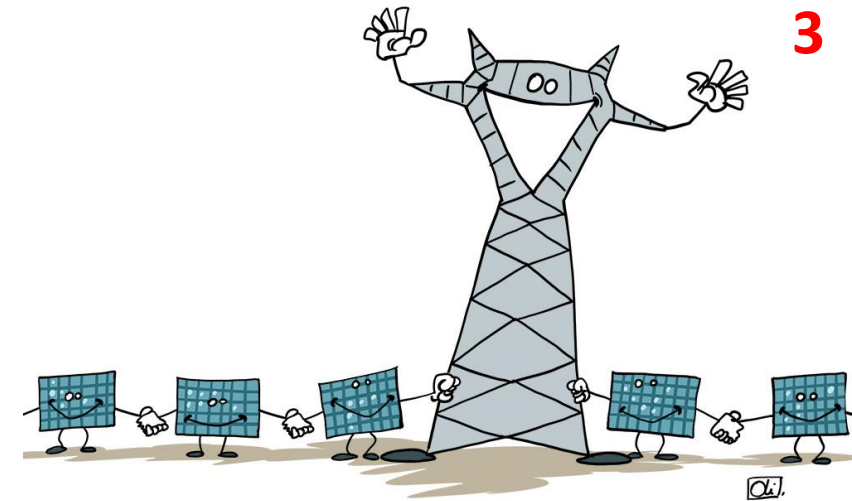
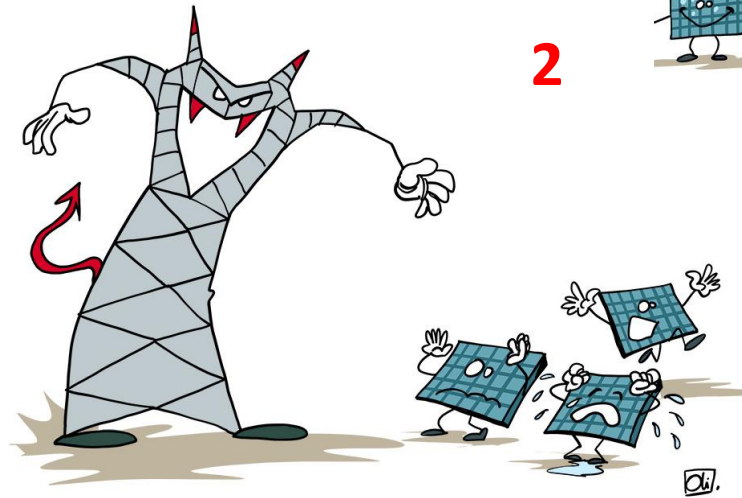
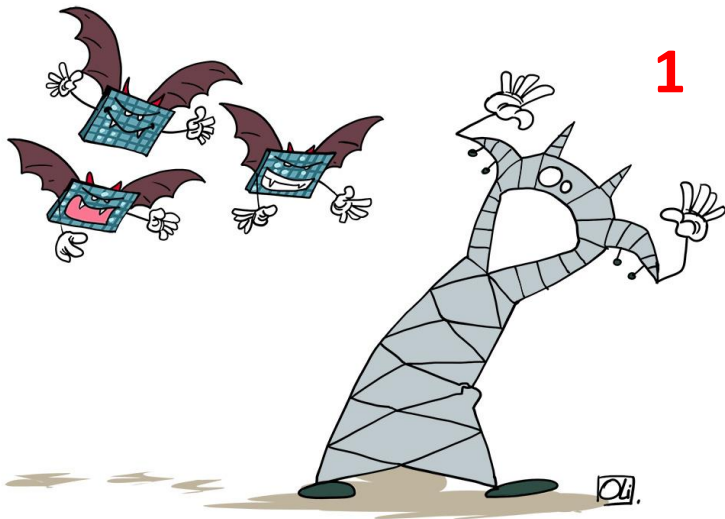
The companies operating electrical networks lobby for having adversarial regulations for microgrids. The main argument used when discussing with policymakers:

Microgrids are the triumph of individualism and poor people will be unable to have access to their own microgrids. Microgrids will destroy this social role that the electrical grid has played for so long.

They may be right **but** microgrids are also a way for people to break free from big energy companies. Community-based microgrids may also foster solidarity and interactions between people.

Challenge #3

What kind of company should ELIA be (or is ELIA becoming)? [Option 1,2 or 3]



Dinosaurs died. What came next was smaller.



Still expensive but already a source of inspiration for artists.

