

Certificação ambiental de edifícios, um enquadramento

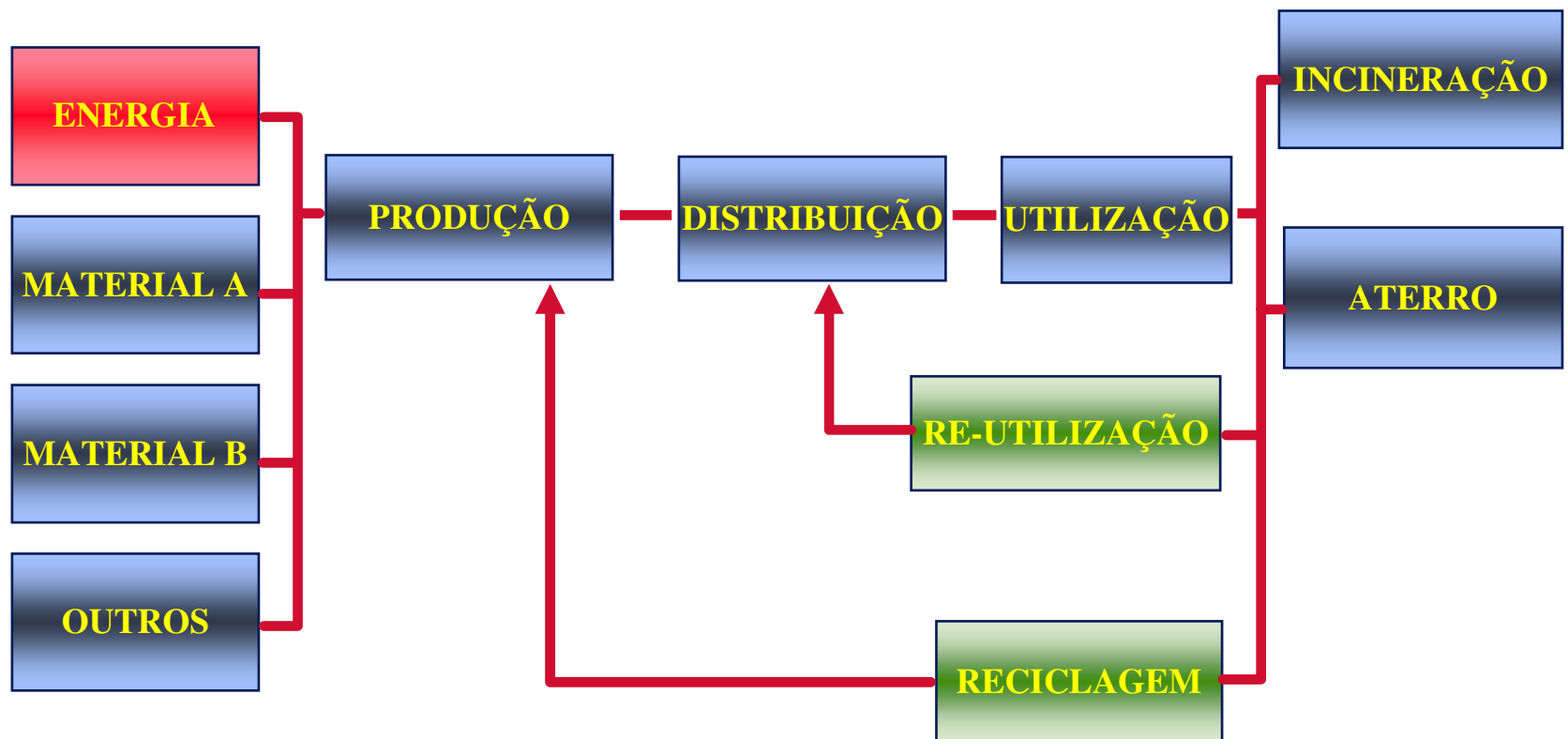
IN+ Center for Innovation, Technology and Policy Research
Centro de Estudos em Inovação, Tecnologia e Políticas de Desenvolvimento

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Ambiental...

- O que é um impacte ambiental,
- Como se calcula?
- Com que referência?
- Qual o sistema a considerar?
- ...?

O ciclo de vida do produto



ACV - Contexto

Os princípios associados à ACV encontram-se especificados nas normas **ISO 14040** e seguintes. A ISO 14040 define ACV como:

Compilação dos fluxos de entradas e saídas e avaliação dos impactes ambientais associados a um produto ao longo do seu ciclo de vida.

Produto/serviço - Função,
Unidade funcional

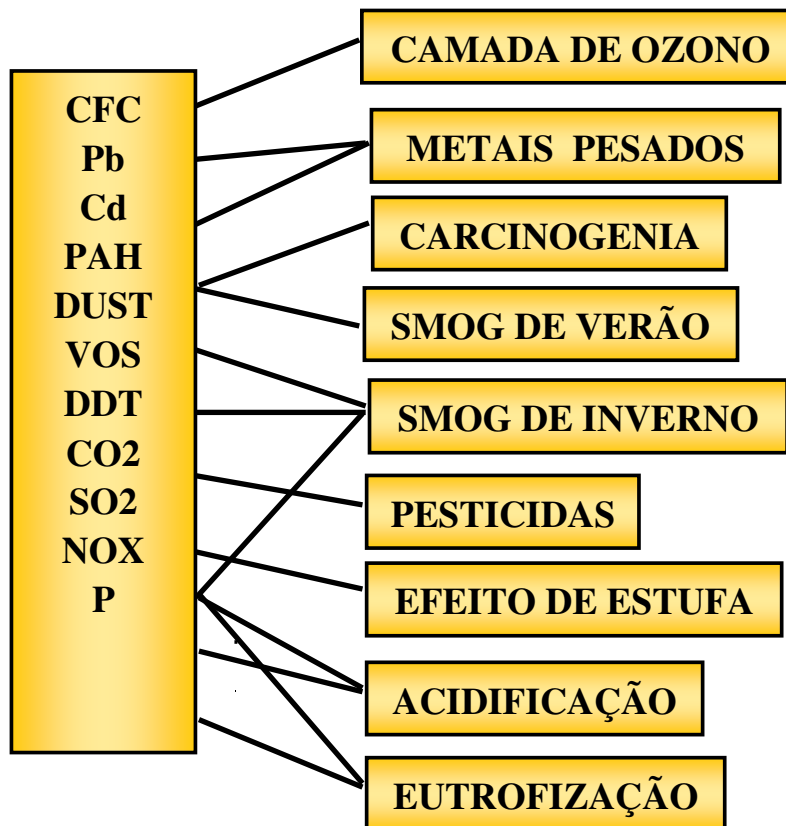
Modelos e incerteza

- **Tecnosfera: Modelação de sistemas tecnológicos.**
 - É, de uma forma geral, uma fase na qual se consegue uma elevada precisão (a incerteza é inferior a um factor de 2)
- **Ecosfera: Modelação de mecanismos ambientais.**
 - É, de uma forma geral, uma fase na qual a incerteza pode abranger ordens de grandeza
- **Valoresfera: Modelação opções subjectivas.**
 - Por exemplo, avaliar a importância relativa de diferentes categorias de impacte ambiental. Tipicamente uma área no foro das ciências sociais. Não é correcto falar de incertezas porque não há uma verdade absoluta

Métodos para Avaliação de Impactes Ambientais

- CML 92
- EPS 2000
- Eco-indicador 95
- Eco-Indicador 99

ACV - CATEGORIAS DE IMPACTE AMBIENTAL



**Intervenção
ambiental**

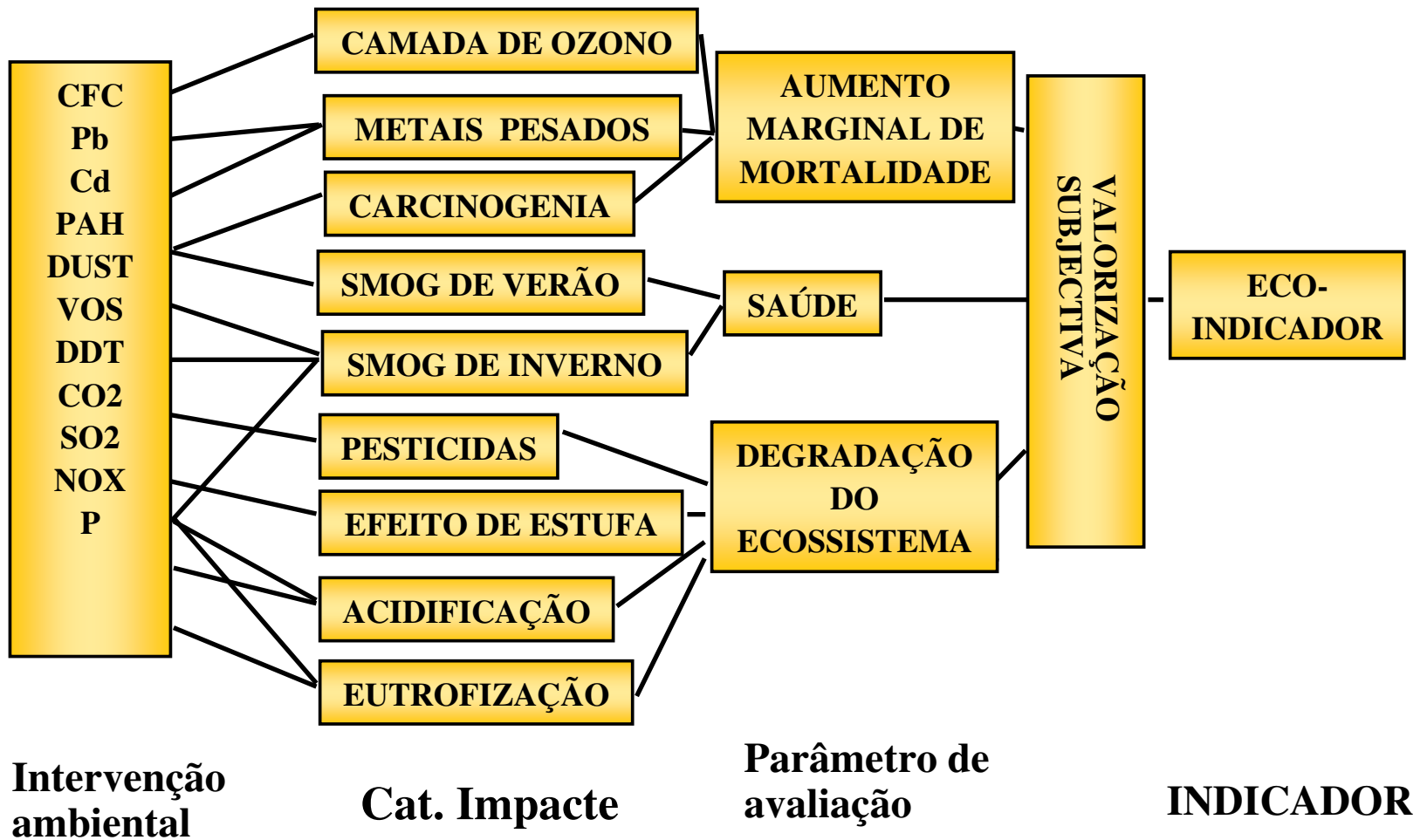
Cat. Impacte

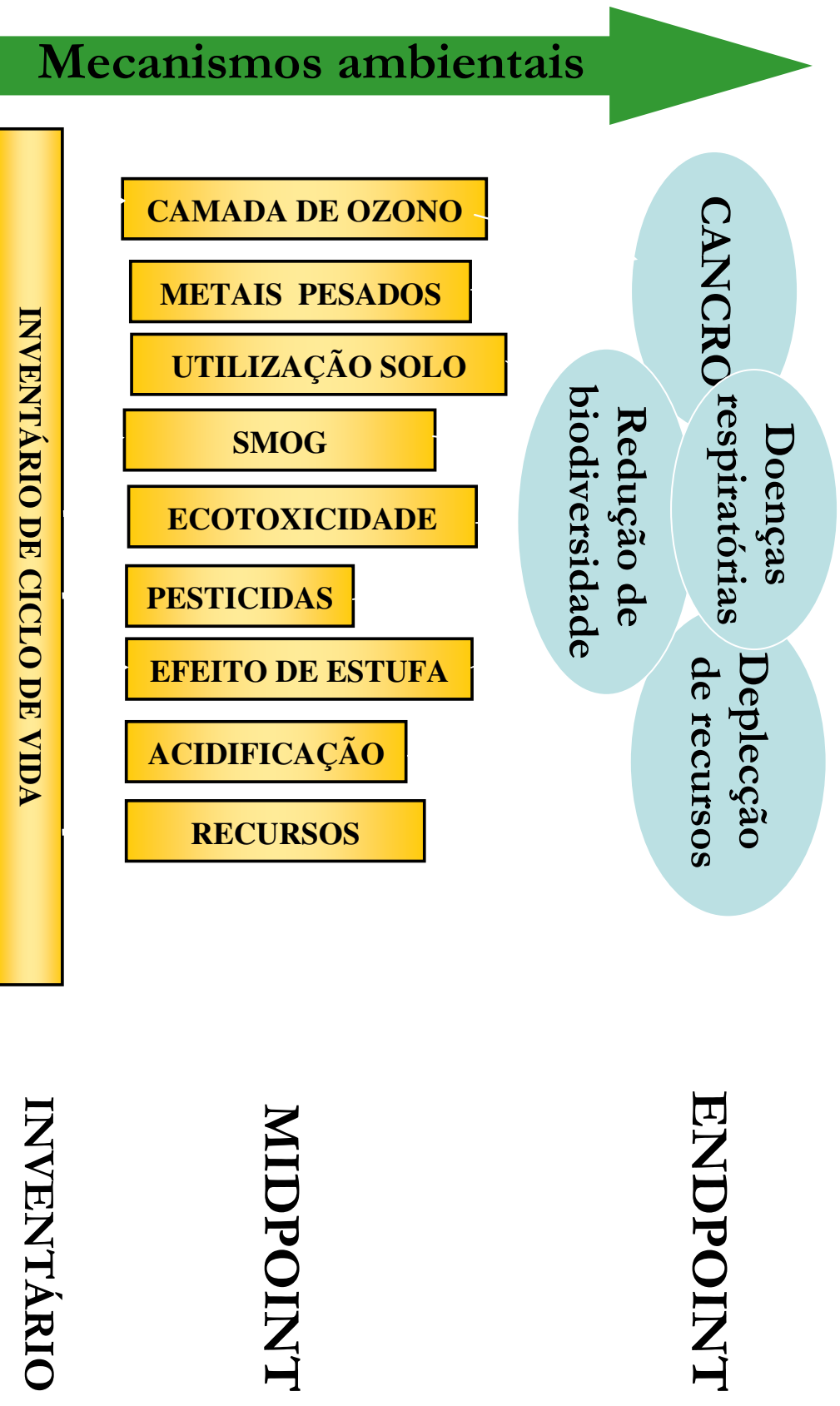
ACV - Caracterização

IN+

| Efeito de estufa | kg _{CO2} equivalente | Camada de ozono | Kg _{CFC11} equivalente |
|-----------------------|-------------------------------|------------------|---------------------------------|
| CC-13 | 13000 | HALON-1301 | 16 |
| CFC (hard) | 7100 | HALON-2402 | 7 |
| CFC-12 | 7100 | HALON-1211 | 4 |
| CFC-114 | 7000 | HALON-1201 | 1,4 |
| CFC-115 | 7000 | HALON-1202 | 1,25 |
| CFC-116 | 6200 | Tetraclorometano | 1,08 |
| HALON-1211 | 4900 | CFC-113 | 1,07 |
| HALON-1301 | 4900 | CFC (hard) | 1 |
| CFC-113 | 4500 | CFC-11 | 1 |
| CFC-14 | 4500 | CFC-12 | 1 |
| HFC-143a | 3800 | CFC-13 | 1 |
| CFC-11 | 3400 | CFC-114 | 0,8 |
| HFC-125 | 3400 | methyl bromide | 0,6 |
| HCFC-142b | 1800 | CFC-115 | 0,5 |
| CFC (soft) | 1600 | HALON-2401 | 0,25 |
| HCFC-22 | 1600 | HALON-2311 | 0,14 |
| Tetraclorometano | 1300 | Tricloroetano | 0,12 |
| HFC-134a | 1200 | HCFC-141b | 0,11 |
| HCFC-141b | 580 | HCFC-142b | 0,065 |
| HCFC-124 | 440 | CFC (soft) | 0,055 |
| | 270 | HCFC-22 | 0,055 |
| HFC-152a | 150 | HCFC-225cb | 0,033 |
| 1,1,1-trichloroethane | 100 | HCFC-225ca | 0,025 |
| HCFC-123 | 90 | HCFC-124 | 0,022 |
| Triclorometano | 25 | HCFC-123 | 0,02 |
| Diclorometano | 15 | | |
| Metano | 11 | | |
| CO2 | 1 | | |

ACV – AVALIAÇÃO: ECO-INDICADOR 95





INVENTÁRIO DE CICLO DE VIDA

INVENTÁRIO

MIDPOINT

ENDPOINT

Eco-indicador 95 ➔ EcoIndicador 99

Eco-indicador 95

Eco-indicador 99:

Bottom-up approach

Top-Down approach

- **Saúde Humana** (todos os seres humanos, no presente e no futuro, devem estar livres de doenças ou morte por causas ambientais)
- **Qualidade dos Ecossistemas** (as espécies não devem sofrer alterações disruptivas das suas populações ou localização geográfica)
- **Recursos** (os recursos naturais essenciais para a subsistência da sociedade humana, devem estar disponíveis para as futuras gerações)

Saúde Humana

DALY – Disability Adjusted Life Years

- Este valor é calculado com base em contributos de:
 - Doenças Respiratórias
 - Cancro
 - Alterações climáticas
 - Diminuição da camada de ozono
 - Radiação ionizante

Saúde Humana

Metodologia de cálculo:

- Consequências do poluente: relacionar as emissões a uma alteração temporária da composição
- Exposição: relacionar a alteração da concentração com a dose que os indivíduos recebem
- Efeito: relacionar a dose com o número e o tipo de efeito na saúde
- Perturbação à vida: relacionar o efeito com DALY

Qualidade dos ecossistemas

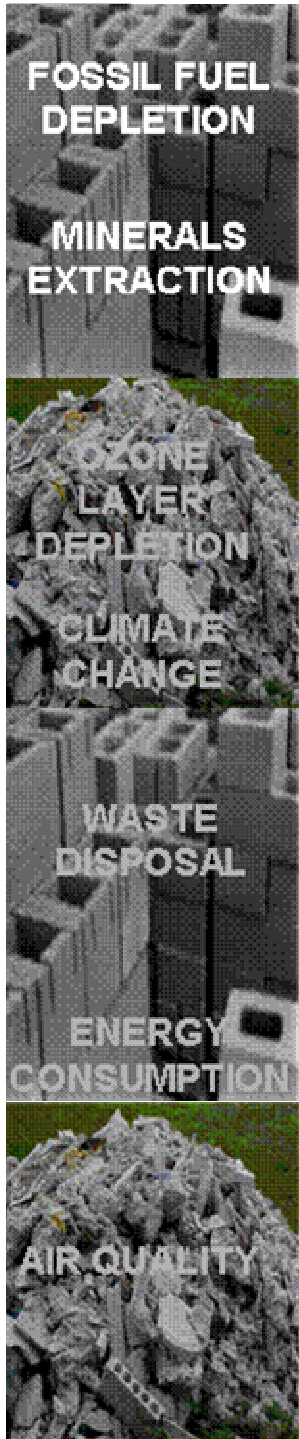
- PDF*m²*ano** – Percentagem de espécies que desapareceram de uma área durante determinado tempo
- Este valor é calculado com base em contributos de:
 - Ecotoxicidade (PAF – Potentially Affected Fraction, % de espécies expostas a uma concentração nociva)
 - Acidificação e Eutrofização (POO – Probability of Occurrence, de uma planta num determinado local, PDF = 1-POO)
 - Utilização do solo (PDF – Potentially Disappeared Fraction)

RECURSOS

MJ/kg – Energia adicional que será necessário gastar para extrair este recurso, quando a humanidade tiver extraído N vezes superior ao total extraído até 1990.

Tomou-se $N=5$

- ...e agora...
- Como é a realidade do edifício ?



| LEED Criteria | BREEAM Criteria |
|---|--|
| Minimum energy performance | Reduction of energy consumption and CO ₂ emissions resulting from site activities and from transport to and from site |
| CFC reduction in HVAC&R equipment | Reduction of construction waste on site |
| Optimize energy performance: Lighting power; Lighting controls; HVAC; Equipment & appliances | Lighting controls |
| Tenant space, Long-term commitment (≥ 10years) | Tenant space, Long-term commitment (50 years) |
| Storage and collection of recyclables | Central storage space for recyclable materials |
| Building reuse, Maintain 40% of interior non-structural components | Reuse of building façade and structure |
| Building reuse, Maintain 60% of interior non-structural components | Recycled aggregates or masonry in the building structure |
| Construction waste management, Divert 50% form landfill | Control of NO _x emissions from heating sources |
| Construction waste management, Divert 75% form landfill | Boiler maintenance |
| Resource reuse, 5% | Embodied impacts: Building; External hard building & Site boundary protection |
| Resource reuse, 10% | Food refrigeration cabinets with CFC and HCFC free insulation |
| Resource reuse, 30% Furniture and furnishings | Thermal insulating materials with zero ODP and GWP |
| Recycled content, 10% or 20% (post-consumer+ ½ pre-consumer) | Food refrigerant systems using zero ODP refrigerants |
| Regional materials, 20% manufactured regionally | Refrigerant with zero ODP and GWP less than 5 |
| Regional materials, 10% extracted and manufactured regionally | Refrigerant leak detection and recovery systems |
| Rapidly renewable materials | Planned refrigerant leak detection procedures |
| Certified wood | Sustainably sourced timber |
| Low-emitting materials: Adhesives & sealants; Paints and coatings; Carpet systems; Composite wood & laminate adhesives; systems furniture & seating | Low impact paints and varnishes |
| Ozone protection | CFC and HCFC free insulations |
| Indoor chemical and pollutant source control | Fire services maintenance procedures |



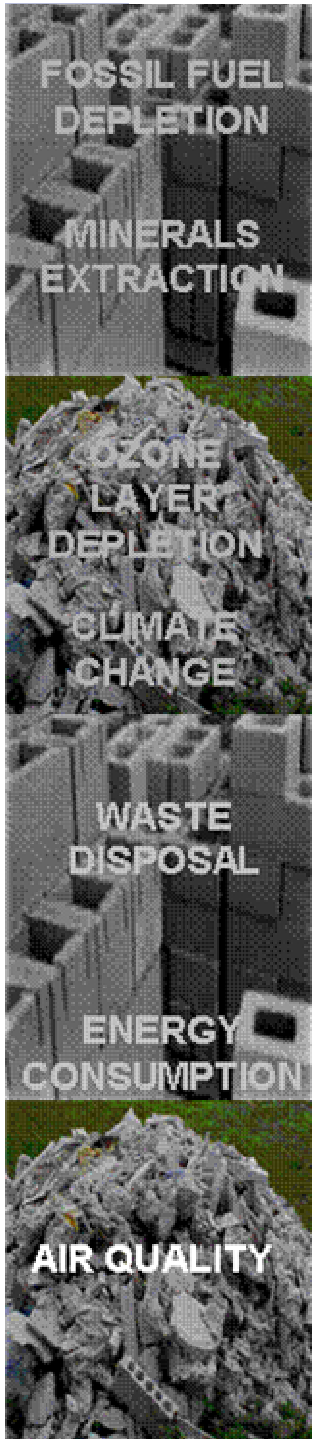
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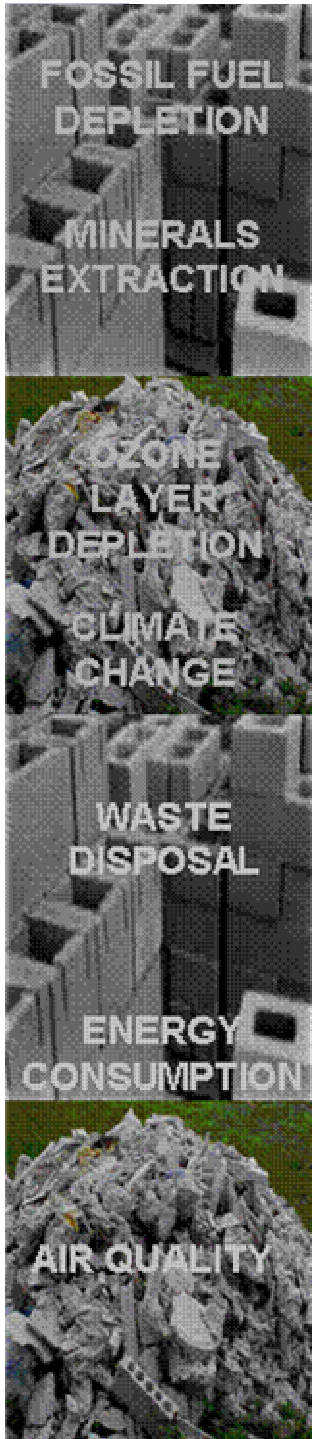
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- ...há espaço para novas métricas!
- ...precisamos delas!!
- Vamos analisá-las...