

GRUPO DE TRABALHO SOBRE SISTEMAS PREDIAIS

AIR POLLUTION IN NUMBERS

AIR POLLUTION AFFECTS NEARLY ALL OF US

An estimated **6.5 million** deaths were associated with air pollution in 2012. This is **11.6% of all global deaths.**

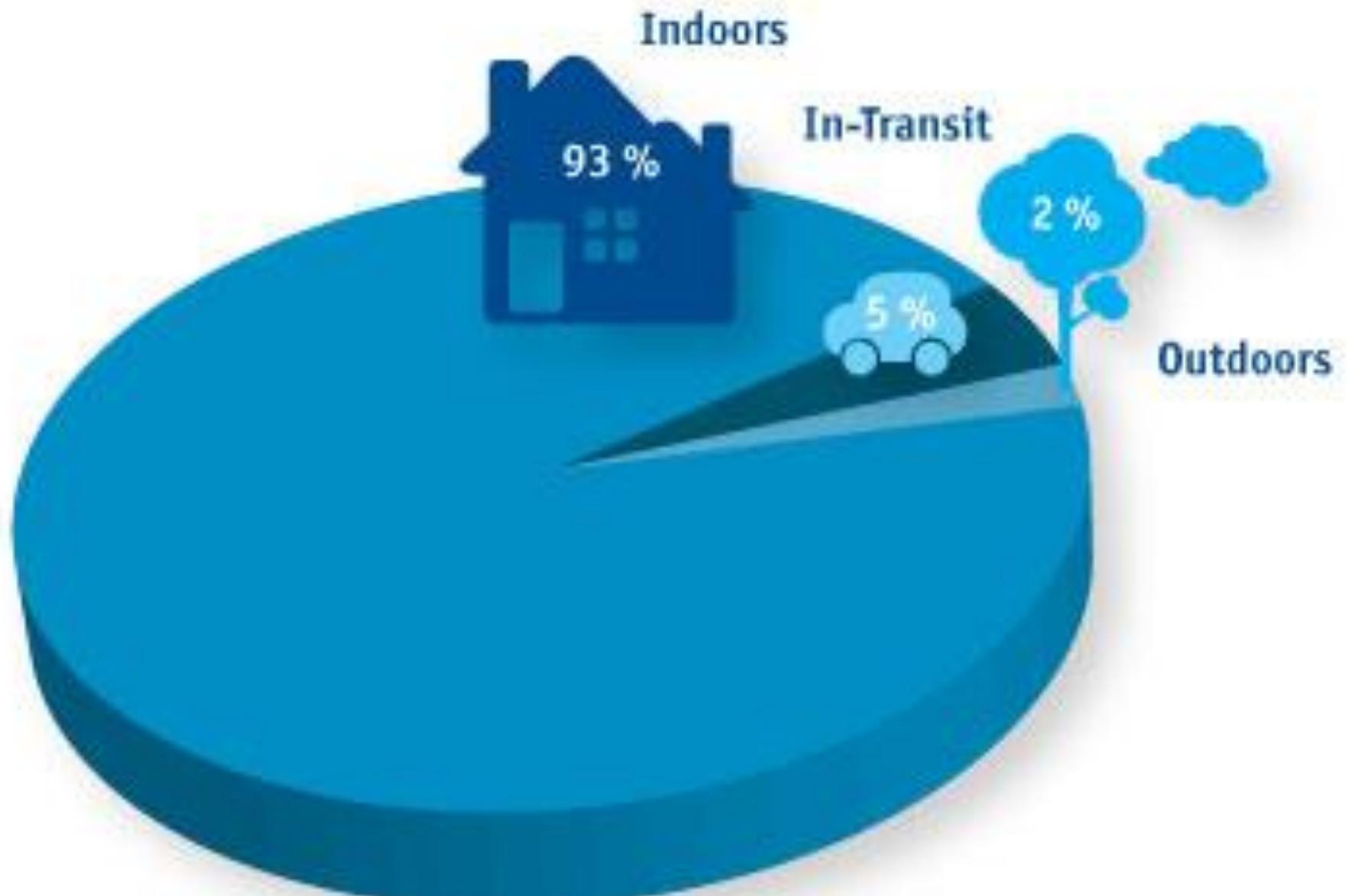
Fonte: Organização Mundial da Saúde



**PERIGO
GASES TÓXICOS**



GASES E MATERIAL PARTICULADO



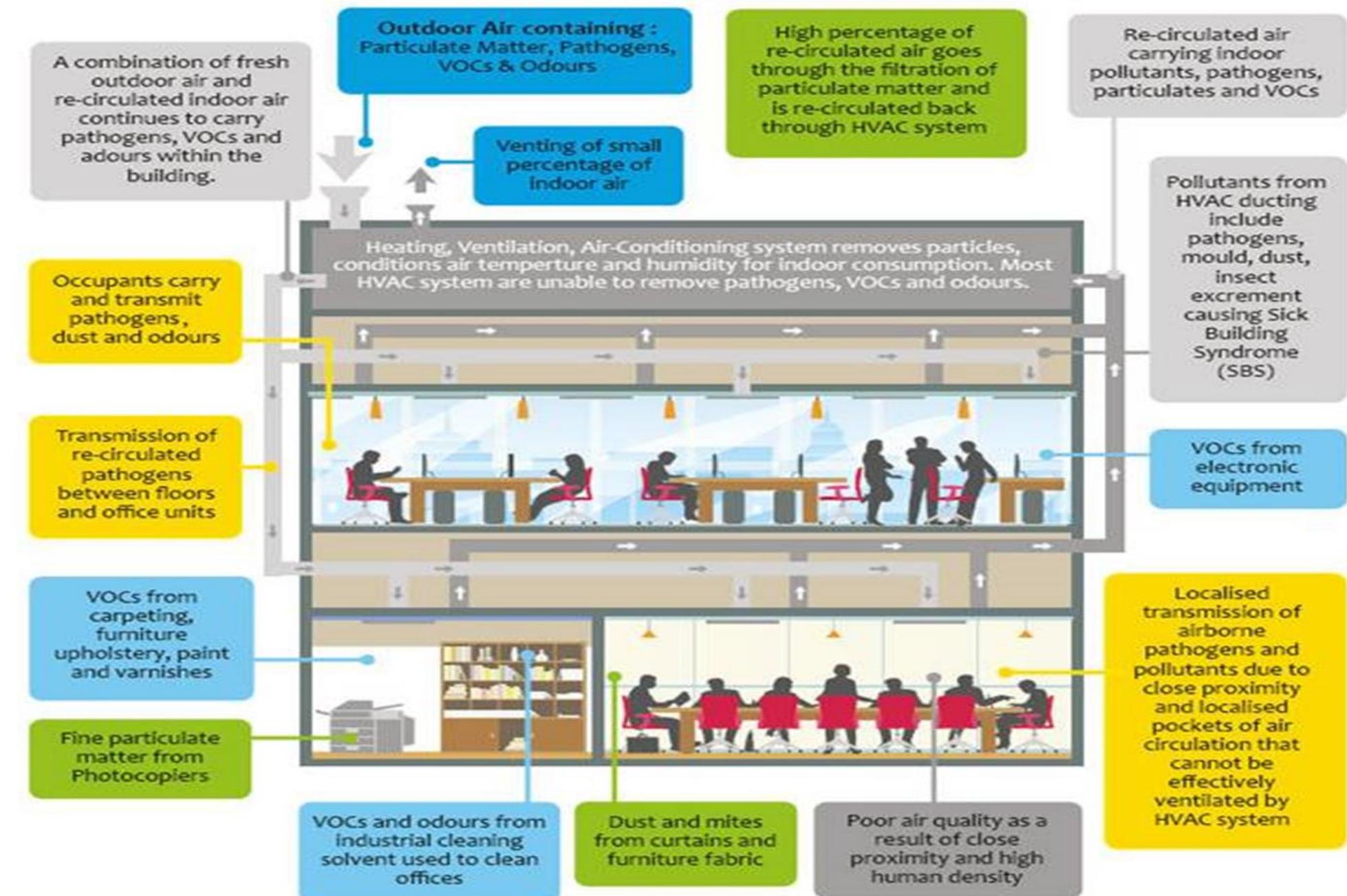
INDOOR AIR IS MORE POLLUTED



People spend more than 90% of their time indoors; air pollutants indoors are 2-5 times higher than outdoors.

Source: US EPA and National Institutes of Health

Air Quality at Work



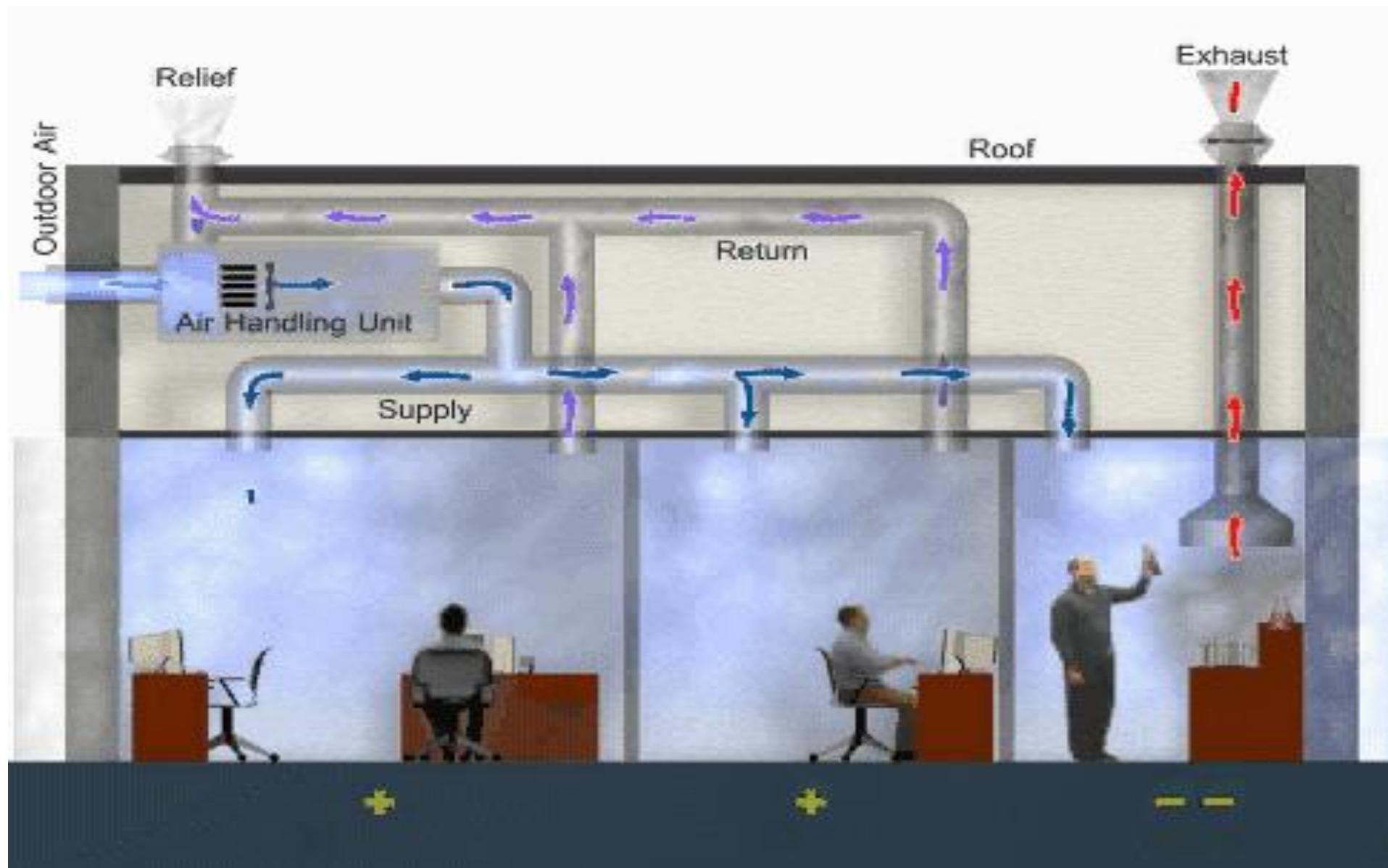


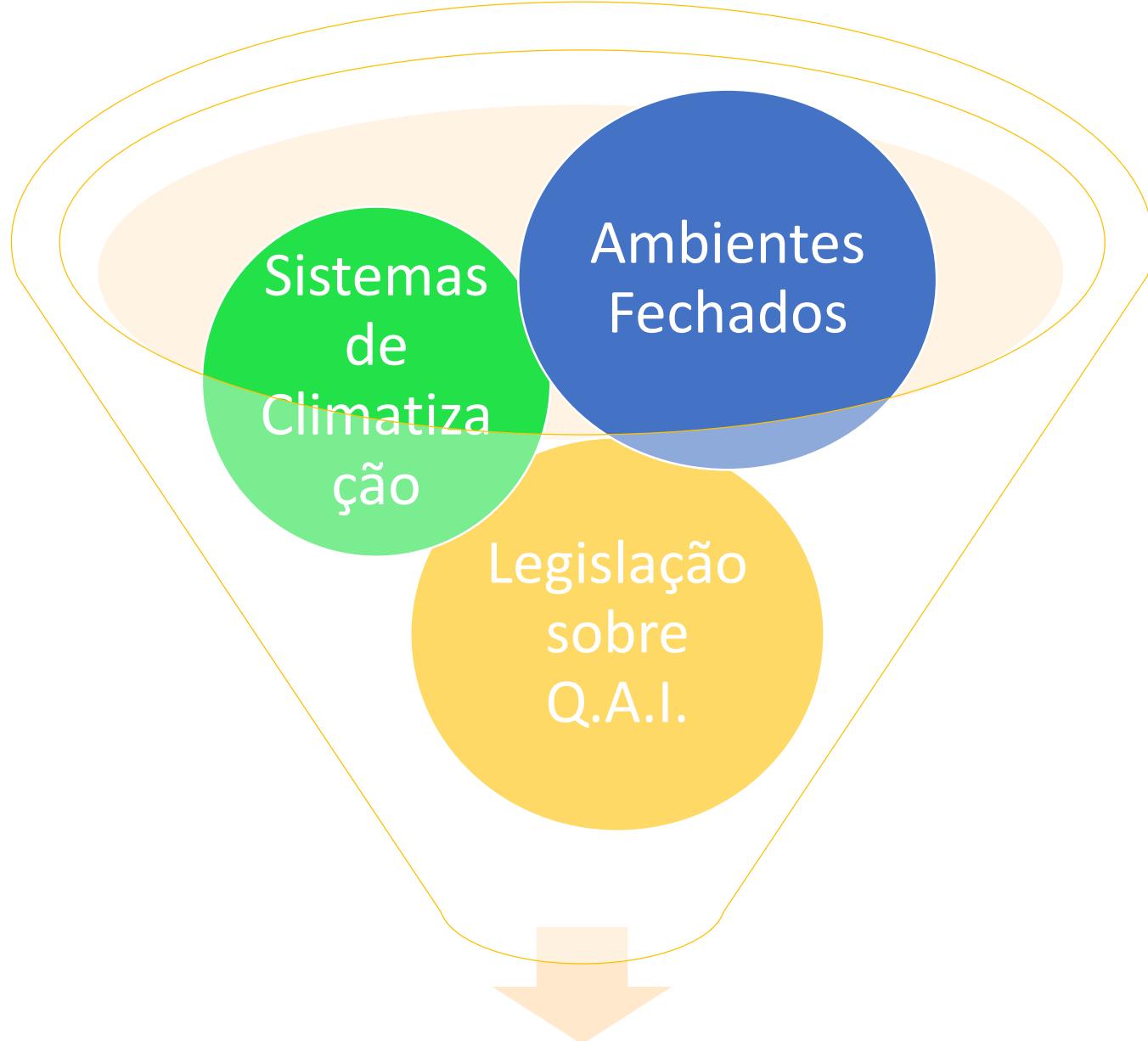




**PARA NOS PROTEGER,
CONTAMOS COM UM GRANDE
ALIADO**

SISTEMA DE CLIMATIZAÇÃO





Qualidade de Vida e
Produtividade

BENEFÍCIOS

✓ QUESTÃO LEGAL

✓ PRODUTIVIDADE

Principais documentos necessários

- **PMOC** – Plano de Manutenção, Operação e Controle do sistema de ar condicionado
- Planta/ desenho sistema de ar condicionado
- Relatório de ensaio da **qualidade do ar** – semestral

RENABRAVA 06 – GUIA DE INSPEÇÃO DE SISTEMAS DE AR CONDICIONADO

RENABRAVA 07 - Cartilha de Orientação sobre Manutenção de Sistemas de Climatização

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Inicio do processo de **fiscalização** na cidade de São Paulo

2004 - Inicio do Processo pelo Ministério Publico do Trabalho e COVISA – Processo Administrativo 7376/2004

A COVISA visitou 10 shoppings centers para verificar a situação do ar condicionado.

2007/2008 - A partir das visitas foi criado uma NOTIFICAÇÃO RECOMENDATÓRIA enviada a 50 shoppings centers

2011 - INICIO DAS AÇÕES PARA ASSINATURA DO TAC

BENEFÍCIOS

✓ QUESTÃO LEGAL

✓ PRODUTIVIDADE

FIGURE 1: Life cycle building costs breakdown

From Figure 1 it's easy to see that the energy cost is the largest single item in the annual facility budget, and if you amortize the original building construction over a 30-year life, the cost of the energy used within the building easily exceeds the cost to put up the building in the first place.

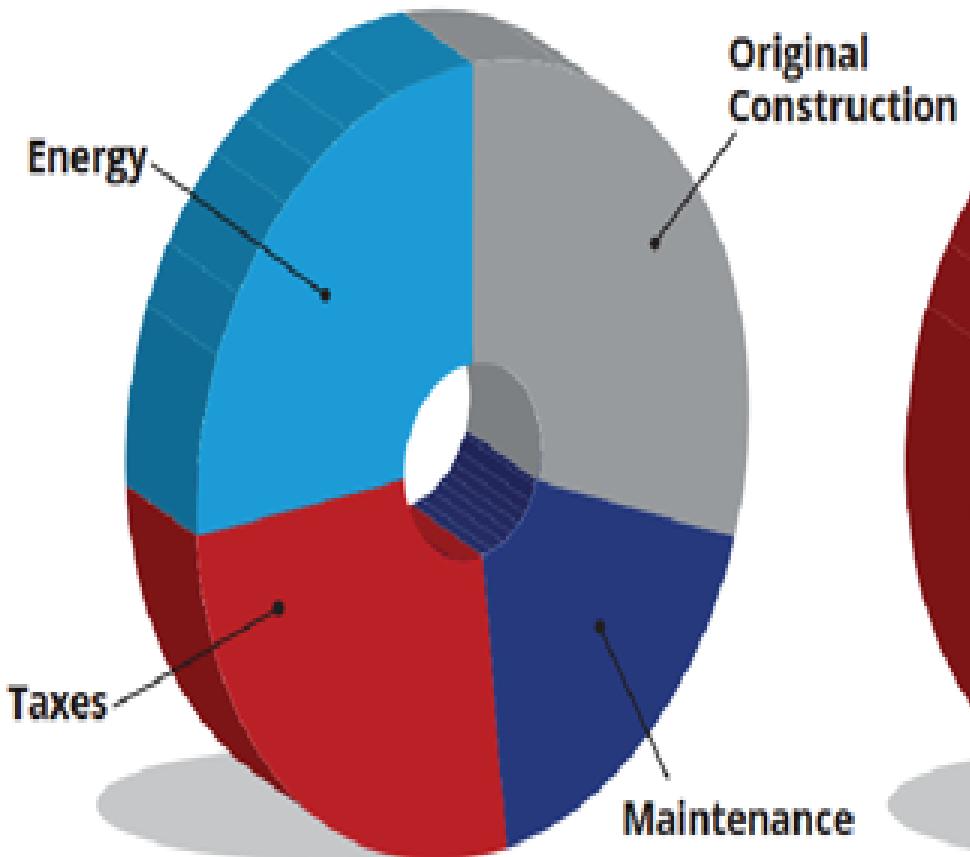


FIGURE 2: Life cycle building costs breakdown with people (salaries)

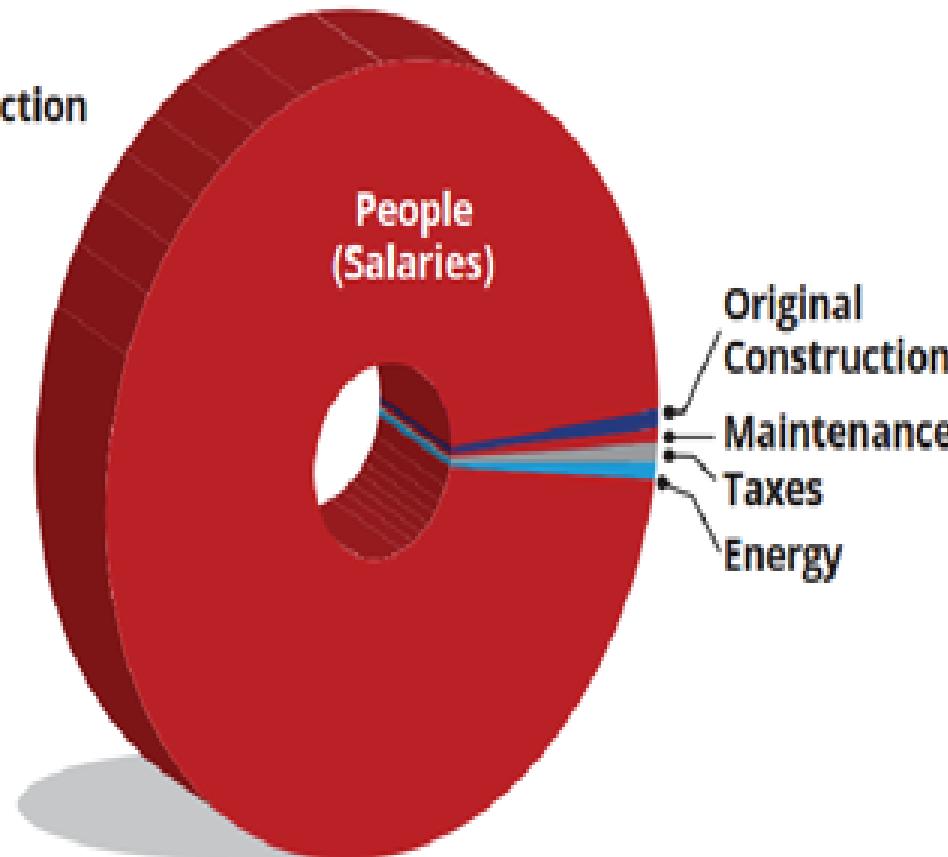


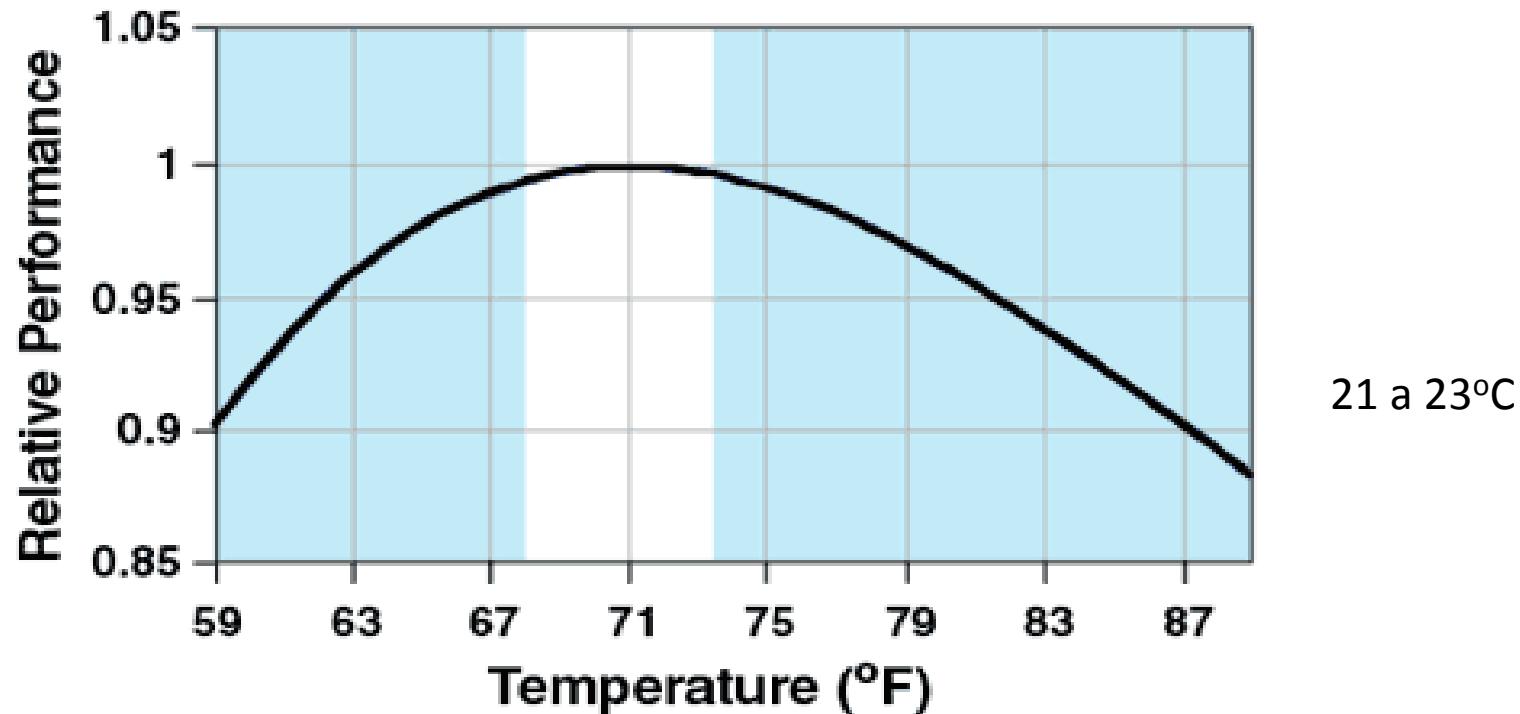
Figure 2 makes it clear that what we traditionally consider to be building costs are dwarfed by the salaries of the people who work inside the building.

Table 1. Estimated value of work performance changes from a 1°C shift in temperature toward the optimum for performance*.

| Temperature Change | | Estimated Increase in Performance (%) | Annual Economic Benefit per Worker @ R\$ 70K per Worker |
|----------------------------|-------------|---|---|
| increasing temperatures | 17 to 18 °C | 1.8 | R\$ 1.260,00 |
| | 18 to 19 °C | 1.30 | R\$ 910,00 |
| | 19 to 20 °C | 0.86 | R\$ 600,00 |
| | 20 to 21 °C | 0.44 | R\$ 300,00 |
| decreasing temperatures | 26 to 25 °C | 1.1 | R\$ 770,00 |
| | 25 to 24 °C | 0.86 | R\$ 600,00 |
| | 24 to 23 °C | 0.59 | R\$ 410,00 |
| | 23 to 22 °C | 0.28 | R\$ 196,00 |

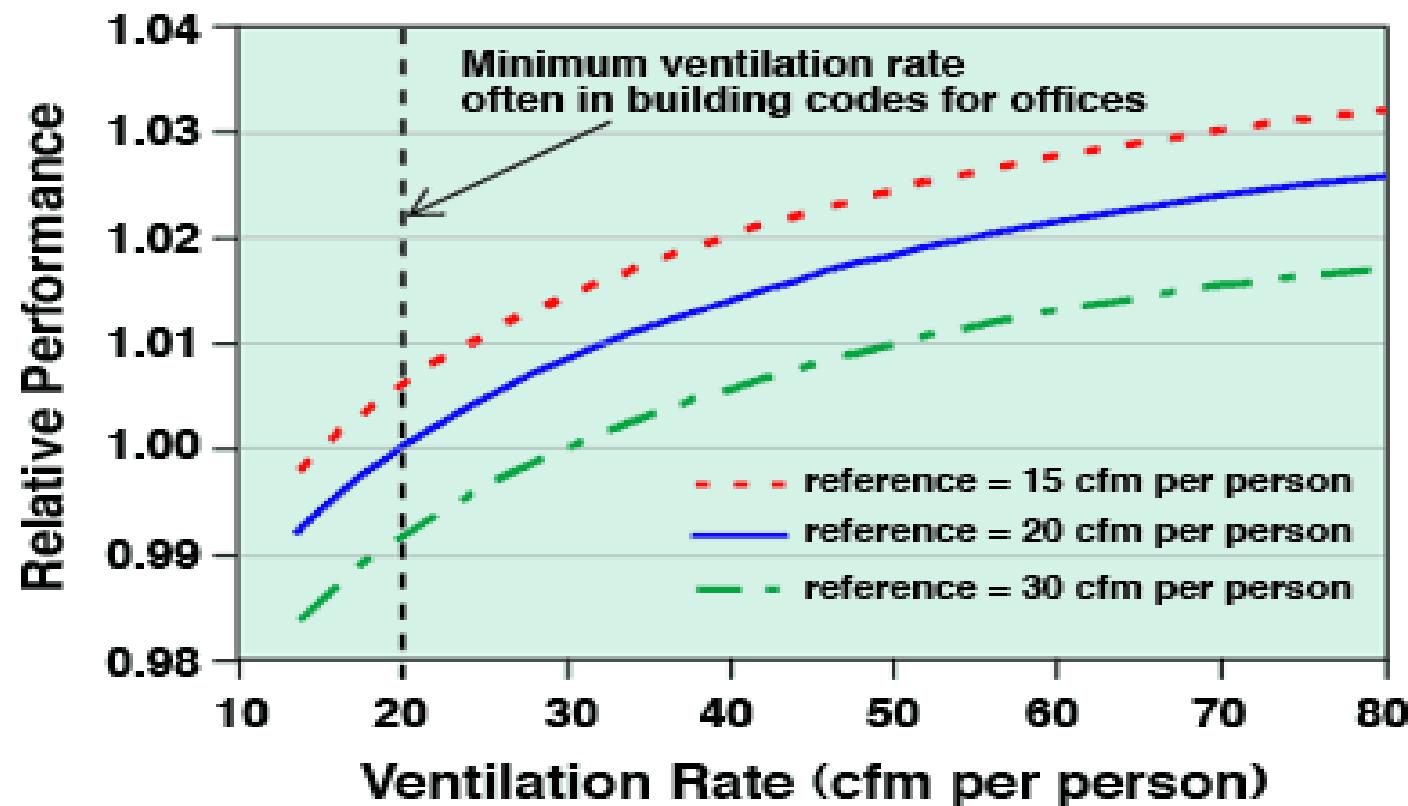
RELAÇÃO PRODUTIVIDADE X TEMPERATURA

Figure 1. The relationship between office work performance and indoor temperature based on a statistical analysis of reported data. The line from a modeled statistical fit to data from 24 studies. The shaded areas in the figure represent the regions where there is a high level of statistical confidence about the performance decrements, i.e., where statistical analyses indicate that decrements in performance in these regions have less than a 10% probability of being the result of chance.



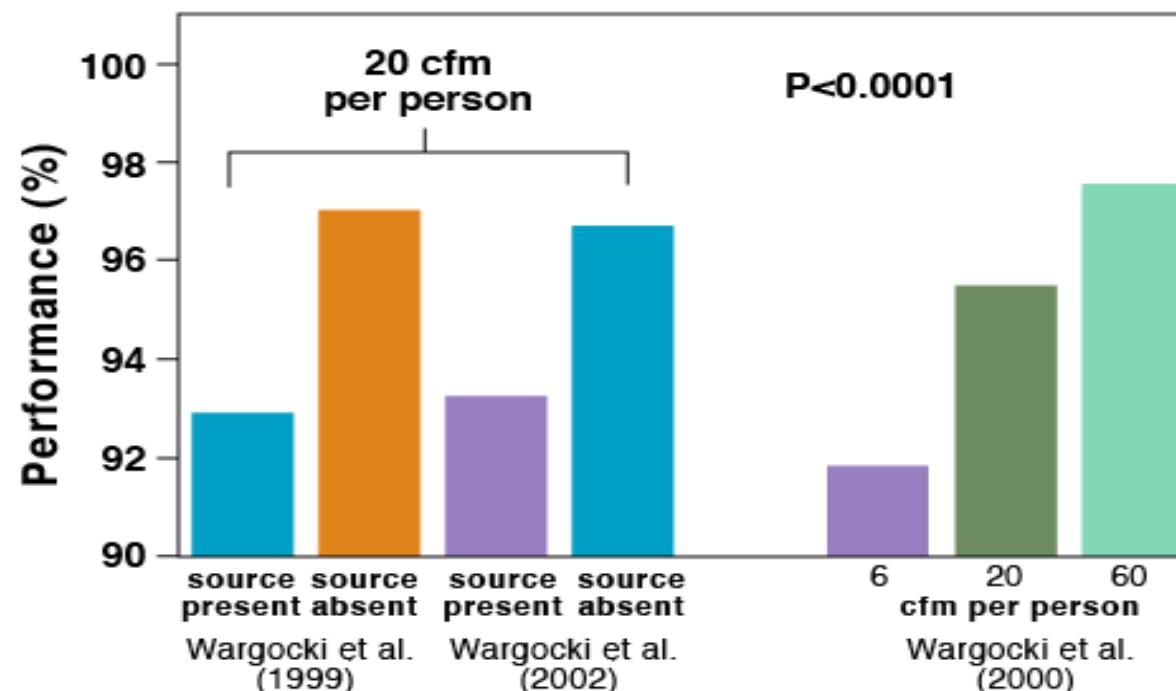
RELAÇÃO PRODUTIVIDADE X VENTILAÇÃO

Figure 3. Predicted performance of office work at various ventilation rates relative to performance at the indicated reference ventilation rates. For ventilation rates less than 28 cfm per person, the increased performance with ventilation rate have a 10% or smaller probability of being the result of chance (i.e., the 90% confidence interval excluded unity).



RELAÇÃO PRODUTIVIDADE X PRESENÇA DE POLUENTES

Figure 5. Controlled laboratory studies performed in Denmark show that performance, based on typing, addition, and proof reading tests, improved when an indoor pollutant source was removed (left sets of bars) or when the ventilation rate per person was increased with the pollution source present. **The pollution source was a carpet** taken from a complaint building.



Estudo de Caso - CUSTO INICIAL DE INSTALAÇÃO

| | caso 1 | caso 2 |
|--|--------------------------------|--------------------------------|
| Ambiente | escritório | call center |
| Local | São Paulo | São Paulo |
| Numero de pessoas estimada | 100 | 200 |
| Area (m2) | 2000 | 2000 |
| Custo inicial (projeto, instalação e equipamentos) de um sistema COM filtragem e renovação do ar adequada | R\$ 850.000,00 | R\$ 1.190.000,00 |
| Custo inicial (projeto, instalação e equipamentos) de um sistema SEM filtragem e renovação do ar adequada | R\$ 825.000,00 | R\$ 1.142.000,00 |
| Economia | R\$ 25.000,00 (2,94%) | R\$ 48.000,00 (4,03%) |

O mesmo raciocínio vale para os **investimentos em manutenção**.

- PMOC
- Filtros/ Tratamento do ar
- Limpeza
- Equipes e Rotinas adequadas
- Boas práticas de manutenção
- Análises do ar – Resolução 09



Retorno do
investimento
garantido



“Ar Condicionado é **bom** e faz **bem**”

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