



Objectifs de Développement
Durable (ODD) avec une focalisation
sur la science des données
Biotech, 17.10.2023

Comment préserver les données numériques sur le long terme dans le contexte des ODD

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[...] Currently, data storage in data centres makes up 4 to 8% of our global energy footprint [...]

From Mendell et al (2020) The Canadian Geographer DOI: 10.1111/cag.12741

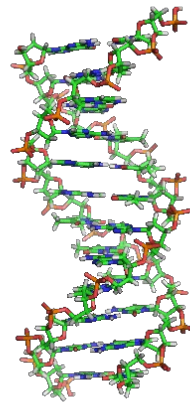
| Parameters for 1 exabyte | Current mainstream technology |
|------------------------------------|----------------------------------|
| Infrastructure Cost ⁽¹⁾ | > CHF 20 M |
| Power | About 1 MW |
| Surface footprint | About 2'000 m ² |

(1) Based on HDD technology





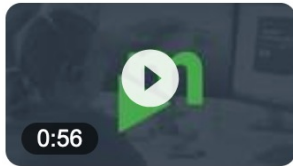
DNA has a theoretical density of over 1 exabyte/mm³
&
1 gram of DNA can contain tens of exabytes



Text

distributions, particularly of
in the next chapter. Chapter
codes and combinatorial gar
ness of the Golay code, ho
handle nonlinear codes using
two-quarter or one-semester
what they like after covering
and seven if that is all the
coding.

Video



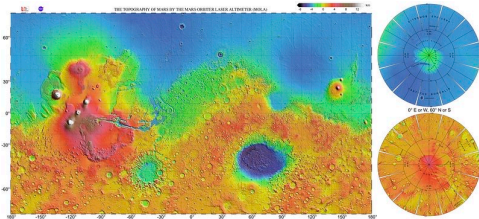
Image



Database



Data set



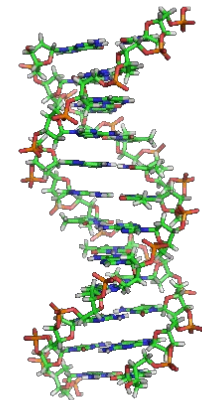
We go from a binary to a
quaternary system,

for instance : 00 \rightarrow A

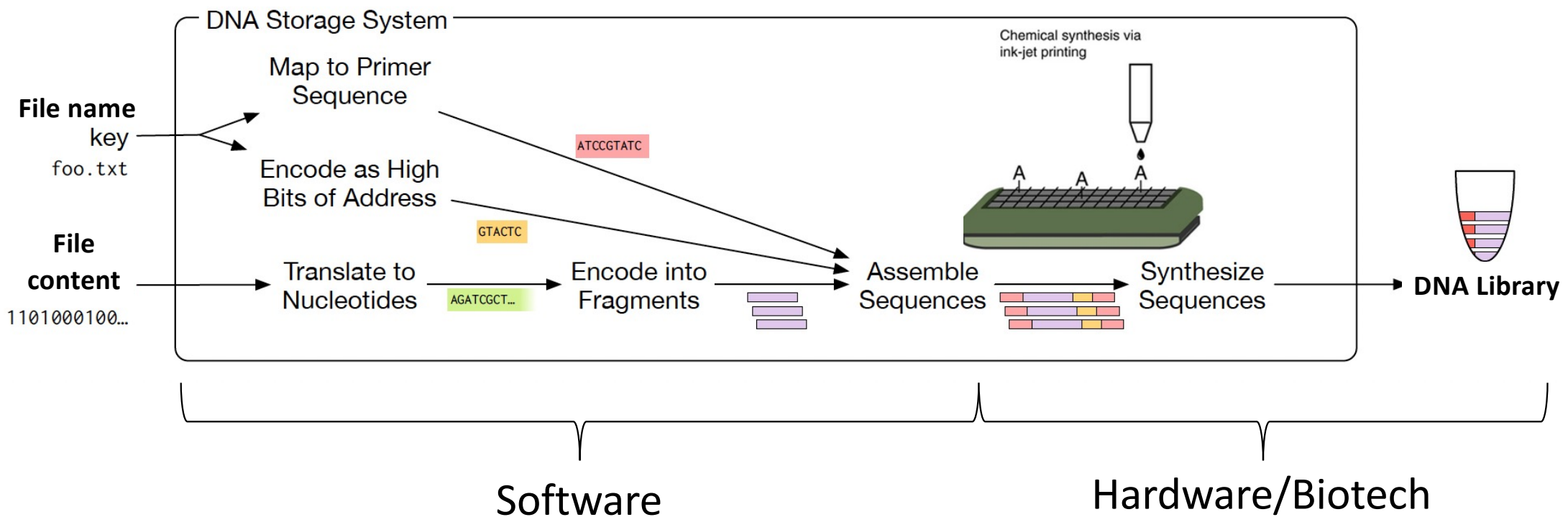
01 \rightarrow T

10 \rightarrow G

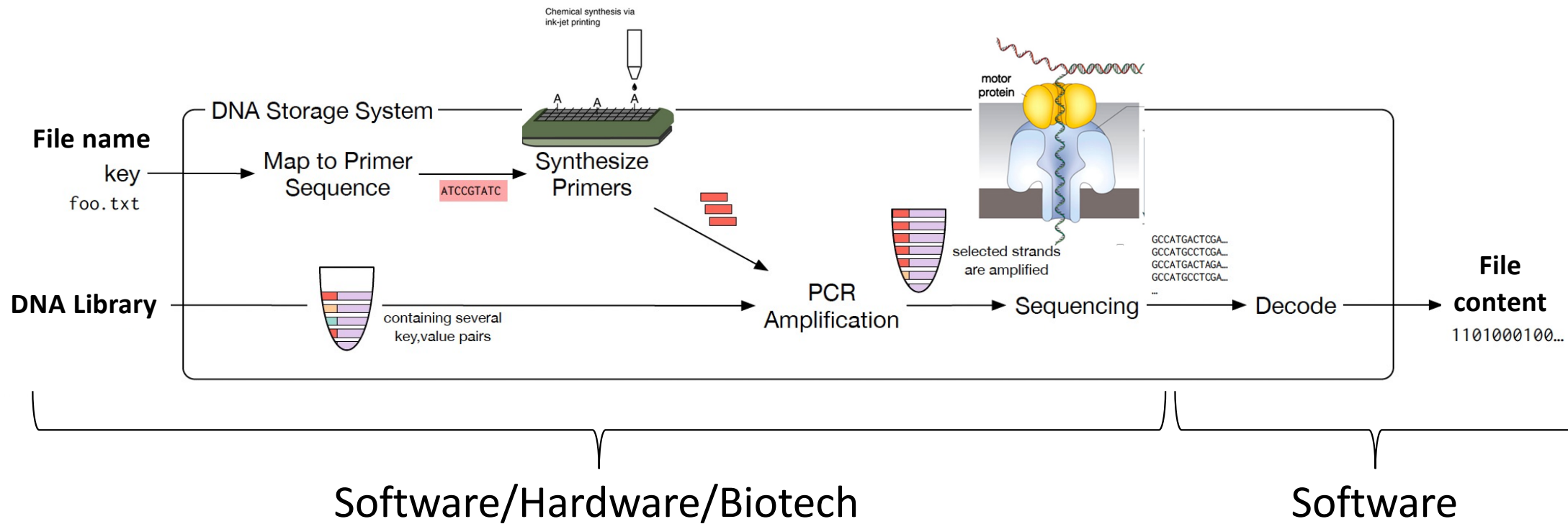
11 \rightarrow C




The DNA writing process



The DNA reading process

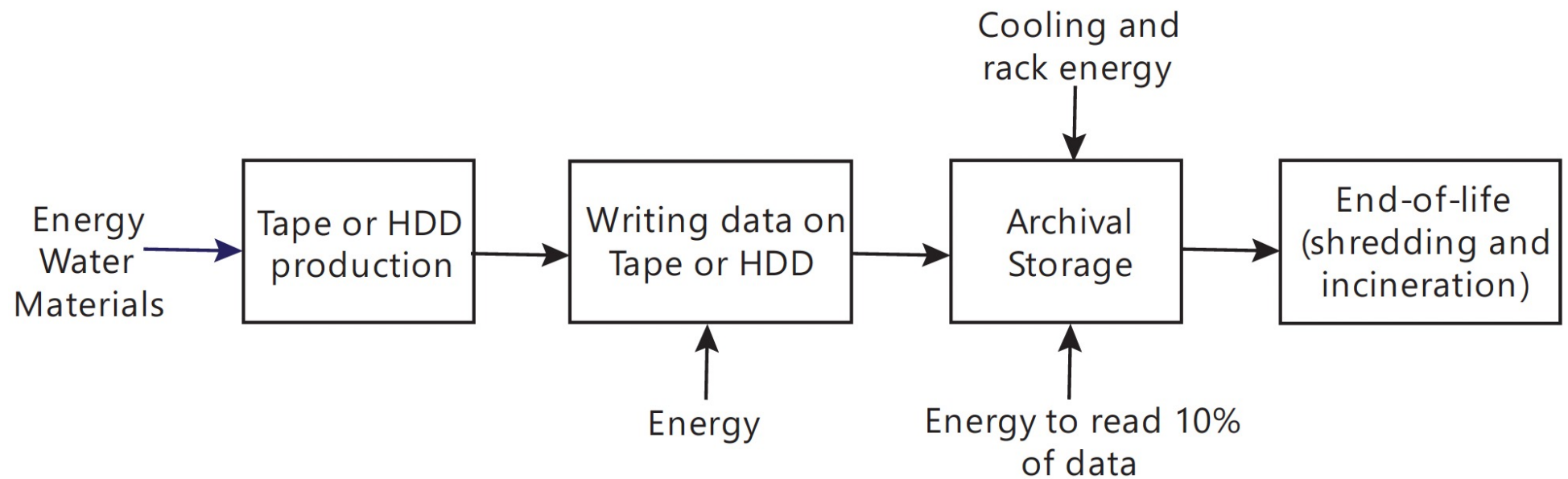




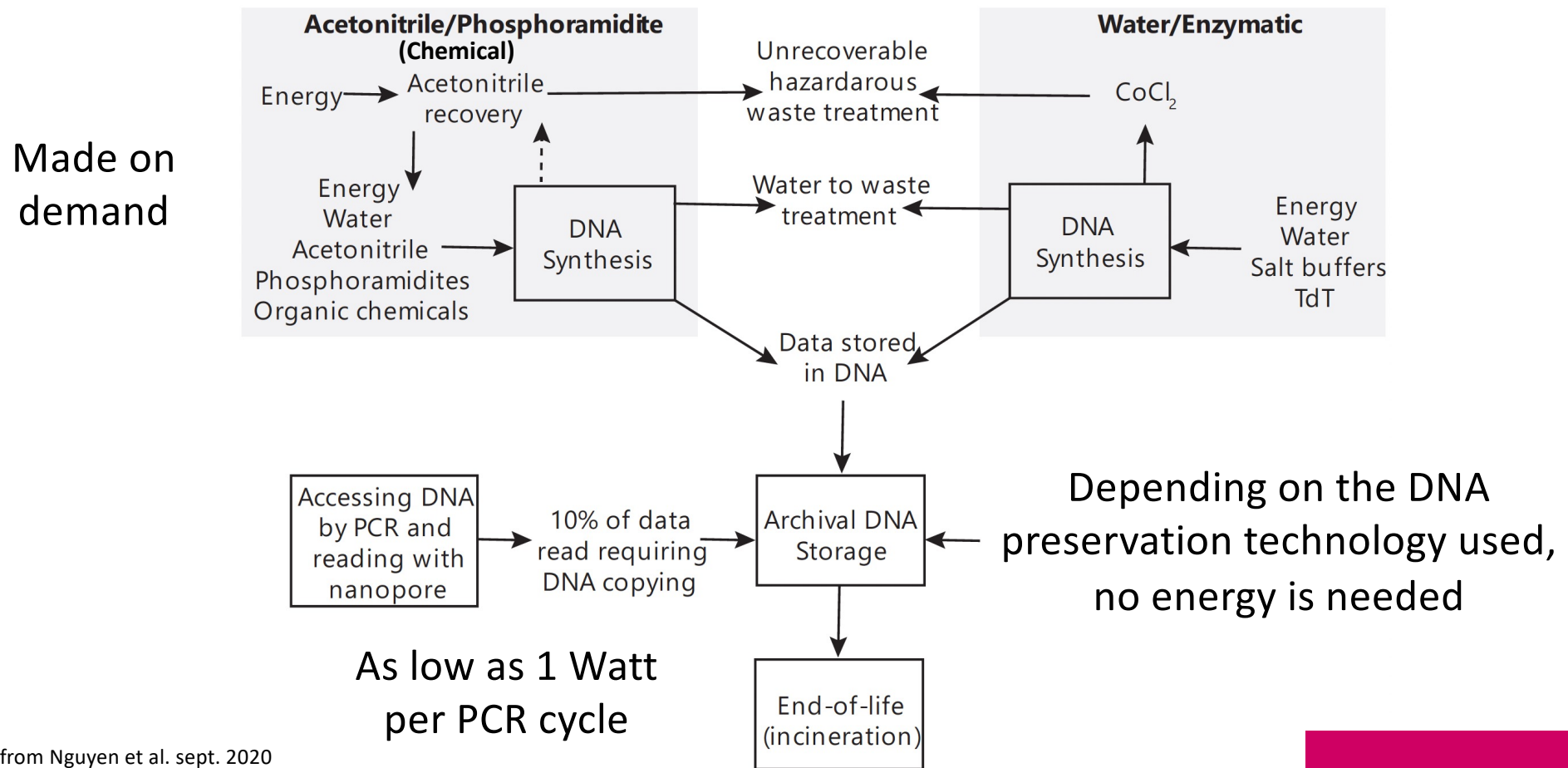
[...] The expansionist sales pitch used to promote DNA to archive and preserve traces of humanity beyond the apocalypse is the new greenwashing [...]

[...] DNA is nowhere near replacing hard drives and servers in data centres yet, but anxieties about the future propel these visions forward; these projections in turn help explain the large-scale investments being made by Big Tech in DNA storage [...]

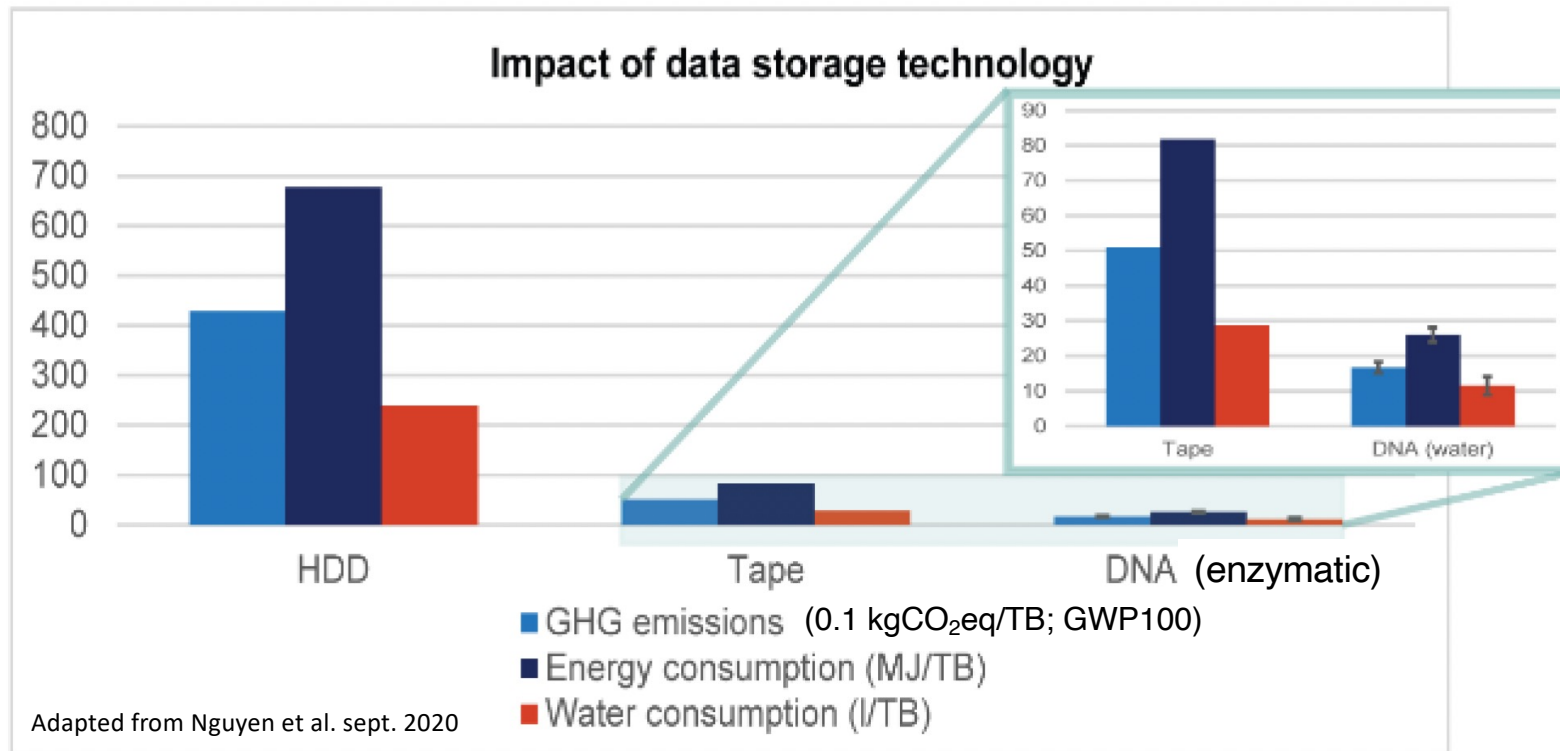
Cradle-to-grave flow diagram for tapes and hard disks



Cradle-to-grave flow diagram for DNA




Writing and maintaining 1 TB for a year with a read rate of 10%



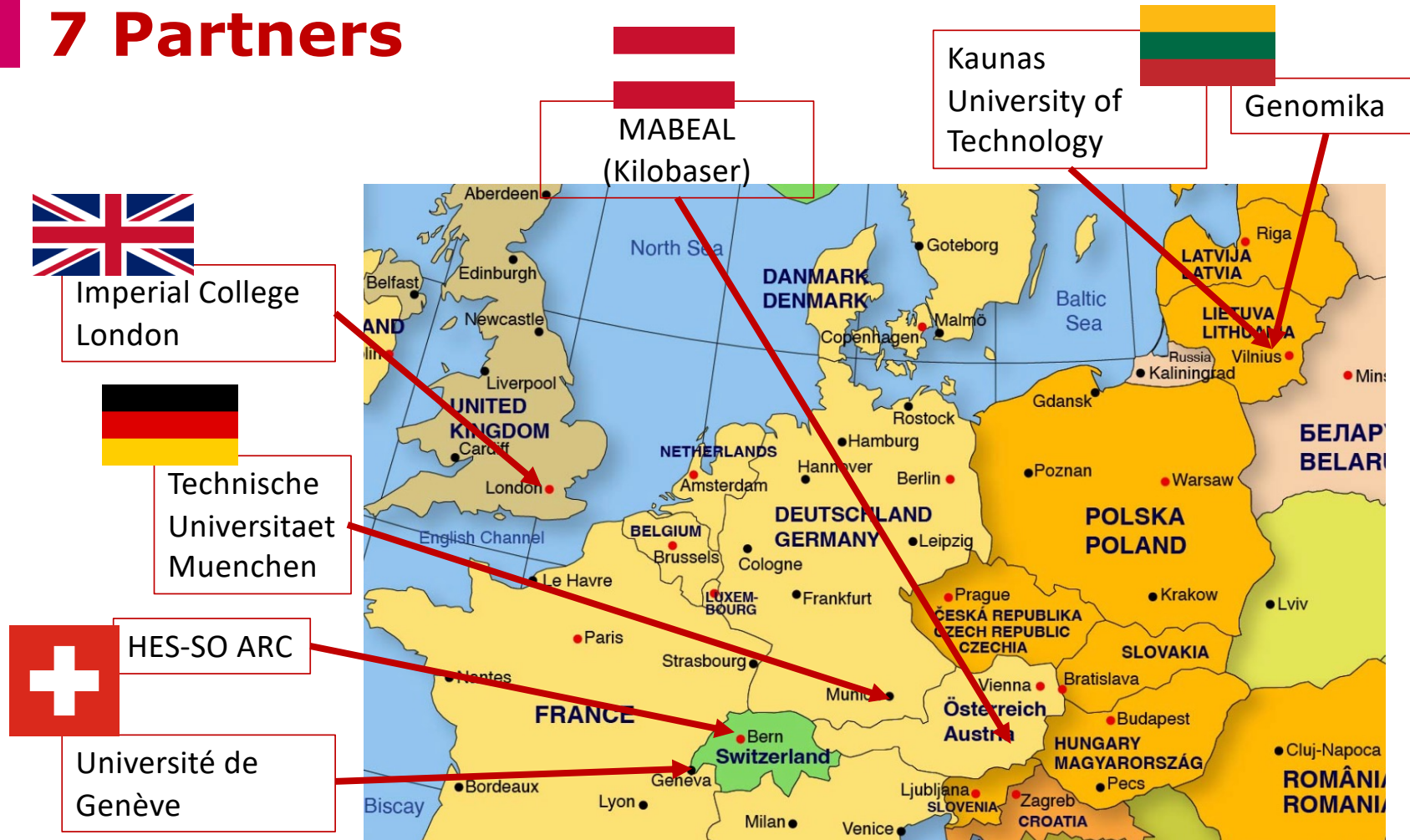
- The main energy consumption of DNA is the production of nucleotides
- The environmental impact of the enzymatic method is about 4 times lower than that of the chemical method



DNAMIC EC Pathfinder project: “DNA Microfactory for Autonomous Archiving”

- Autonomous solution based around a low-energy consumption micro-factory that will be developed for end-to-end DNA data archiving
 - The small footprint micro-factory is based around so-called blocks, including storage blocks for DNA samples and reagents and technology blocks
 - 3-year term - kick-off meeting held on October 2nd, 2023
- 

7 Partners





Conclusions

- DNA data storage meets the SDG, especially for cold data storage
- The microlean factory concept (microleanlab.ch) should further strengthen these sustainability objectives
- DNA synthesis based on the enzymatic process is promising in terms of low environmental impact and waste reduction
- DNA molecules are manufactured on demand, which avoids overproducing material that will ultimately not be used and will quickly become obsolete





Thank you
Merci



DLCM



YARETA



DYNAMIC

