Introducing: The Sustainability Unit and the Climate2Preserv project

Estelle De Bruyn
Annelies Cosaert

23/04/2023, Bergen (Norway)
Managing museum climate in the face of economic challenges

Koninklijk Instituut voor
het Kunstpatrimonium

belspo .be

Flooding in Wallonia in 2021 (BE) © Bruno Fahy / Belga / AFP / Getty

Flooding in Wallonia in 2021 (BE) © The Brussels Times

Climate crisis:
adapt, mitigate, share

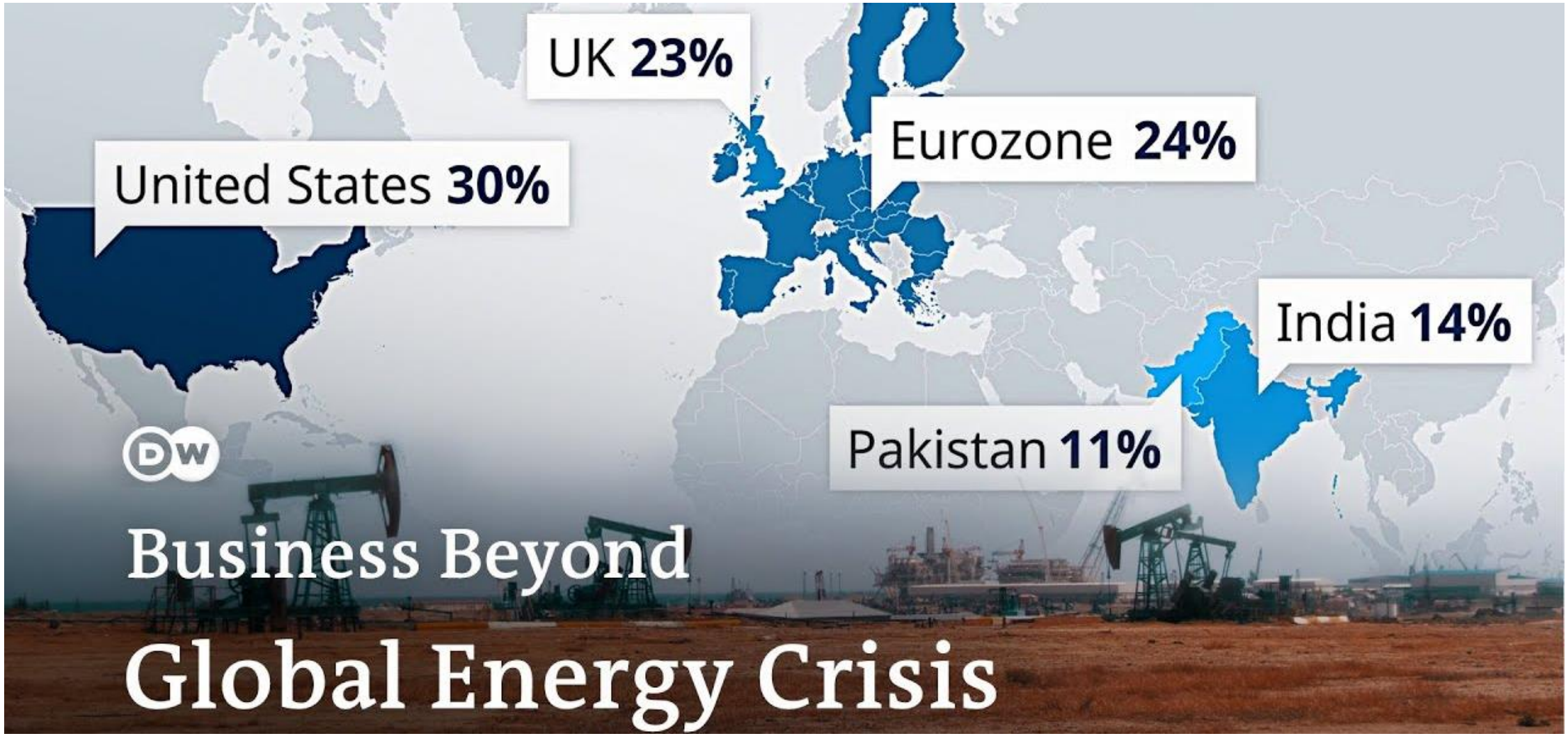
Adapt & Prepare

Mitigate carbon footprint

Share stories

Energy crisis:

2022 increase in Energy Costs (October 2022)




LE NUOVE SALE DI
BOTTICELLI
POLLAIOLO
E VAN DER GOES
A11
AZIONE
RBONE

Energy crisis & cultural institutions in BE: dystopia becomes reality

Network of European Museum Organisations (NEMO), 2022

KIK-IRPA
And the sustainability unit

Restauration Ghent alterpiece
1951, © KIK-IRPA, Brussels

KIK-IRPA

The Royal Institute for Cultural Heritage
Koninklijk Instituut voor het Kunstpatrimonium
L'Institut Royal du Patrimoine Artistique
Königliches Institut für das Kunsterbe

An institution that is part of the Belgian Federal Government

What is the institutes mission
in small and overcomplicated

Belgium?

Regions

Is divided in different regions, following the provincial borders

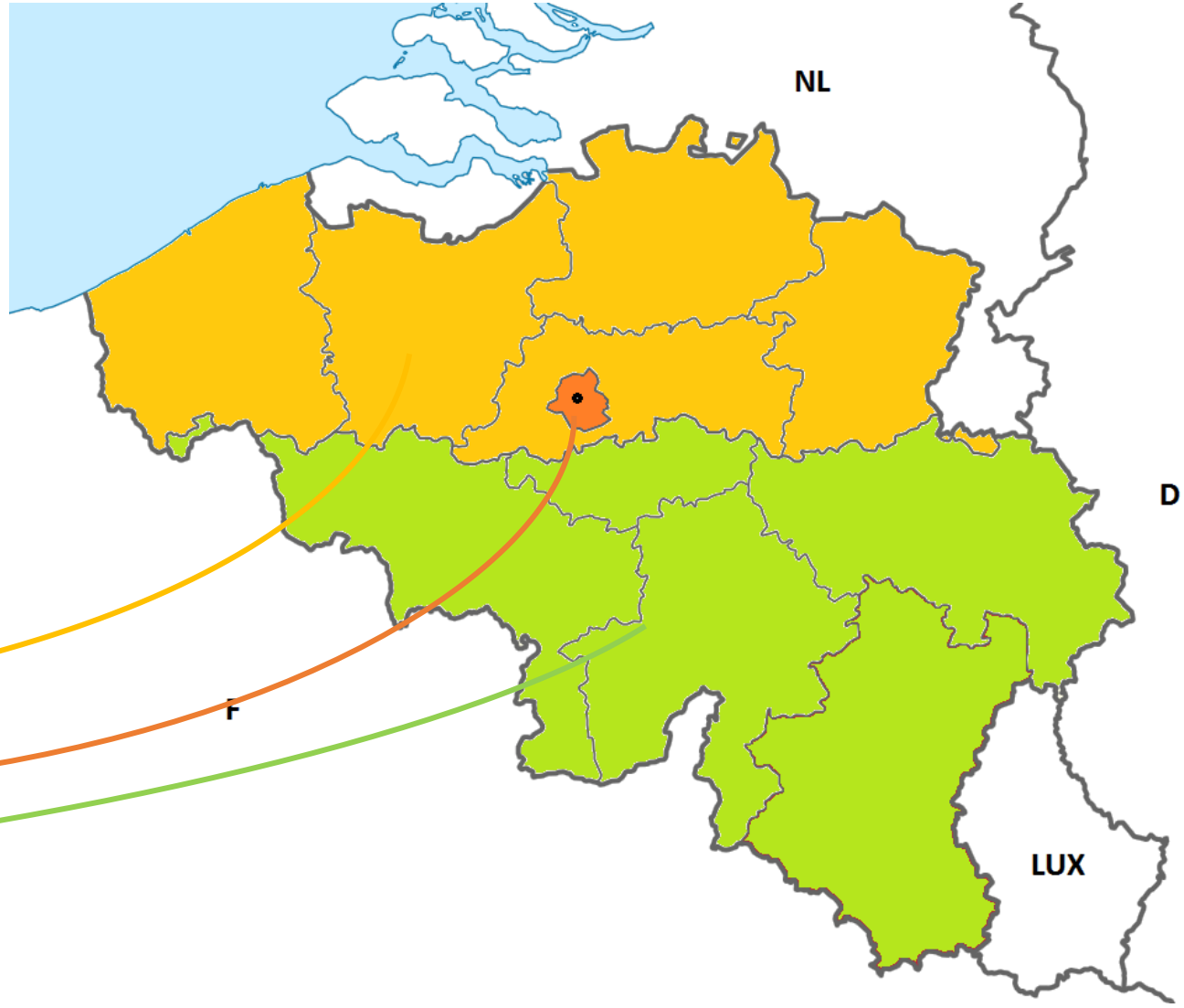
The regions are responsible for matters tied to '**land**' such as: environment, urbanism, mobility, housing, infrastructure, economy and work

Divided in:

Flanders

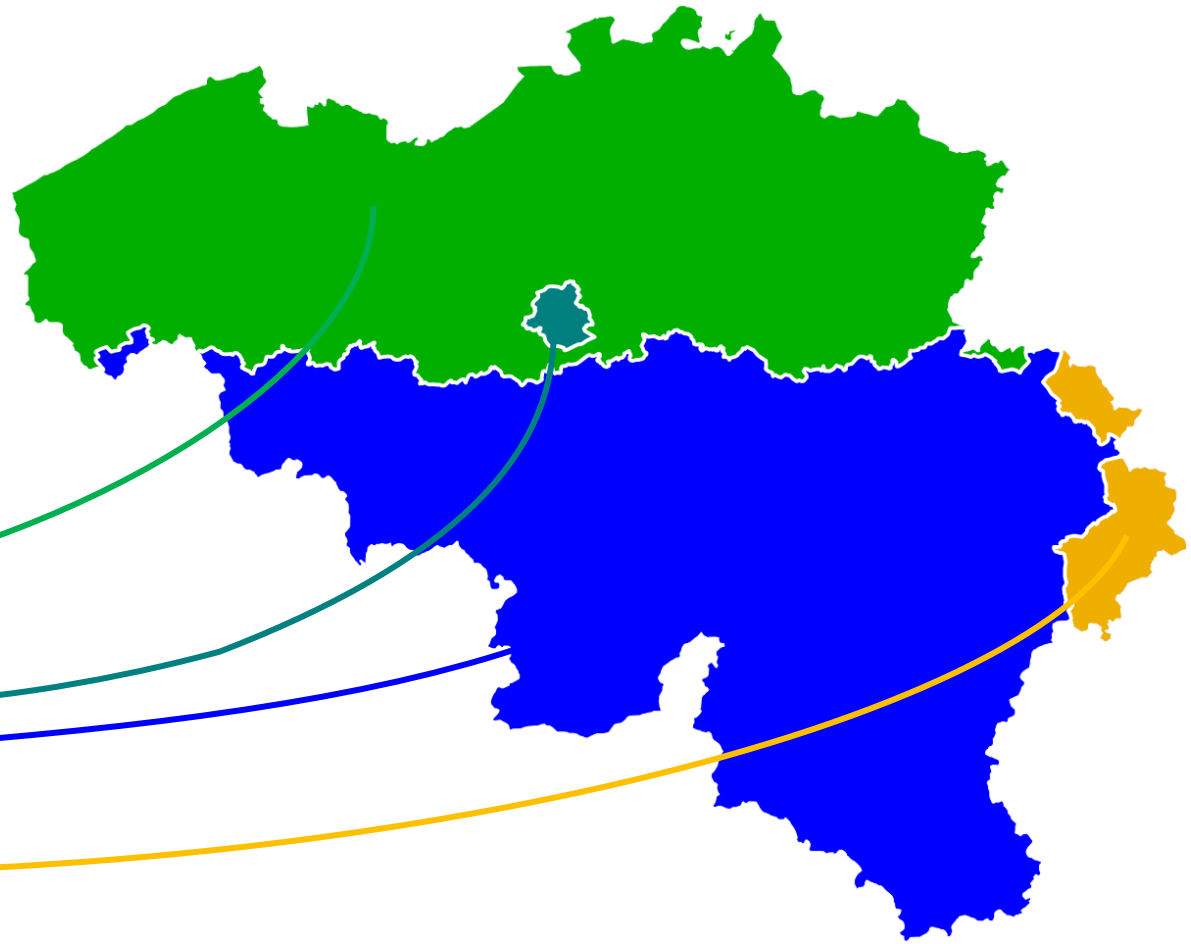
Brussels Capital Region

Wallonia



Communities

Are responsible for matters based on **'personal matters'** such as: education, wellbeing, health, sport, language and culture.



Divided in:

Dutch

Brussels (French – Dutch, bilingual)

French

German

But wait, if **culture** is a matter for communities, and KIK-IRPA is a federal institution… What do you do?

Well,… Good question.

Federal Government

Federal government is responsible for things as the justice system, army, federal police, social security, the post, railways and the …Belgian Science Policy (Belspo)

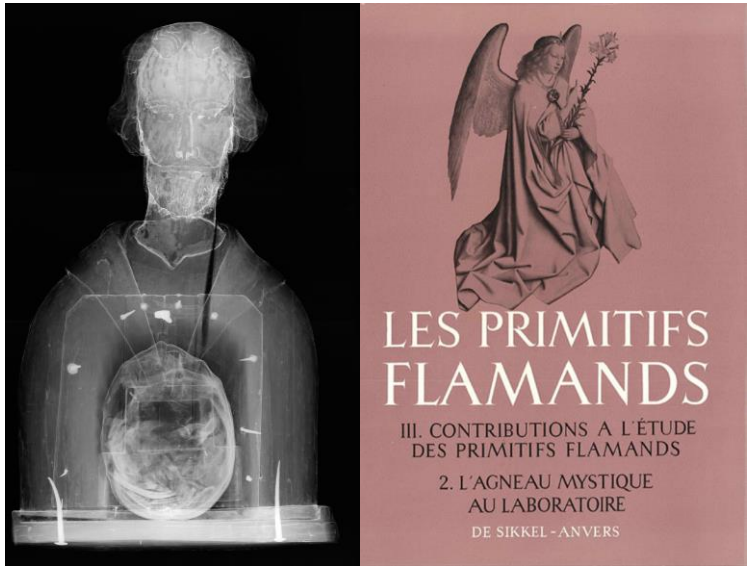
Research and Space (+ Artic research) } Belgian research for ESA

Royal Institute for Cultural Heritage (KIK-IRPA)
National and Provincial State Archives
Royal Library of Belgium
Royal Museum for Art and History
Royal Museum of Fine Arts
Royal Belgian Institute of Natural Sciences
Royal Museum for Central Africa
} Research institution for cultural heritage (small collection) + Collection managing institutions and museums

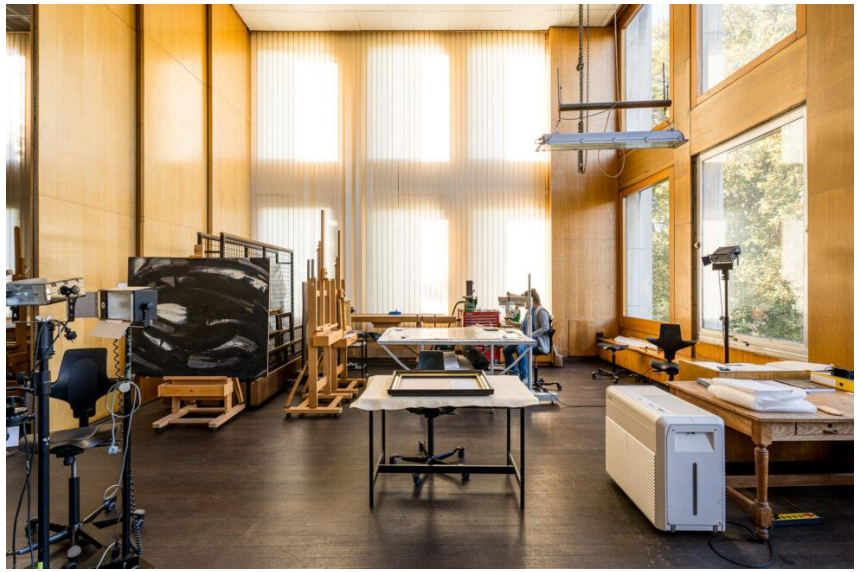
Royal Belgian Institute for Space Aeronomy
Royal Observatory of Belgium and Planetarium
Royal Meterological Institute
} Space and weather Research and services

Mission

- **Inventory**: establishing a photographic inventory
- **Study**: carrying out expert assessments and scientific analyses
- **Conservation and restoration**: ensuring a good state of preservation, materially and visually
- **Valorisation**: valorising and sharing all scientific, photographic and technical documentation, data and know-how



Documentation



Conservation & Restauration

Scientific analysis

Sustainability Unit

KIK-IRPA identifies a durable cultural heritage institution as a high-quality institution that:

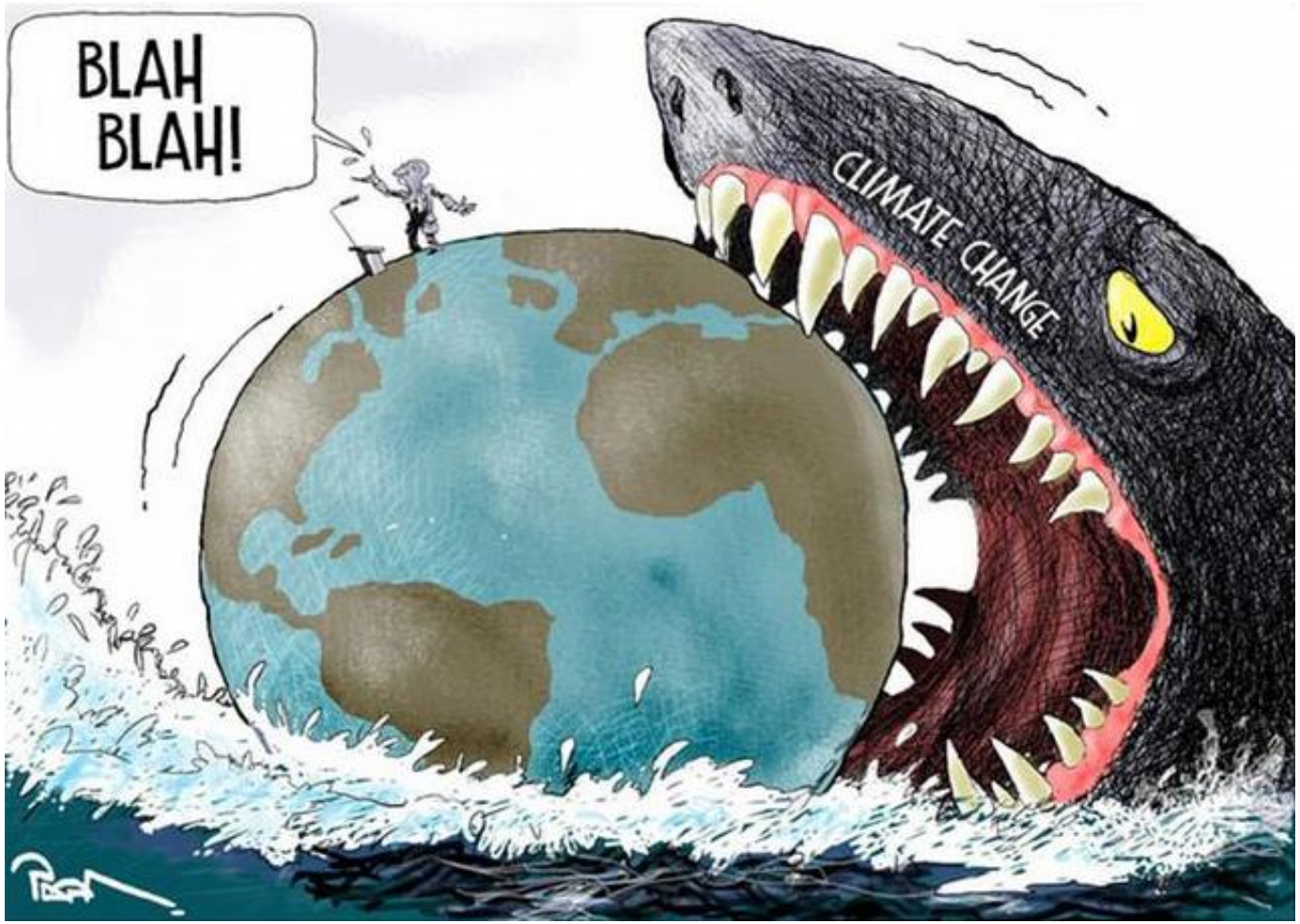
- Avoids excess and waste
- Strives for continuous optimization while respecting existing practices and the communities it represents
- Suited for its own activities and conservation requirements
- While respecting its own priorities

Focus on:

- interdisciplinary collaboration with allied fields
- creating tools and providing support and guidance to facilitate the integration of sustainability in daily practice
- themes such as energy reduction, climate change and emergency response.

Reduce energy consumption

Climate2Preserv



- Need for a methodology adapted to the (Federal Scientific) Institutions' context for an **energy efficient and sustainable management of collections**
  → *C2P Protocol, handbook and templates*

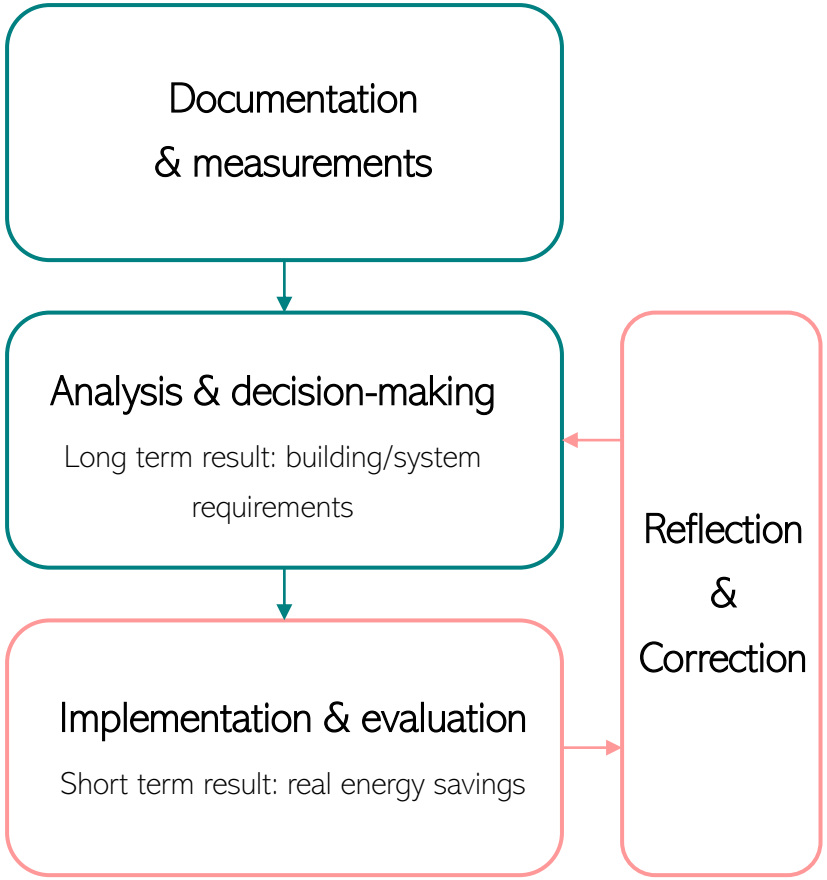
- **Need for (a) practical tool(s)** available that empowers professionals from various disciplines to collaborate effectively on these topics
  → *C2P Toolbox*

- **Need for a shift from the sector**: standards based on urban legend or tradition VS evidence-based decision making to build recognition and trust
  → *Case studies, workshops, publications*

C2P

Protocol

- Guide (and methodology) to: Sustainable Preservation Practices for Managing Storage Environments (IPI)
- Practical Guide for Sustainable Climate Control and Lighting in Museums and Galleries (Museums & Galleries Queensland)
- ASHRAE Handbook 2019, Chapter 24: Museums, Galleries, Archives, and Libraries (ASHRAE)
- Managing Indoor Climate Risks in Museums (Ankersmit & Stappers)
- DEMI MORE : une approche intégrée du processus de conservation (Kempens Landschap, provincie Noord-Brabant)
- Analyse van en Bouwstenen voor de Uitwerking van een Programma van Eisen voor Cultureel-Erfgoeddepots in Vlaanderen (Flemish Gouvernement)



C2P

Q&A

- How does your **building envelope** perform and how can it be changed: materials, value, mass, glass surfaces, orientation, etc.
- What is your **outdoor climate** and how will it evolve in the future years
- Who is on and off site for maintenance of your climate control systems and what is your **budget for system maintenance**, upgrades, etc.
- How much **energy** do you currently use and for which tasks: lighting, heating, cooling, ventilation, etc.
- How does your climate control **perform** during the hottest, coldest, driest and wettest moments of the year
- What is your **collection** composition, what are your biggest risks and what is the state of your collection
- How are different **areas used**: public, non-public and storage areas
- What is formulated in your **loan policy**

Case Studies

Royal Museums of Fine Arts of Belgium

© Brussels Museums

Surface 1300m²/floor x 5 levels ≈ 6500m²
energy guess based on DIN V18599)
heating : 90 000 m³gas/year
300 000 kWh_{elec}/year

Wiertz Museum

© Alfred De Ville De Goyet (MRBC DMS)

≈ 750m² ; 18 000 liters fuel/year
15000 kWh_{elec}/year
(total≈25k€/year in 07/03/22 prices)

Royal Film Archive of Belgium
CINEMATEK (acetate)

© Bea Borgers

Cinematek ≈ 4000m²
Electricity or gas cons. unknown

Changing guidelines

Table that shows the evolution in international environmentel climate guidelines for collections
Note that these guidelines only apply to certain structures (Check ASHRAE 2019 for detailed information)
- ***Buildings:*** *Closed envelopes, passive buildings and historical buildings*
- ***Climate control:*** *Precision control (temperature and relative humidity) and partial control (temperature or relative humidity)*
- ***Outdoor climate****: mild climate (most of western Europe)*

Guideline	Annual average	Seasonal fluctuations	Long term outer limits	24h fluctuations
1999 - **ASHRAE** Handbook, Chapter 20, table 2, Climate class **AA (and loans)**	T: closest to ann. avg. RH: 50% Permanent Collection: RH: annual average Loans (typically): T: 21°C RH: 50%	T: ±5°C RH: None	T: 15°C - 25°C	T: ±2°C RH: ±5%
1999 - **ASHRAE** Handbook, Chapter 20, table 2, Climate class **A(1)**		IF NO 24h fluctuations, then: T: ±5°C RH: ±10%		IF NO Seasonal fluctuations, then: T: ±2°C RH: ±10%
2014 - **ICOM-CC and IIC** Environmental Guidelines	Series of remarks endorsing the Bizot Green Protocol, AIC and AICCM guidelines			
2014 - **Bizot** Green Protocol	Not applicable	T: 'stable' RH: ±10%	T: 16°C - 25°C RH: 45% - 55%	T: 'stable' RH: ±10% (RH 24h fluctuations cannot surpass the long term outer limits)
2019 - **ASHRAE** Handbook, Chapter 20, table 13, Climate Class **A1**	Permanent Collection: T: Annual average RH: Annual average	T: +5°C, -10°C RH: +10%, -10%	T: 10°C - 25°C RH: 35% - 65%	T: ±2°C RH: ±5% (RH 24h fluctuations can surpass the long term outer limits)
2019 - **ASHRAE** Handbook, Chapter 20, table 13, Climate Class **B**	Exhibition rooms: Take into account human comfort	T: +10°C, -20°C RH: ±10%	T: <30°C RH: 30% - 70%	T: ±5°C RH: ±10% (RH 24h fluctuations can surpass the long term outer limits)
2019 - **ASHRAE** Handbook, Chapter 20, table 13, **Loans**	Loans are not tied to a climate class. They are the result from a negotiation between two parties taken into account both their respective climates,			

Historical guidelines
(for (inter)national loans)

Current guidelines
(for (inter)national loans)

Psychrometric Chart

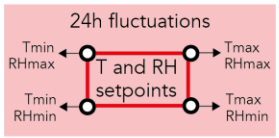
SI (metric) units
Barometric Pressure 101.325 KPa (sea level)
Based on data from Carrier Corporation Cat. No. 794-001, Dated 1975

Historical building, Belgium
- Annual average: RH: 44 T: 24

ASHRAE 2019, Climate Class A1:
Long term outer limit: 35-65% RH, 10-25°C
Seasonal Fluctuations: +- 10%RH, +5°C, -10°C
24h Fluctuations: +- 5% RH, +- 2°C

Calculated set-points for:
- Annual avg RH:44, T:24
- According to ASHRAE 2019, A1

Tmax: 25°C + 2°C/24h
Tmin: 14°C - 2°C/24h
RHmax: 54% + 5%/24h
RHmin: 35% - 5%/24h



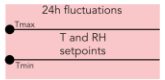
Timeline - ASHRAE 2019 - Climate Class A1 - Narrow interpretation

SI (metric) units
Typical interpretation for an (at least) T controlled building
in a temperate climate with 4 seasons

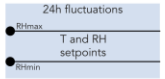
Historical building, Belgium
RH Annual average: 44%RH
T Annual average: 24°C

ASHRAE 2019, Climate Class A1:
RH Long term outer limit: 35-65% RH
T Long term outer limit: 10-25°C
RH Seasonal Fluctuations: +- 10%RH
T Seasonal Fluctuations: +5°C, -10°C
RH 24h Fluctuations: +- 5% RH
T 24h Fluctuations: +- 2°C

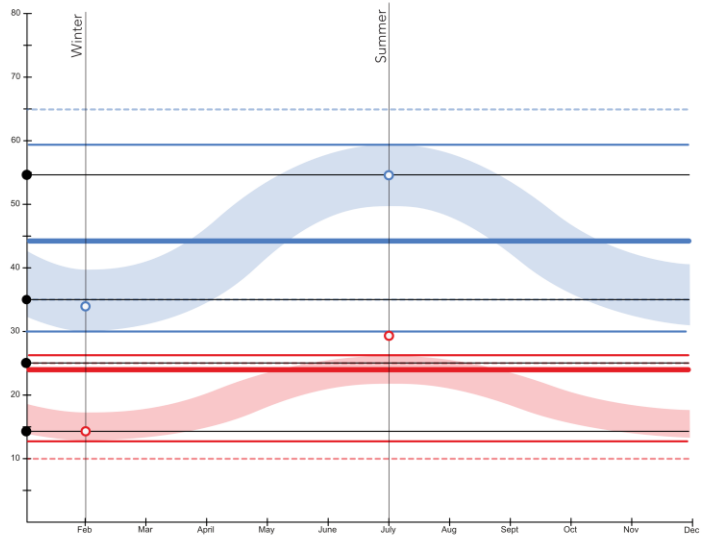
Calculated set-points for:
- Annual avg RH:44, T:24
- According to ASHRAE 2019, A1



Tmax: 25°C + 2°C/24h
Tmin: 14°C - 2°C/24h



RHmax: 54% + 5%/24h
RHmin: 35% - 5%/24h



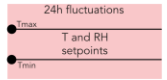
Timeline - ASHRAE 2019 - Climate Class A1 - Wide interpretation

SI (metric) units
Typical interpretation for an (at least) T controlled building
in a temperate climate with 4 seasons

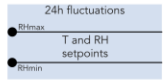
Historical building, Belgium
RH Annual average: 44%RH
T Annual average: 24°C

ASHRAE 2019, Climate Class A1:
RH Long term outer limit: 35-65% RH
T Long term outer limit: 10-25°C
RH Seasonal Fluctuations: +- 10%RH
T Seasonal Fluctuations: +5°C, -10°C
RH 24h Fluctuations: +- 5% RH
T 24h Fluctuations: +- 2°C

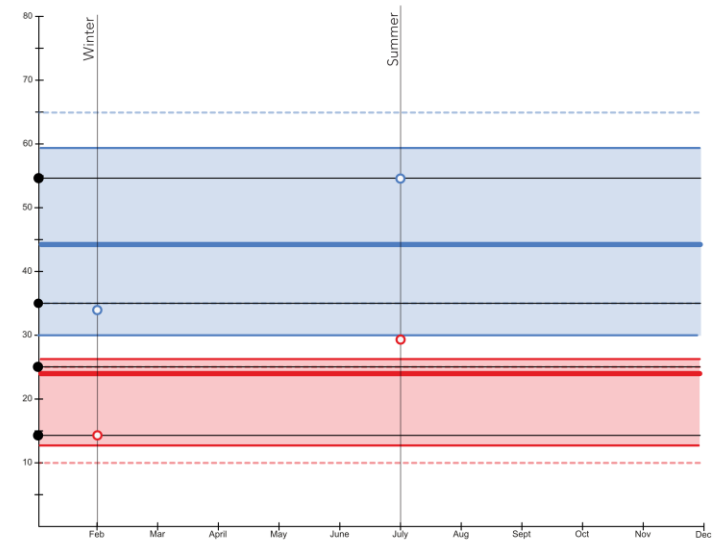
Calculated set-points for:
- Annual avg RH:44, T:24
- According to ASHRAE 2019, A1



Tmax: 25°C + 2°C/24h
Tmin: 14°C - 2°C/24h



RHmax: 54% + 5%/24h
RHmin: 35% - 5%/24h



Raising Awareness

Klimaatverklaring

Versie 1.1
Maart 2023

Voor erfgoedorganisaties

Inleiding

Erfgoedorganisaties zoals musea, archieven en bibliotheken dragen zorg voor ons erfgoed en proberen de kwetsbare objecten in hun collecties zoveel mogelijk beschikbaar te stellen aan een breed publiek, nu en in de toekomst. Om het gebruik van de collecties ook in de toekomst te garanderen worden risico's bij de bescherming ervan tot een aanvaardbaar minimum beperkt. Naast factoren als licht, pollutie, fysieke krachten en veiligheid speelt het klimaat een rol. Organisaties besteden veel tijd en aandacht aan een veilig binnenklimaat waar mens en object comfortabel zijn. Maar het binnenklimaat beheersen kost veel energie en drukt daarmee enorm op de begroting. Welke mogelijkheden zijn er om energie te besparen en toch een veilige omgeving voor erfgoedcollecties te bieden?

Urgentie

In het kader van klimaatverandering zijn erfgoedorganisaties genoodzaakt zich bezig te houden met energietransitie en het nakomen van internationaal gemaakte afspraken om significant minder CO_2 uit te stoten. Daarnaast is door de stijgende energieprijzen de noodzaak voor besparing op het energiegebruik verder toegenomen.

De laatste decennia zijn er nieuwe wetenschappelijke inzichten verkregen in de mate waarin collecties en bezoekers om een bepaald klimaat vragen. Deze inzichten bieden mogelijkheden om daadwerkelijk minder energie te gebruiken terwijl de risico's voor de objecten niet toenemen en de aanpassingen vaak juist tot een verbetering van het behoud leiden. Met deze klimaatverklaring willen wij enkele algemene uitgangspunten voor mogelijke aanpassingen aan het binnenklimaat voorstellen, zodat u collecties op een optimale wijze behouden en gepresenteerd kunnen worden zonder onnodig energieverbruik.

Hiermee sluiten we aan bij het initiatief dat in 2014 door de internationale groep van grote musea (Bizot) is genomen om o.a. de eisen van het bruikleenverkeer tussen grote musea te versoepelen [1]. Dit initiatief is vervolgens breed overgenomen door ICOM in samenwerking met IIC in de Environmental Guidelines ICOM-CC and IIC Declaration [2].

1 Bizot Green Protocol | Webpagina | The Bizot Group
2 Environmental Guidelines ICOM-CC and IIC Declaration | Webpagina | International Council of Museums - Committee for Conservation (ICOM-CC) en Canadian Conservation Institute (CCI)

Déclaration sur le climat

pour les organisations du patrimoine

Version 1.1
mars 2023

Introduction

Les organisations patrimoniales telles que les musées, les centres d'archives et les bibliothèques prennent soin de notre patrimoine. Elles visent autant que possible à rendre accessibles à un large public les objets fragiles de leurs collections, pour aujourd'hui et pour demain. Afin d'assurer l'utilisation des collections aussi pour l'avenir, nous cherchons à limiter au maximum les risques liés à leur préservation. Outre des facteurs comme la lumière, la pollution, les forces physiques et la sécurité, le climat joue également un rôle. Les organisations consacrent beaucoup de temps et d'attention à la création d'un climat intérieur sûr, pour le confort des visiteurs et la préservation des objets. Or, le contrôle du climat intérieur est très énergivore et pèse lourdement sur le budget. Quelles sont dès lors les solutions pour économiser de l'énergie tout en offrant un environnement sûr pour les collections patrimoniales ?

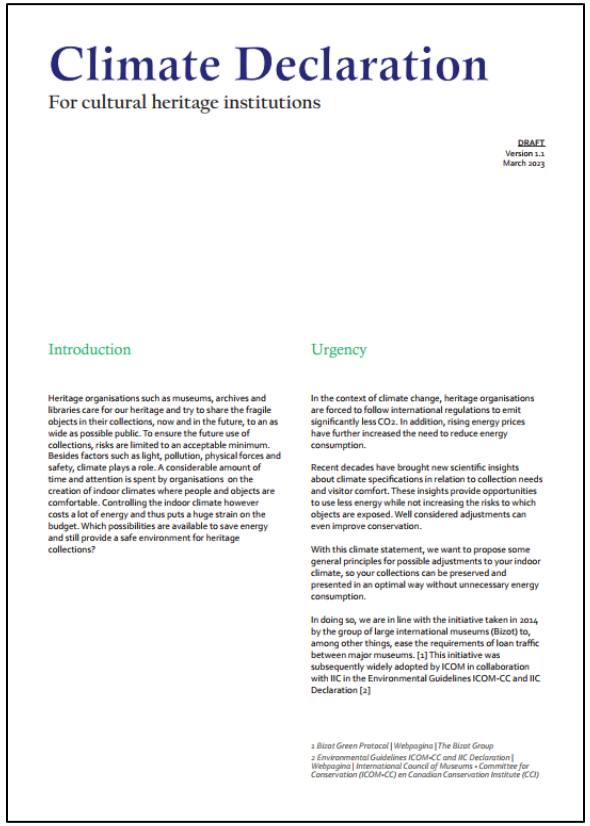
Urgence

Dans le contexte du changement climatique, les organisations du patrimoine doivent s'engager dans la transition énergétique et respecter les engagements internationaux afin de réduire significativement les émissions de CO_2. En outre, la hausse des prix de l'énergie a accentué davantage le besoin de faire des économies d'énergie.

Ces dernières dizaines d'années, nous avons acquis de nouvelles connaissances scientifiques sur les besoins climatiques spécifiques des collections et des visiteurs. Ces découvertes offrent des solutions pour diminuer sa consommation d'énergie sans augmenter les risques pour les objets. Par ailleurs, ces ajustements permettent souvent aussi d'améliorer les conditions de conservation. Cette déclaration sur le climat, vise donc à présenter quelques principes généraux fondamentaux pour une adaptation du climat intérieur afin de conserver et d'exposer les collections de manière optimale, sans gaspiller de l'énergie.

Elle s'inscrit ainsi dans la lignée de l'initiative prise en 2014 par le Groupe international des grands organisateurs de grandes expositions (Groupe Bizot), qui vise notamment à assouplir les exigences des conventions de prêts pour faciliter les échanges d'œuvres entre les grands musées. [1] Cette initiative a ensuite été largement reprise par l'ICOM en collaboration avec l'IIC dans le document Environmental Guidelines ICOM-CC and IIC Declaration. [2]

1 Bizot Green Protocol | Page internet | The Bizot Group
2 Environmental Guidelines ICOM-CC and IIC Declaration | Page internet | International Council of Museums - Committee for Conservation (ICOM-CC) en Canadian Conservation Institute (CCI)



Climate Declaration

For cultural heritage institutions

DRAFT
Version 1.1
March 2023

Introduction

Heritage organisations such as museums, archives and libraries care for our heritage and try to share the fragile objects in their collections, now and in the future, to an as wide as possible public. To ensure the future use of collections, risks are limited to an acceptable minimum. Besides factors such as light, pollution, physical forces and safety, climate plays a role. A considerable amount of time and attention is spent by organisations on the creation of indoor climates where people and objects are comfortable. Controlling the indoor climate however costs a lot of energy and thus puts a huge strain on the budget. Which possibilities are available to save energy and still provide a safe environment for heritage collections?

Urgency

In the context of climate change, heritage organisations are forced to follow international regulations to emit significantly less CO_2. In addition, rising energy prices have further increased the need to reduce energy consumption.

Recent decades have brought new scientific insights about climate specifications in relation to collection needs and visitor comfort. These insights provide opportunities to use less energy while not increasing the risks to which objects are exposed. Well considered adjustments can even improve conservation.

With this climate statement, we want to propose some general principles for possible adjustments to your indoor climate, so your collections can be preserved and presented in an optimal way without unnecessary energy consumption.

In doing so, we are in line with the initiative taken in 2014 by the group of large international museums (Bizot) to, among other things, ease the requirements of loan traffic between major museums. [1] This initiative was subsequently widely adopted by ICOM in collaboration with IIC in the Environmental Guidelines ICOM-CC and IIC Declaration [2]

1 Bizot Green Protocol | Webpagina | The Bizot Group
2 Environmental Guidelines ICOM-CC and IIC Declaration | Webpagina | International Council of Museums - Committee for Conservation (ICOM-CC) en Canadian Conservation Institute (CCI)

Nederlandstalige versie
https://www.kikirpa.be/nl/nieuws/klimaatverklaring-voor-erfgoedorganisaties

Version française
https://www.kikirpa.be/fr/nouvelles/declaration-sur-le-climat-pour-les-organisations-du-patrimoine

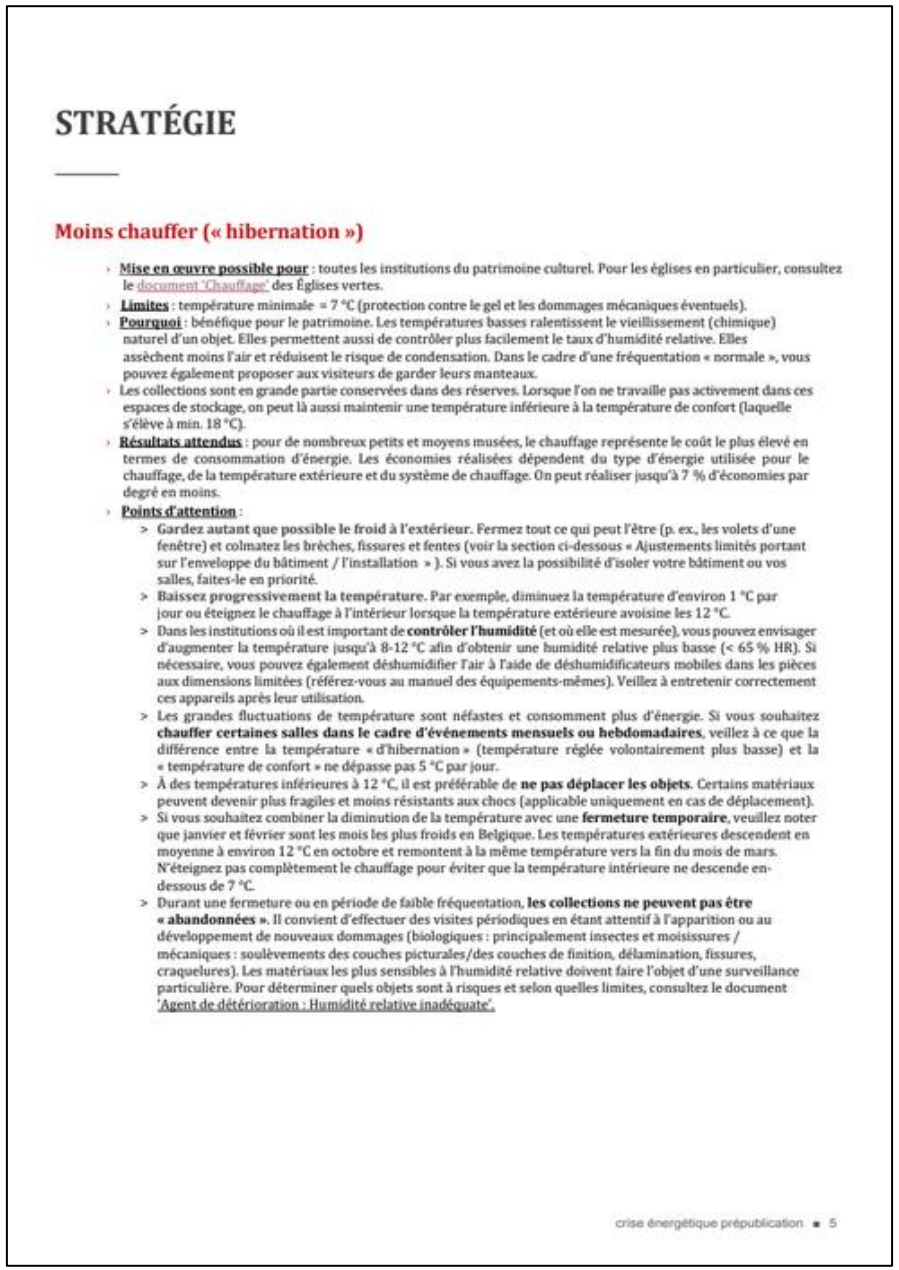
English version (draft)
https://drive.google.com/drive/folders/1IrilRWHtpiaFJSSXYcC5w9ODDbPFy4QD

→ Raising awareness about international guidelines that exist since 2014.

Energy Crisis

Dutch version
https://drive.google.com/file/d/1jEfYJx9Ys693pJQVyPy6ipusCk4KX4X1/view

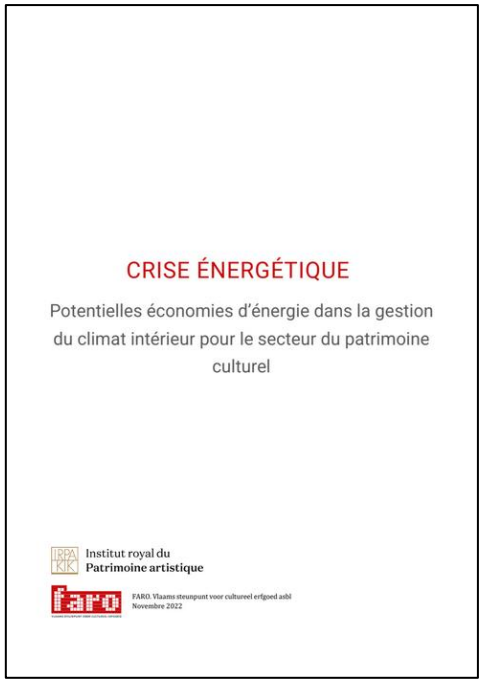
French version
https://drive.google.com/file/d/1jEfYJx9Ys693pJQVyPy6ipusCk4KX4X1/view



STRATÉGIE

Moins chauffer (« hibernation »)

- **Mise en œuvre possible pour** : toutes les institutions du patrimoine culturel. Pour les églises en particulier, consultez le document 'Chauffage' des Églises vertes.
- **Limites** : température minimale = 7 °C (protection contre le gel et les dommages mécaniques éventuels).
- **Pourquoi** : bénéfique pour le patrimoine. Les températures basses ralentissent le vieillissement (chimique) naturel d'un objet. Elles permettent aussi de contrôler plus facilement le taux d'humidité relative. Elles assèchent moins l'air et réduisent le risque de condensation. Dans le cadre d'une fréquentation « normale », vous pouvez également proposer aux visiteurs de garder leurs manteaux.
- Les collections sont en grande partie conservées dans des réserves. Lorsque l'on ne travaille pas activement dans ces espaces de stockage, on peut là aussi maintenir une température inférieure à la température de confort (laquelle s'élève à min. 18 °C).
- **Résultats attendus** : pour de nombreux petits et moyens musées, le chauffage représente le coût le plus élevé en termes de consommation d'énergie. Les économies réalisées dépendent du type d'énergie utilisée pour le chauffage, de la température extérieure et du système de chauffage. On peut réaliser jusqu'à 7 % d'économies par degré en moins.
- **Points d'attention** :
  - Gardez autant que possible le froid à l'extérieur. Fermez tout ce qui peut l'être (p. ex., les volets d'une fenêtre) et colmatez les brèches, fissures et fentes (voir la section ci-dessous « Ajustements limités portant sur l'enveloppe du bâtiment / l'installation »). Si vous avez la possibilité d'isoler votre bâtiment ou vos salles, faites-le en priorité.
  - Baissez progressivement la température. Par exemple, diminuez la température d'environ 1 °C par jour ou éteignez le chauffage à l'intérieur lorsque la température extérieure avoisine les 12 °C.
  - Dans les institutions où il est important de **contrôler l'humidité** (et où elle est mesurée), vous pouvez envisager d'augmenter la température jusqu'à 8-12 °C afin d'obtenir une humidité relative plus basse (< 65 % HR). Si nécessaire, vous pouvez également déshumidifier l'air à l'aide de déshumidificateurs mobiles dans les pièces aux dimensions limitées (référez-vous au manuel des équipements-mêmes). Veillez à entretenir correctement ces appareils après leur utilisation.
  - Les grandes fluctuations de température sont néfastes et consomment plus d'énergie. Si vous souhaitez **chauffer certaines salles dans le cadre d'événements mensuels ou hebdomadaires**, veillez à ce que la différence entre la température « d'hibernation » (température réglée volontairement plus basse) et la « température de confort » ne dépasse pas 5 °C par jour.
  - À des températures inférieures à 12 °C, il est préférable de **ne pas déplacer les objets**. Certains matériaux peuvent devenir plus fragiles et moins résistants aux chocs (applicable uniquement en cas de déplacement).
  - Si vous souhaitez combiner la diminution de la température avec une **fermeture temporaire**, veuillez noter que janvier et février sont les mois les plus froids en Belgique. Les températures extérieures descendent en moyenne à environ 12 °C en octobre et remontent à la même température vers la fin du mois de mars. N'éteignez pas complètement le chauffage pour éviter que la température intérieure ne descende en-dessous de 7 °C.
  - Durant une fermeture ou en période de faible fréquentation, **les collections ne peuvent pas être « abandonnées »**. Il convient d'effectuer des visites périodiques en étant attentif à l'apparition ou au développement de nouveaux dommages (biologiques : principalement insectes et moisissures / mécaniques : soulèvements des couches picturales/des couches de finition, délamination, fissures, craquelures). Les matériaux les plus sensibles à l'humidité relative doivent faire l'objet d'une surveillance particulière. Pour déterminer quels objets sont à risques et selon quelles limites, consultez le document 'Agent de détérioration : Humidité relative inadéquate'.

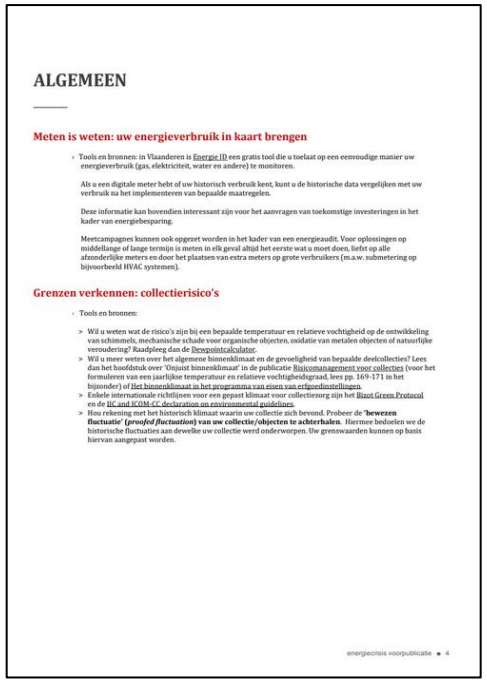


CRISE ÉNERGÉTIQUE

Potentielles économies d'énergie dans la gestion du climat intérieur pour le secteur du patrimoine culturel

Institut royal du Patrimoine artistique

FARO. Vlaams steunpunt voor cultureel erfgoed asbl
Novembre 2022



ALGEMEEN

Meten is weten: uw energieverbruik in kaart brengen

- Tools en bronnen: in Vlaanderen is Energie ID een gratis tool die u toelaat op een eenvoudige manier uw energieverbruik (gas, elektriciteit, water en andere) te monitoren.

  Als u een digitale meter hebt of uw historisch verbruik kent, kunt u de historische data vergelijken met uw verbruik na het implementeren van bepaalde maatregelen.

  Deze informatie kan bovendien interessant zijn voor het aanvragen van toekomstige investeringen in het kader van energiebesparing.

  Meetcampagnes kunnen ook opgezet worden in het kader van een energieaudit. Voor oplossingen op middellange of lange termijn is meten in elk geval altijd het eerste wat u moet doen, liefst op alle afzonderlijke meters en door het plaatsen van extra meters op grote verbruikers (m.a.w. submetering op bijvoorbeeld HVAC systemen).

Grenzen verkennen: collectierisico's

- Tools en bronnen:
  - Wil u weten wat de risico's zijn bij een bepaalde temperatuur en relatieve vochtigheid op de ontwikkeling van schimmels, mechanische schade voor organische objecten, oxidatie van metalen objecten of natuurlijke veroudering? Raadpleeg dan de Dewpointcalculator.
  - Wil u meer weten over het algemene binnenklimaat en de gevoeligheid van bepaalde deelcollecties? Lees dan het hoofdstuk over 'Onjuist binnenklimaat' in de publicatie Risicomanagement voor collecties (voor het formuleren van een jaarlijkse temperatuur en relatieve vochtigheidsgraad, lees pp. 169-171 in het bijzonder) of Het binnenklimaat in het programma van eisen van erfgoedinstellingen.
  - Enkele internationale richtlijnen voor een gepast klimaat voor collectieszorg zijn het Bizot Green Protocol en de IIC and ICOM-CC declaration on environmental guidelines.
  - Hou rekening met het historisch klimaat waarin uw collectie zich bevond. Probeer de **'bewezen fluctuatie' (*proofed fluctuation*) van uw collectie/objecten te achterhalen**. Hiermee bedoelen we de historische fluctuaties aan dewelke uw collectie werd onderworpen. De grenswaarden kunnen op basis hiervan aangepast worden.

ENERGIECRISIS

Mogelijke energiebesparingen in het binnenklimaat voor de cultureel-erfgoedsector

Koninklijk Instituut voor het Kunstpatrimonium

FARO. Vlaams steunpunt voor cultureel erfgoed vzw November 2022

To the point...

- → Support for the 'Climate Declaration' by a large number of institutions shows that **we want to participate in more sustainable energy policies within museums.**
- → The guidelines in these documents give cultural heritage institutions the means to create an adequate collection climate in a more flexible way **without being dependent on complex HVAC systems.**
- → It **allows almost all museums to save energy**, **fluctuate with the seasons,** which **reduces the risk for calamities**, and allows a larger number of museums to **exchange loans.**
- → The 'Energy Crisis' informs cultural heritage institutions on the **safest measures that can be taken in the event of an energy crisis** on the short term and based on their own climate control systems.

	Preservation metric	Tools that use it	Based on	Intended use for
MECHANICAL				
1A	Equilibrium Moisture Content (%EMC)	eClimate Notebook (IPI)	Average species of (bulky) wood	mixed collections
1B	Max (%EMC)	eClimate Notebook (IPI)	Average species of (bulky) wood	mixed collections
2	Dimensional Change (%DC)	eClimate Notebook (IPI)	Average species of (bulky) wood	mixed collections
3A	Risk Index (RI), Wooden Sculpture	Physics of Monuments (TUe)	Lime wood / wooden sculpture (bulk)	wooden sculpture
3B	Risk Index (RI), Furniture	Physics of Monuments (TUe)	* Lime wood / wooden sculpture (bulk) * Japanese lacquer and lime wood protected by it	furniture
3C	Risk Index (RI), Painted wood panel	Physics of Monuments (TUe)	* One or all of the following: panel pieces of pine, red oak and spruce * Gesso on 1cm of wooden panel	panel painting
4A	Risk Index (RI) Painting on Wood	HERIe (JH)	Different simulation for: * Types of wood: poplar, lime, oak, pine * Thickness of support: 5-40mm * Different cuts: radial and tangential * Type of gesso: soft or stiff * Water vapor transport: trough one or two faces (should represent a bare wood panel).	panel painting
4B	Risk Index (RI), Restrained wood	HERIe (JH)	Different simulation for: * Types of wood: poplar, lime, oak, pine * Thickness of support: 5-40mm * Different cuts: radial and tangential * Water vapor transport: trough one or two faces (should represent a bare wood panel).	furniture and other types of wood where the movement of the panel is restricted
5	Parchment Damage Criteria (PDC)	HERIe (JH)	* Modern restraint parchment	parchement
BIOLOGICAL				
6	Mold Risk Factor (MRF)	eClimateNotebook (IPI)	* Xerophilic (lower, +- over 60%, humidity needed for germination) * Mildew	(environments housing) mixed collections
7	Mold Growth (MG)	Physics of Monuments (TUe)	* 20-30 types of mold common in buildings * 10-20 toxic types of mold	(environments housing) mixed collections
CHEMICAL				
8A	Preservation Index (PI)	eClimate Notebook (IPI)	* Acetate film ('chemically unstable material')	mixed collections
8B	Time Weighted Preservation Index (TWPI)	eClimate Notebook (IPI)	* Acetate film ('chemically unstable material')	mixed collections
9	Lifetime Multiplier (LM)	Physics of Monuments (TUe)	* Paper * Films (synthetic) * Dyes	mixed (organic) collections with a specific pocus on paper, wooden sculpture, panel painting and furniture

Research

Tools, programming and preservation metrics

- What are preservation metrics?
- How do they relate to each other?
- How can they be applied in the field?
- What is the added benefit of analysis using programming languages such as R and Python?

→ Collaboration with dept. of Physics at UNamur.

Research

Applied research: Acetate collection Cinematek

Collection needs

Existing and new measurements

Review theoretical models

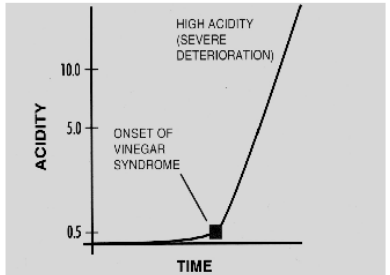


Fig. 17 Time-versus-acidity curve for acetate film. The autocatalytic part of the curve occurs at about 0.5 free acidity, the point chosen as the basis for predictions of the onset of vinegar syndrome in the *Guide*.

Figure 4: Two-stage deterioration of acetate base, from IPI's Reilly (1993) p13.

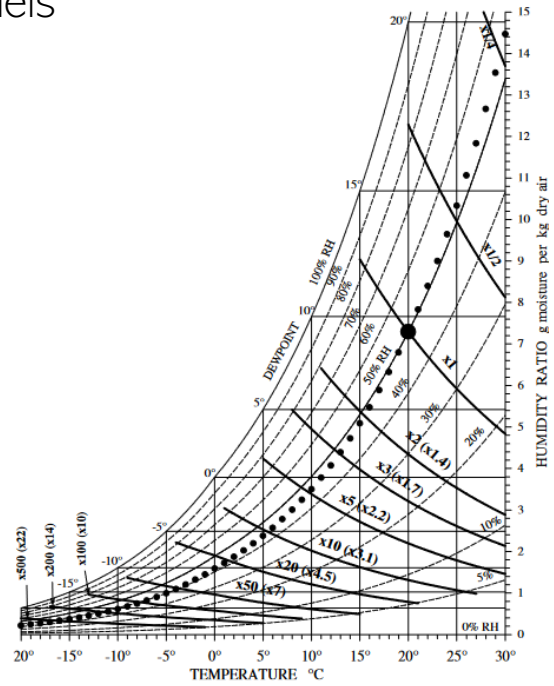


Figure 1. Lines of constant lifetime (isoperms) relative to 20°C and 50%RH, plotted on the psychrometric chart. The isoperms shown are based on the middle value of activation energy derived from the data review (100 kJmol⁻¹), and are thus best representative of deterioration in paper and film and dyes. (Values in brackets are based on the lower extreme in reported activation energy (60 kJmol⁻¹), and are thus best representative of the decay of magnetic media binders, and varnish yellowing. The shape of the isoperm lines is only accurate near 50%RH.) The dotted line is a line of constant EMC (equilibrium moisture content) that averages the corrections published for wood, paper and gelatin (i.e. a correction of 0.4% RH per degree Celcius). It indicates the correction in RH necessary in cold storage to maintain constant EMC.

Chemically unstable organic materials in modern purpose-built buildings or purpose-built rooms[j]	**Cool**	8 to 16°C, 30 to 50% rh As defined in ISO *Standard* 18934:2011. IPI (Adelstein 2009) uses an anchor of 12°C.
	Cold	0 to 8°C, 30 to 50% rh As defined in ISO-18934:2011. IPI (Adelstein 2009) uses an anchor of 4°C.
	Frozen	–20 to 0°C, 30 to 50% rh As defined in ISO *Standard* 18934:2011 and Adelstein (2009)

The benefit of low temperature storage is extended lifetime of objects that will be lost within a generation or two at room temperature. See the section Chemical Damage for details on quantifying the benefits. Biological damage is also much reduced. The risks are the many side-effects of such systems: high humidity or condensation during malfunctions, water exposure. Objects must be packaged appropriately to reduce risk of condensation during retrieval, and a transition space with intermediate climate may be required. Hourly, daily, and even longer humidity

Research

Acetate collection Cinematek

	0-Fridge		0-NoFridge		0-Fridge		Level1		Level2		Level3		Level4	
AD strip value	AD Strips (1997-2007) - level 0, fridge - depot A	AD Strips (2022) - level 0, fridge - depot A	AD Strips (1997-2007) - level 0, non fridge - depot B	AD Strips (2022) - level 0, non fridge - depot B	AD Strips (1997-2007) - level 0, fridge - depot C	AD Strips (2022) - level 0, fridge - depot C	AD Strips (1997-2007) - level 1 - depot G/I	AD Strips (2022) - level 1 - depot G/I	AD Strips (1997-2007) - level 2 - depot G/II	AD Strips (2022) - level 2 - depot G/II	AD Strips (1997-2007) - level 3 - depot G/III	AD Strips (2022) - level 3 - depot G/III	AD Strips (1997-2007) - level 4 - depot G/IV	AD Strips (2022) - level 4 - depot G/IV
<4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4,2	0	0	2	3	14	15	31	59	16	19	24	45	16	39
4,4	0	0	0	0	11	25	19	12	2	9	6	14	2	26
4,6	0	1	0	3	34	19	28	20	17	17	36	33	39	81
4,8	0	6	0	12	6	26	19	75	14	30	36	109	63	71
5	10	34	9	116	44	101	143	539	42	161	114	697	108	78
5,5	10	14	44	63	108	115	335	649	153	189	504	345	61	45
6	56	21	153	13	272	189	844	65	181	0	572	48	56	5
Total	76	76	208	210	489	490	1419	1419	425	425	1292	1291	345	345

Choose analysis tool:

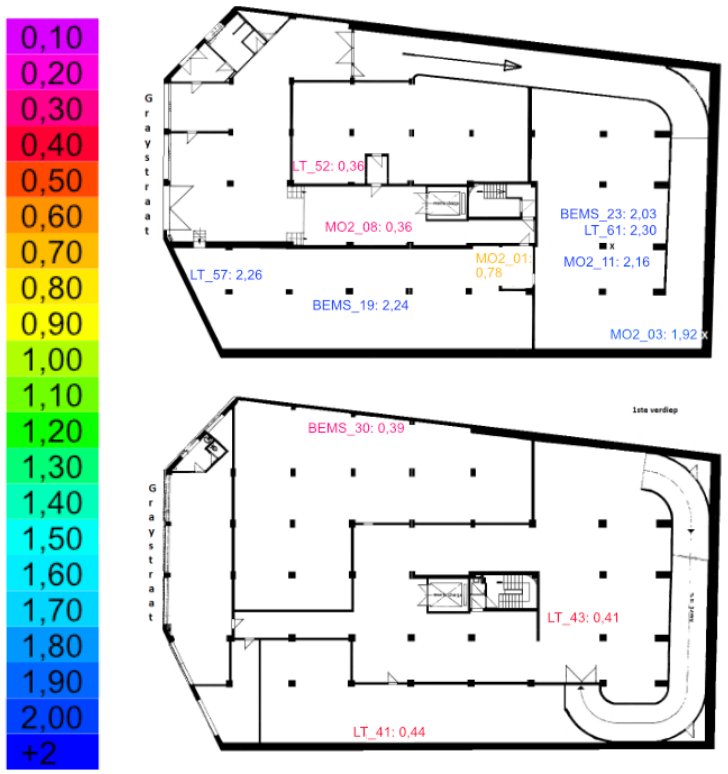
- **Python:** Create Psychrometric charts
- **Python:** perform analysis of relative expected lifetime
  Relative expected lifetime = (40/RH%)^1.3*exp[90300/8.31*(1/T-1/283)]
  With: Adapted activation energy, Adapted Comparative T and RH (based on 'cool climate' – 10°C and 40%RH)
- **Excel:** Perform simple calculations to translate relative expected lifetime to 'real lifetime'
- **Excel:** Perform calculations based on results AD strips:
  - Per depot area
  - Per stock (type of film – supplier)
  - Per year of creation
  - → Compare analysis 1990's to 2022
- **Affinity Designer:** Create visuals

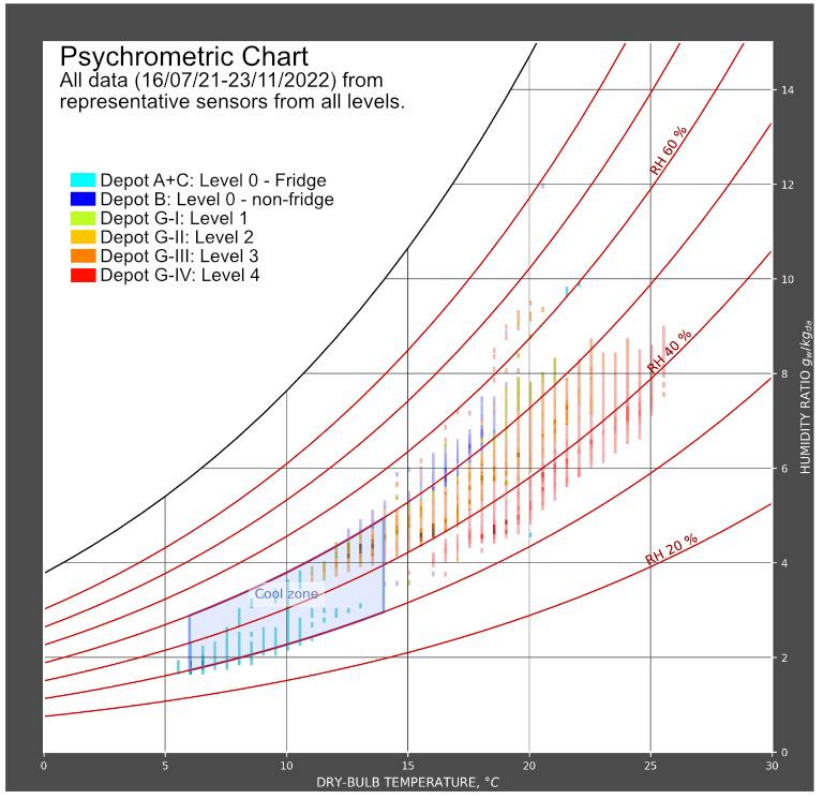
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import glob
names = []
vecteur_moy_LM_summer = []

for name in glob.glob('*.xlsx'):
    if name[-6] == 's':
        pass

    else:
        names.append(name)

        data = pd.read_excel(r'{}'.format(name)) #chargement du dataset
        df = pd.DataFrame(data)

        start_date = "21/06/2022" #en fonction de start et end date, il est possi
        end_date = "23/09/2022"

        mask = (df["Time"] >= start_date) & (df["Time"] <= end_date)
        df_season = df.loc[mask]

        column_headers = list(data.columns.values)
        #name = column_headers[0]
        time = pd.DataFrame(df_season, columns=[column_headers[1]]).to_numpy()
        T =  pd.DataFrame(df_season, columns=[column_headers[2]]).to_numpy()
        RH = pd.DataFrame(df_season, columns=[column_headers[3]]).to_numpy()
        time = np.reshape(time, -1)
        T = np.reshape(T, -1)
        T_moy = np.mean(T)
        RH = np.reshape(RH, -1)
        #print(RH)
```

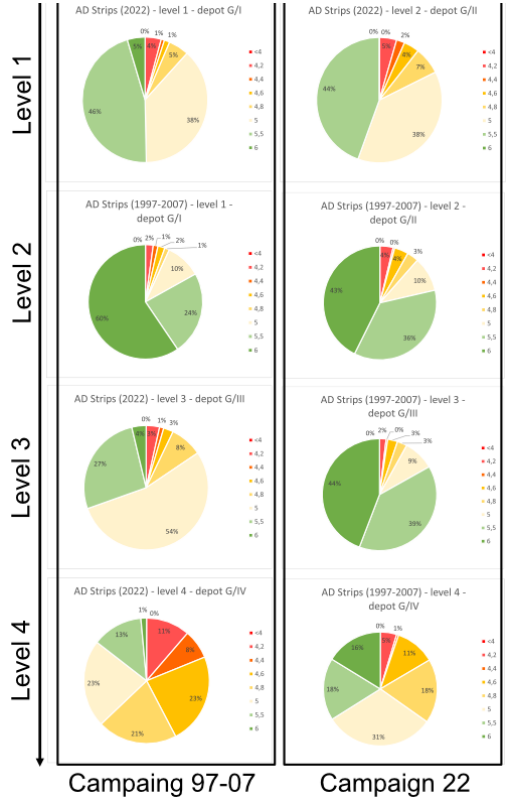
Research

Results: comparing theoretical models to symptoms.
Is short term optimization worth the effort?
Is there a possibility to reduce energy consumption?

IPI lifetime	Condition Description	AD (Danchek) strip color	Free acid value	AD Strip Value: Danchek Color Shift
0	L1 No Deterioration	Blue	0.05	pH 6,0
10	L1.5 Very Slight Curl, No yellowing	Blue	0.1	pH 5,5
20	L2 Slight Curl & Possible	Blue with Green Edges	0.15	pH 5,0
30	L2.5 Curled with Definite Yellowing	Mottled Blue-Green	0.2	pH 5,0
40	L3 Vinegar Smell, Shrinkage, Yellowing	Green	0.5	pH 4,8
45	L3.5 As Above, but Greater	Yellow-Green	0.7	pH 4,6
48	L4 Warp Begins	Yellower-Green	1.1	pH 4,6
50	L5 Bubbles Begin	Yellow +	4.0	pH 4,4
55	L6* Channeling & Highly Distorted	Yellow ++	10.0	< pH 4,0







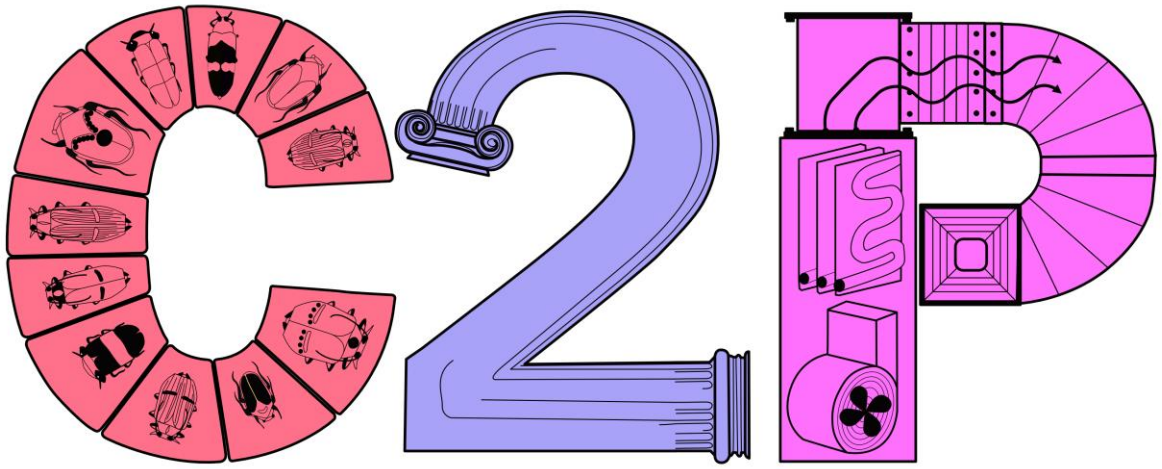
Research

Results: Conservation standards are problematic outside the fridge.
Analysis shows need for long term optimization (and big investments) or transfer to another (passive? purpose built?) building.

Training

Active need for practical training!

"Analysis of Temperature and Relative Humidity Data Workshop
The Getty conservation Institute's Managing Collection Environments Initiative (Los Angeles) and the Royal Institute for Cultural Heritage (Brussels) organized a 3-day (27-28 June. + 4 July 2022) workshop focusing on the analysis of temperature and relative humidity data. The workshop was open to students, teachers, and all heritage professionals (people working with all types of movable and immovable heritage, and people working with collections and facilities)."



CLIMATE2PRESERV

Collections · Buildings · Systems

Summer School 2024

KIK-IRPA, Jubelpark 1, 1000 Brussels
Beginning of July

Introducing the Summer School

Annelies Cosaert
(Royal Institute for Cultural Heritage, Brussels)
Estelle De Bruyn
(Royal Institute for Cultural Heritage, Brussels)

IRPA KIK

ICCROM

ACADEMIA ROYALE BELGICA

Participants and selection

Participants

- 10 institutions with 2 participants per institution:
  Technical personnel (ref. facilities) and collections staff (ref. collections)
  External collaborators are allowed
- At least 3 Belgian institutions

Selection through:

- Self assessment exercise:
  Will require early collaboration between facilities and collections
  Info about: institutional mindset, institution, building, collection, systems
  Information that can be reused in the project
- Motivation

GENERAL QUESTIONS: examples – yes/no answers

1 Are building renovations planned in the near future
2 Are there plans to transition to another or renovate your current climate control system
3 Would you consider a periodical partial or complete system shut down
4 Are you happy overall with the state of your collection present in the building that is part of the project…

SYSTEM RELATED QUESTIONS: examples - multiple choice answers

1 Information about system infrastructure
1A Which climate systems are present (% of total surface) - all that apply
1B Which heating systems are present (all that apply)
1C Which cooling systems are present (all that apply)
1D Which dehumidification systems are present
1E Which mechanical ventilation systems are present
1F Which water heating systems are present
1G When were you climate systems last renovated or installed
1H If HVAC system, how many groups control the rooms considered
1I If HVAC system, how much indoor vs outdoor air is used (intake in %)
2 Information about energy consumption
2A What is your total energy consumption (in kWh/year)
2B Which energy resources are used (all that apply)

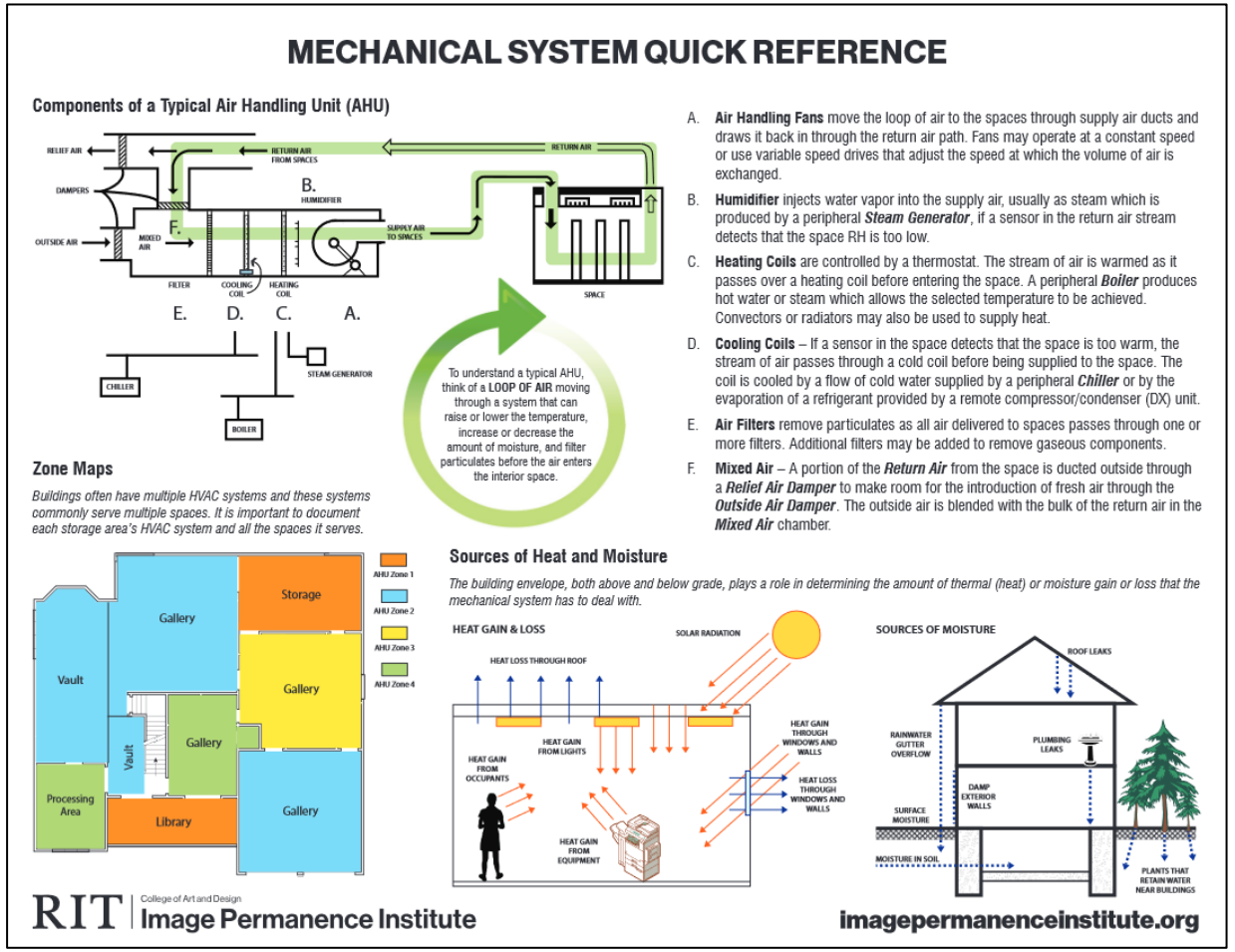
Axis

Theory
- Understanding collections, buildings and systems
- Knowing possible energy saving measures

Case-studies
- Active Case study (KIK-IRPA)
- C2P Case study visits

Tools and exercises
- CHARP and KIK-IRPA EMS system
- Energy ID
- Connections to alternative tools: T and RH analysis tools, Retscreen,…

Presentations
- Gain confidence and learn a common language



Theory including existing, openly accessible sources.
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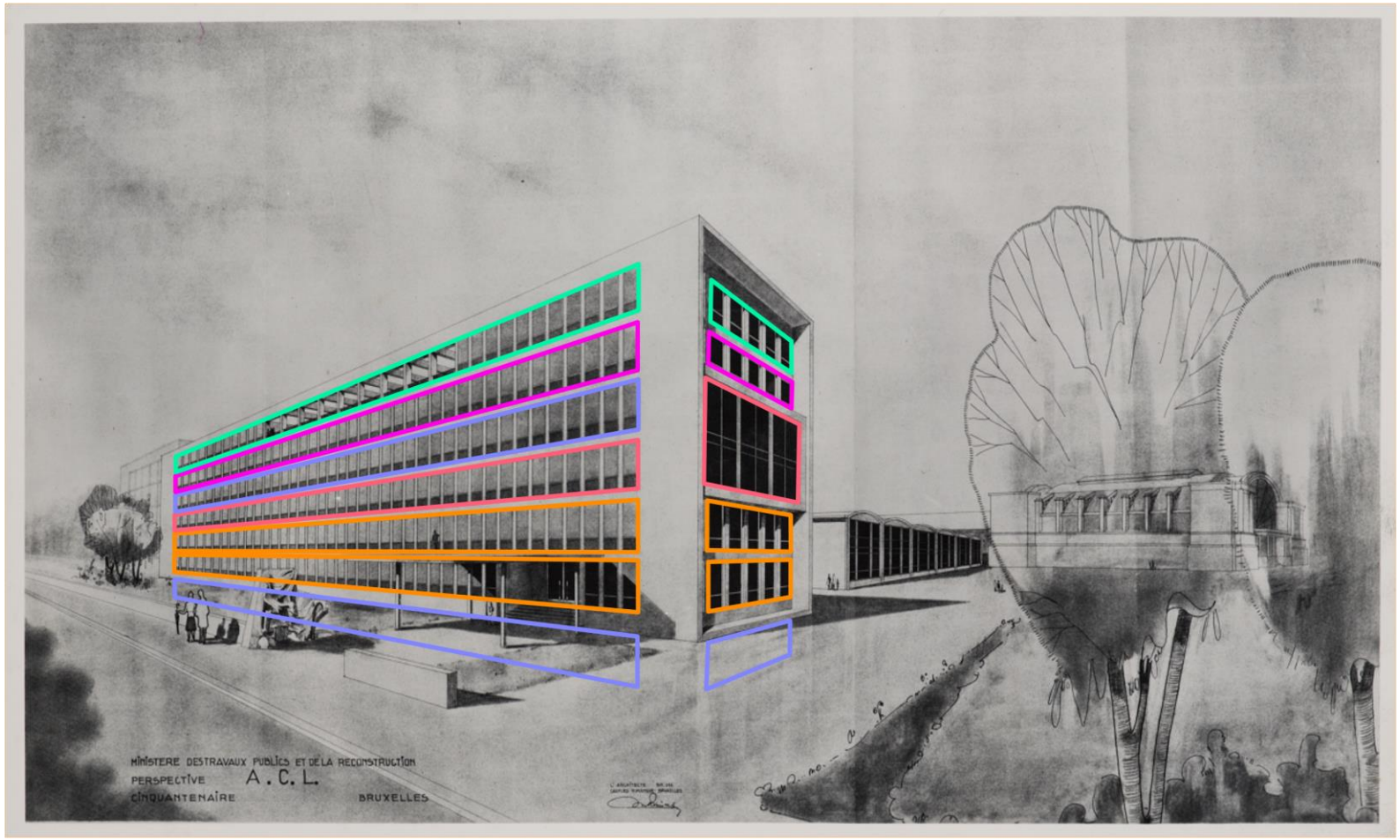

Early drawing (1959, Rimanque) for the construction of the Royal Institute for Cultural Heritage (KIK-IRPA)
© KIK-IRPA

Active case study

- Groups of 4 (link 2 institutions)
- Every group gets 1 or more floors + all available data for all floors

Floors

- -1 and 3: Photo archives and file archive
- 0 and 1: Stone atelier, large formats atelier (Rubens room) and library
- 2: Painting atelier and photo studio's macro- XRF
- 4: Wood sculptures atelier, Glass atelier and vaults
- 5: Textiles atelier, protected interior of the meeting room, hallway and directors' office

Program

		Collections	Systems	Buildings	Energy
	DAY 1 10/07/2023	**DAY 2** 11/07/2023	**DAY 3** 12/07/2023	**DAY 4** 13/07/2023	**DAY 5** 14/07/2023
09:00	Intro / Welcome *Estelle De Bruyn, Annelies Cosaert*	Collection environments basics *Names*	HVAC basics *Names*	Building envelope basics *Names*	Energy sources and energy savings basics *Names*
09:30	Participants present themselves and their institution as a duo (15 min each)				
10:30		Break	Break	Break	Break
11:00	*Names*	Introducing tools: CHARP, EMS and other T and RH analysis tools. *Names*	Introducing tools: Energy ID and RETscreen (?) *Names*	Introducing tools: Energy ID and Retscreen (?) *Names*	Group exercise: Visualize energy consumption *Names*
12:30	Lunch	Lunch	Lunch	Lunch	Lunch
13:30	Project intro: C2P, Sustainability, handbook *Names*	Group exercise: collecting and understanding collection information *Names*	Group exercise: collecting and understanding HVAC Information *Names*	Group exercise: collecting and understanding building envelope Information *Names*	Heading for and visiting KMSKB: museums and systems *Names*
15:00	Break	Break	Break	Break	
15:30 (- 17:00)	Presenting the Case-Study: KIK-IRPA *Names*	Presenting your findings to the group (15 min per group) + Q and A *Names*	Presenting your findings to the group (15 min per group) + Q and A *Names*	Presenting your findings to the group (15 min per group) + Q and A *Names*	Drink in center of Brussels (17:00h)

Program

Constraints | Energy saving options and building strategies | Communicating about decisions | Focus on your institution

	DAY 6 17/07/2023	DAY 7 18/07/2023	DAY 8 19/07/2023	DAY 9 20/07/2023	DAY 10 21/07/2023
09:00	Speed dating: what have we learned *Names*	Collection based short and long term energy savings *Names*	Building envelope based short and long term strategies for energy savings *Names*	Communication, stakeholders and leadership: making sure your plans are heard *Names*	Volunteer catch-up for questions around tools *Names*
10:30	Break	Break	Break	Break	Break
11:00	Focus on constraints: value, budget, staff, time, visitor (comfort), mission *Names*	System based short and long term strategies for energy savings *Names*	Group exercise: weiging descisions. Work with tools: cost - benefit - implications *Names*	Group exercise, roleplay: uniting different interests. Goal oriented diplomacy *Names*	Institutional exercise: making your battle plan. Creating a team and indentifying stakeholders *Names*
12:30	Lunch	Lunch	Lunch	Lunch	Lunch
13:30	Group exercise: Identifying influencial factors *Names*	Visiting Cinematek: short term and long term aspirations	Group exercise: weiging descisions. Developing 2 possible strategies for energy savings *Names*	Presenting common plan (for KIK-IRPA) to stakeholders as a team *Names*	Presenting your institutional plan to the group (20 min)
15:00	Heading for the Wiertz Museum		Break	Ending of day	
15:30 (- 17:00)	Visiting the Wiertz Museum: value set bounderies *Names*	*Names*	Presenting your findings to the group (20 - 30 min per group) *Names*	Volunteer catch-up for questions around tools *Names*	Presenting your institutional plan to the group (20 min) *Names*
				Dinner (19:00h)	

Program

	DAY 6 17/07/2023	DAY 7 18/07/2023	DAY 8 19/07/2023	DAY 9 20/07/2023	DAY 10 21/07/2023
09:00	[illegible] what have we learned *Names*	Collecti[illegible] based short and long term energy savings *Names*	Building envelope based short and long term strategies for energy savings *Names*	Communication, stakeholders and leadership: making sure your plans are heard *Names*	Volunteer catch-up for questions around tools *Names*
10:30	Break	Break	Break	Break	Break
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13:30	Group exercise: Identifying influencial factors *Names*	Visiting Cinematek: short term and long term aspirations	Group exercise: weiging descisions. Developing 2 possible strategies for energy savings *Names*	Presenting common plan (for KIK-IRPA) to stakeholders as a team *Names*	Presenting your institutional plan to the group (20 min)
15:00	Heading for the Wiertz Museum		Break	Ending of day	
15:30 (- 17:00)	Visiting the Wiertz Museum: value set bounderies *Names*	*Names*	Presenting your findings to the group (20 - 30 min per group) *Names*	Volunteer catch-up for questions around tools *Names*	Presenting your institutional plan to the group (20 min) *Names*
				Dinner (19:00h)	

DECISION - MAKING

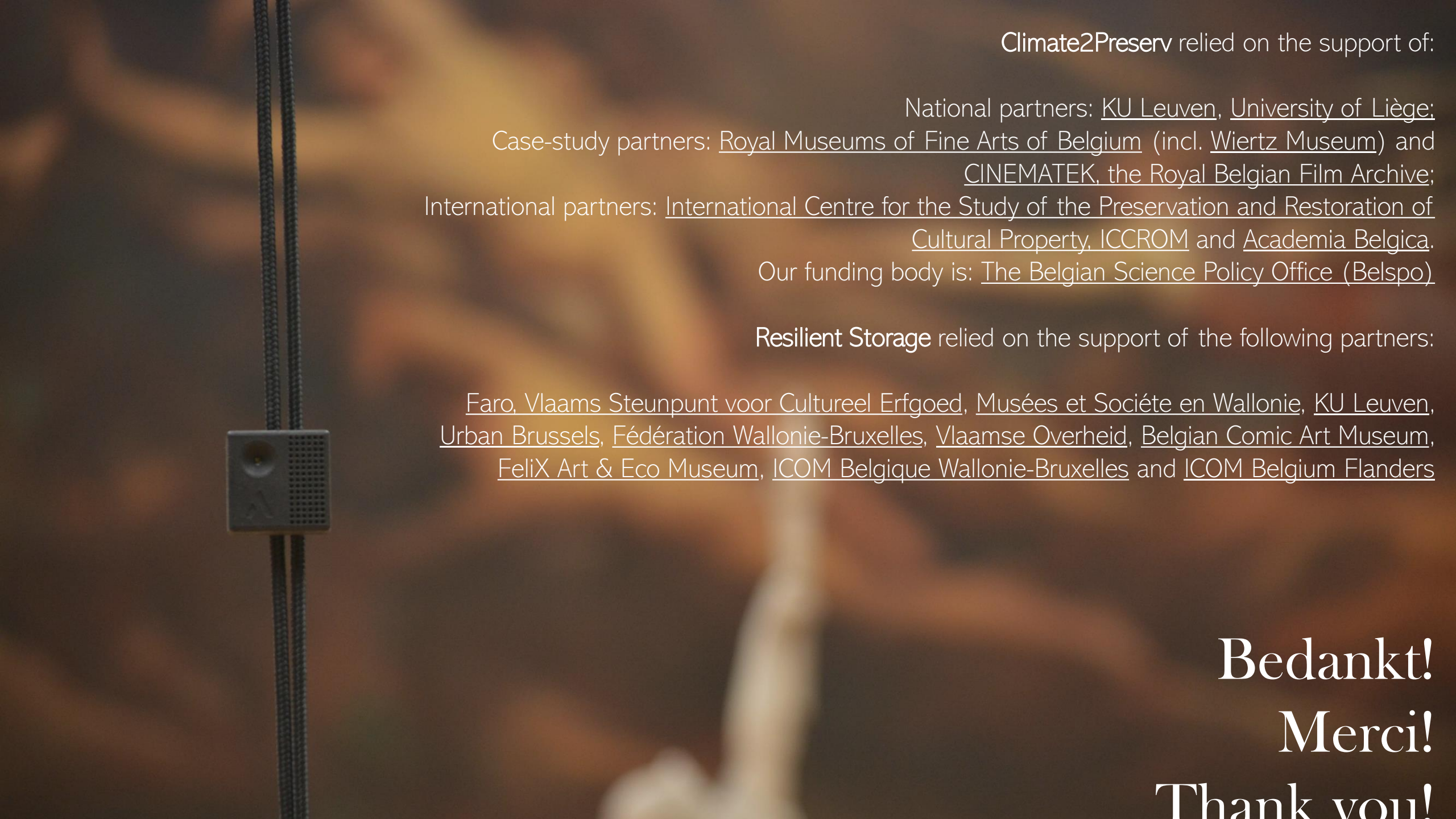
Theory
Exercise
Presentation
Visits

Collaboration

- Collaboration with **regional partners, universities, case-study partners, engineering / architecture firms and international partners**.
- Chairs **for het Nemo (Network of European Museum Organizations) sustainability group** and are involved in the **revision of the European norm 'NF EN 16883'** through AFNOR (Association Française de Normalisation).
- Unite experts in **collection care**, **building physics and architecture**, and **energy and climate control systems** in all our projects.
- Publications are a joined effort with help from (amongst others) **RCE, Faro and MSW**.

Some conclusions

- Protocol is not enough, **motivation** is very important.
- Existing **relations between facilities and collection department** must be good, or have potential to improve
- **Support** from management, adminitrative services, building services, government, must be present.
- Still an active need for **training and raising awareness**.
- It is energizing to **keep contact with similar projects** in the sector.
- After these projects other collection care needs can be prioritized.



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National partners: KU Leuven, University of Liège;
Case-study partners: Royal Museums of Fine Arts of Belgium (incl. Wiertz Museum) and CINEMATEK, the Royal Belgian Film Archive;
International partners: International Centre for the Study of the Preservation and Restoration of Cultural Property, ICCROM and Academia Belgica.
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Bedankt!
Merci!
Thank you!

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Referencies
Références

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