

GRUPO DE TRABALHO SOBRE SISTEMAS PREDIAIS

AIR POLLUTION IN NUMBERS

AIR POLLUTION AFFECTS NEARLY ALL OF US

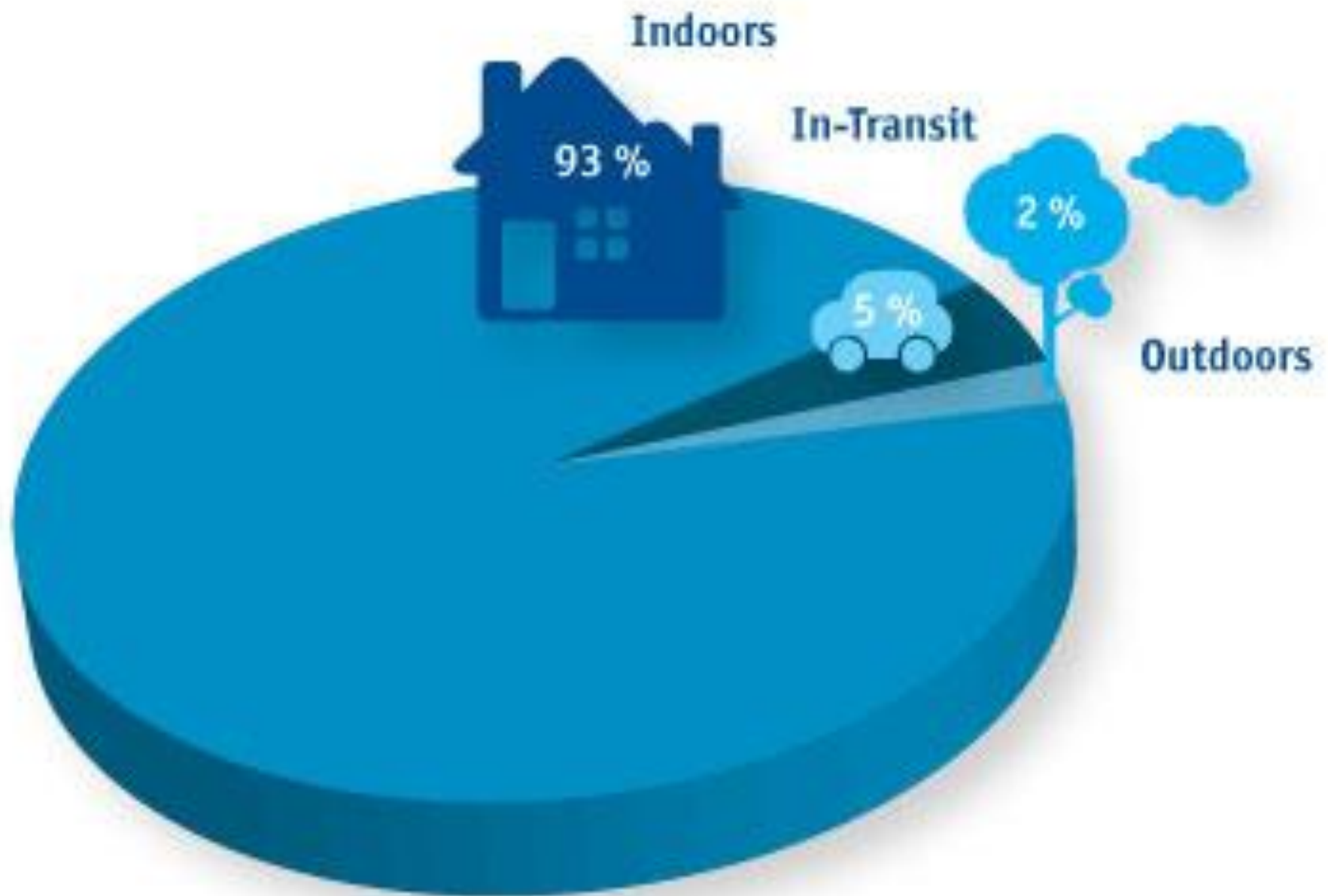
An estimated **6.5 million** deaths were associated with air pollution in 2012. This is **11.6% of all global deaths.**



PERIGO
GASES TÓXICOS



GASES E MATERIAL PARTICULADO



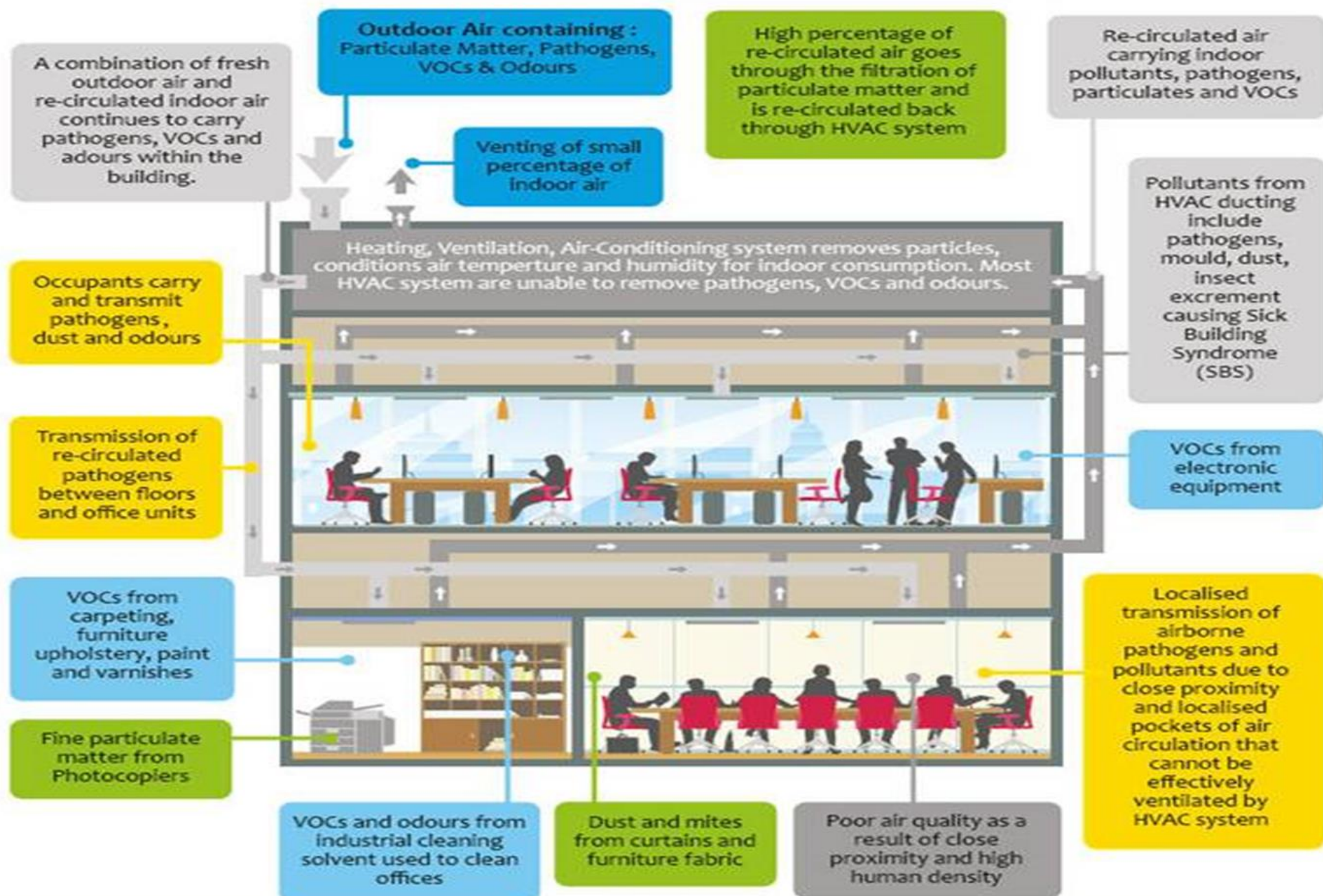
INDOOR AIR IS MORE POLLUTED



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





4171ppm

4:46pm

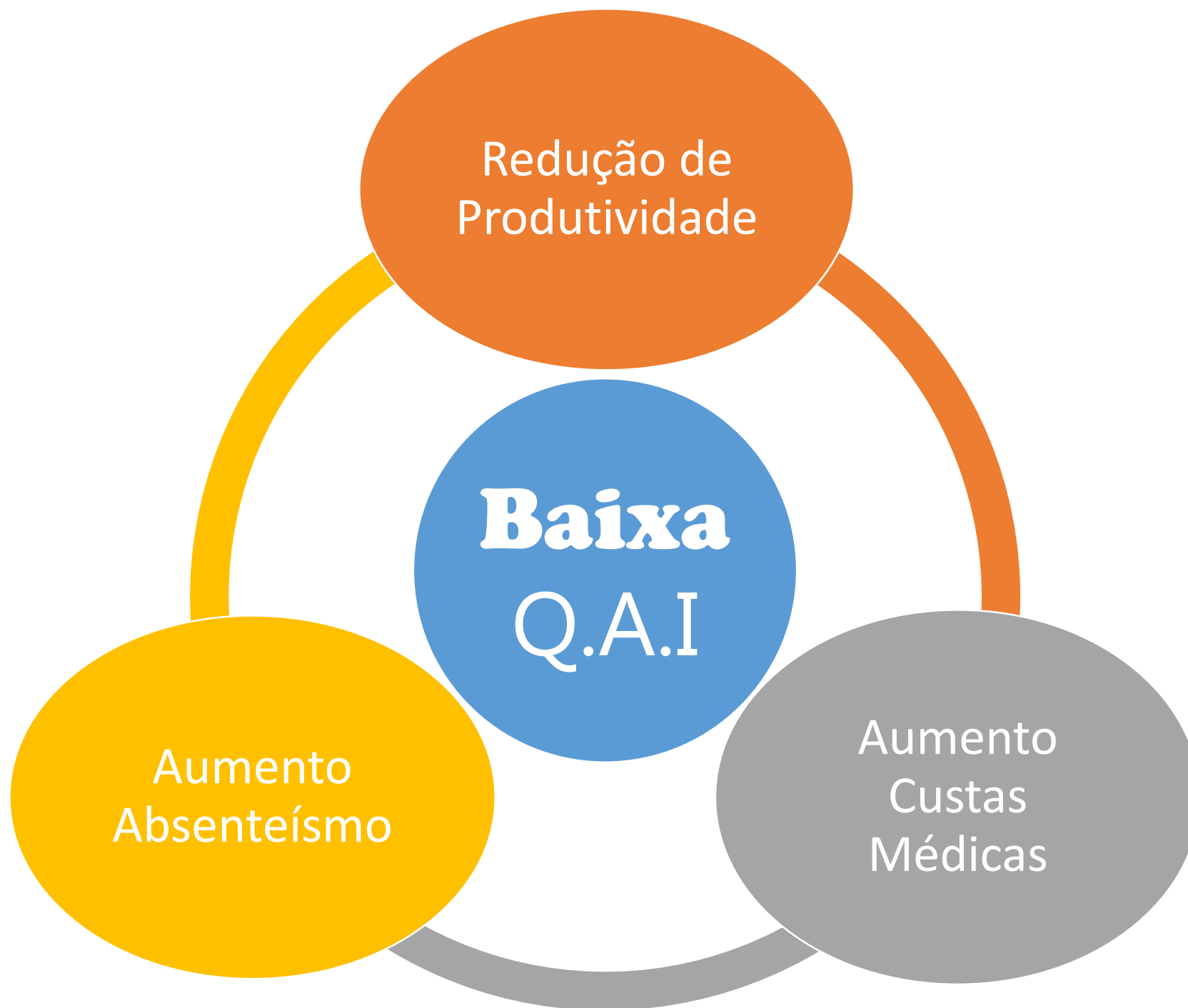
Renovação ar fechada



659 ppm

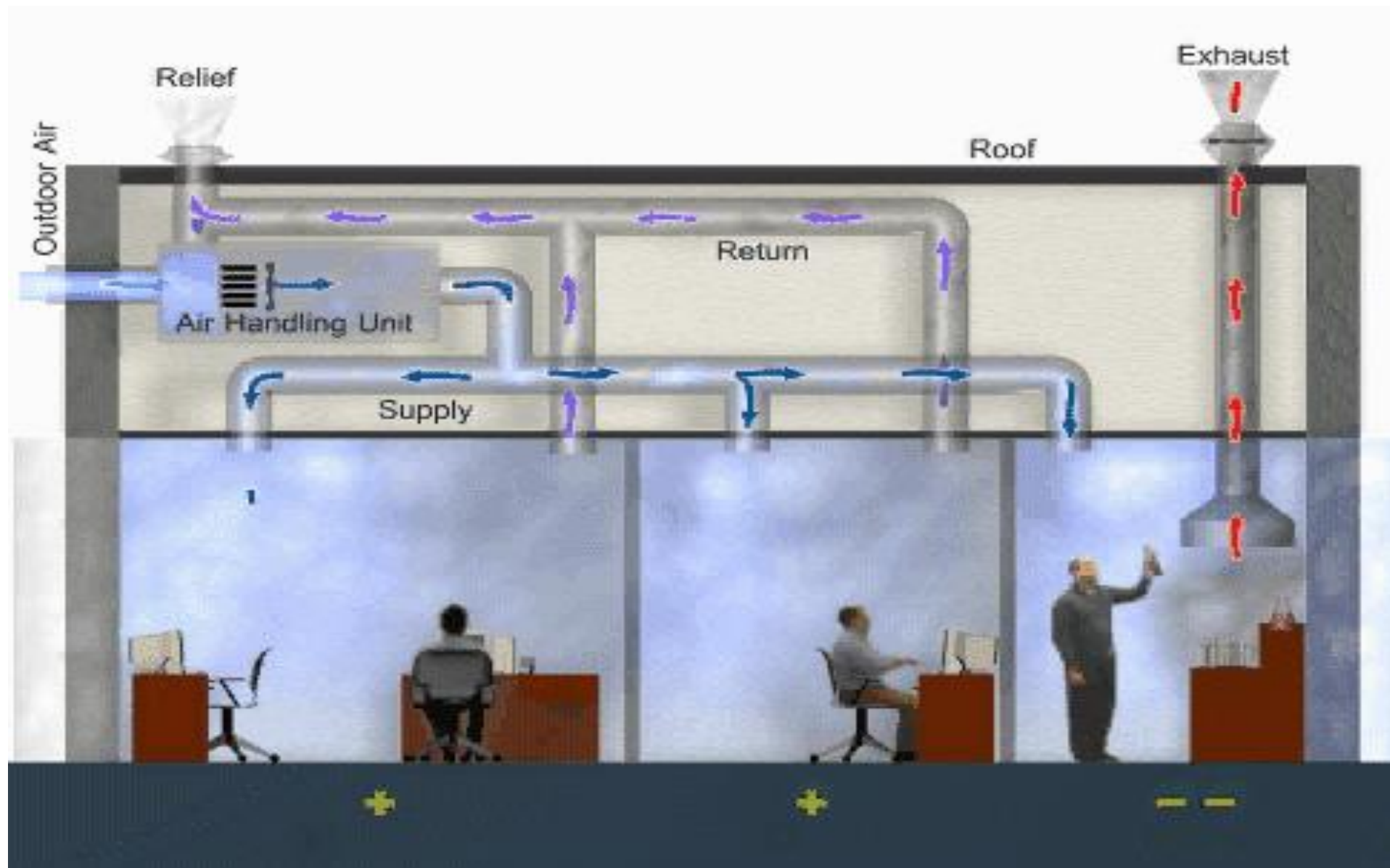
4:51 pm

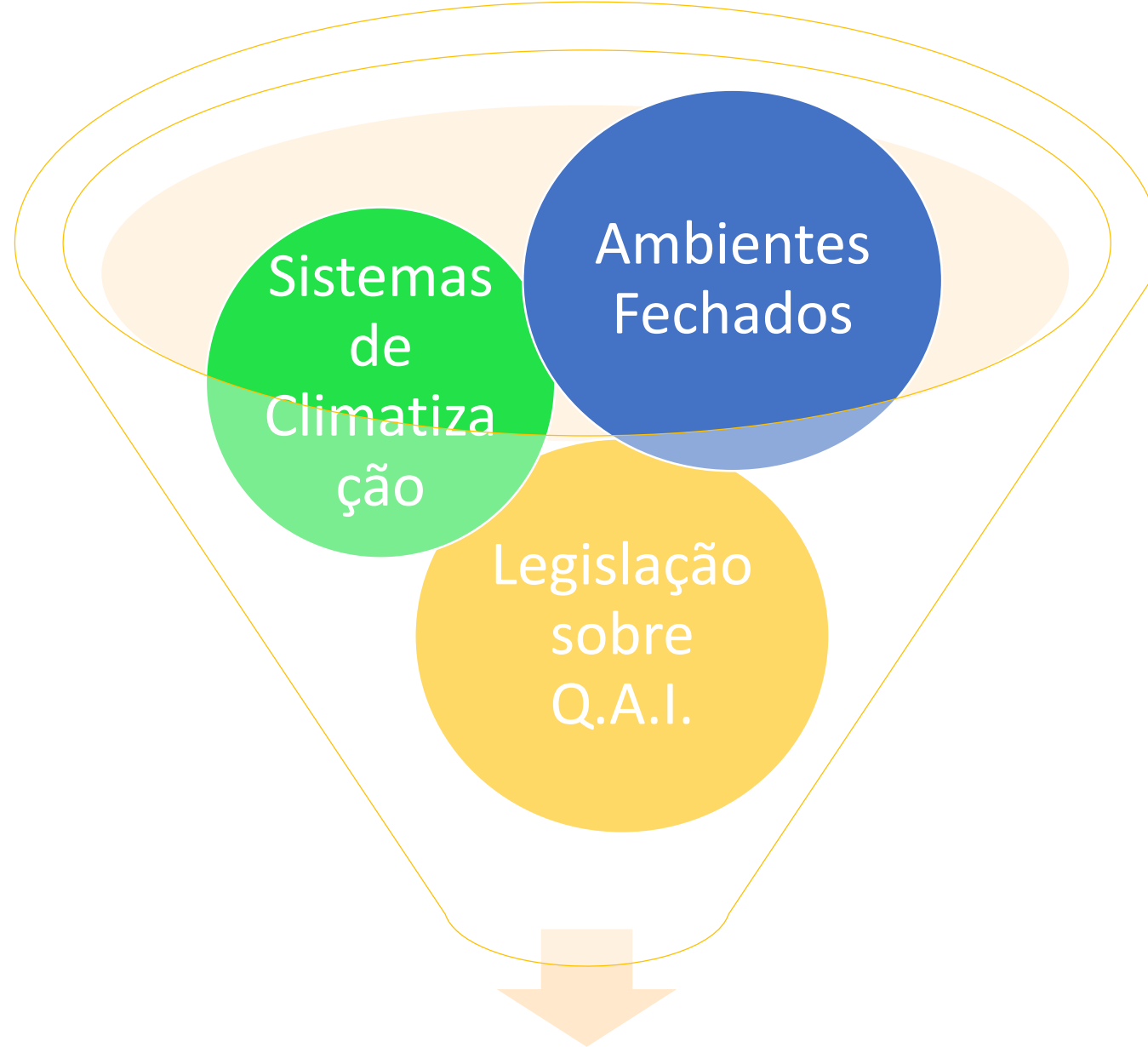
Renovação ar aberta



**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

pmoc@abrava.com.br

www.abrava.com.br

www.dnqaiabrava.org.br

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

2004 - Início do
Processo pelo
Ministério Público 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

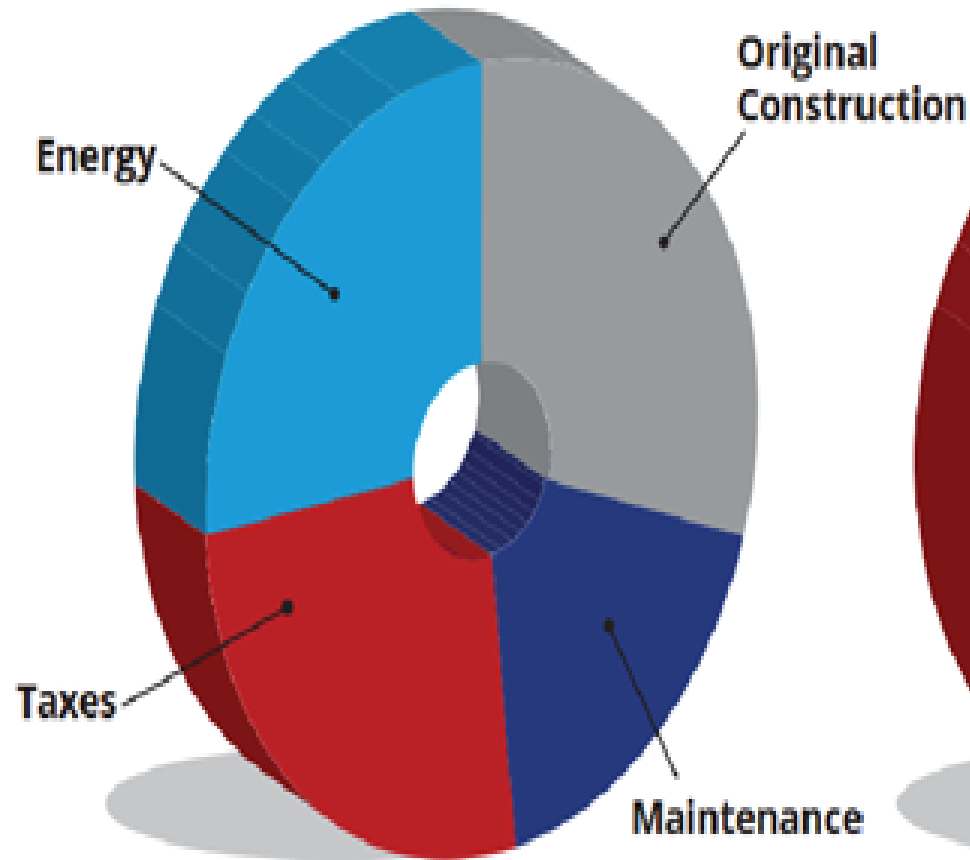
2011 - INICIO DAS
AÇÕES PARA
ASSINATURA DO TAC

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)

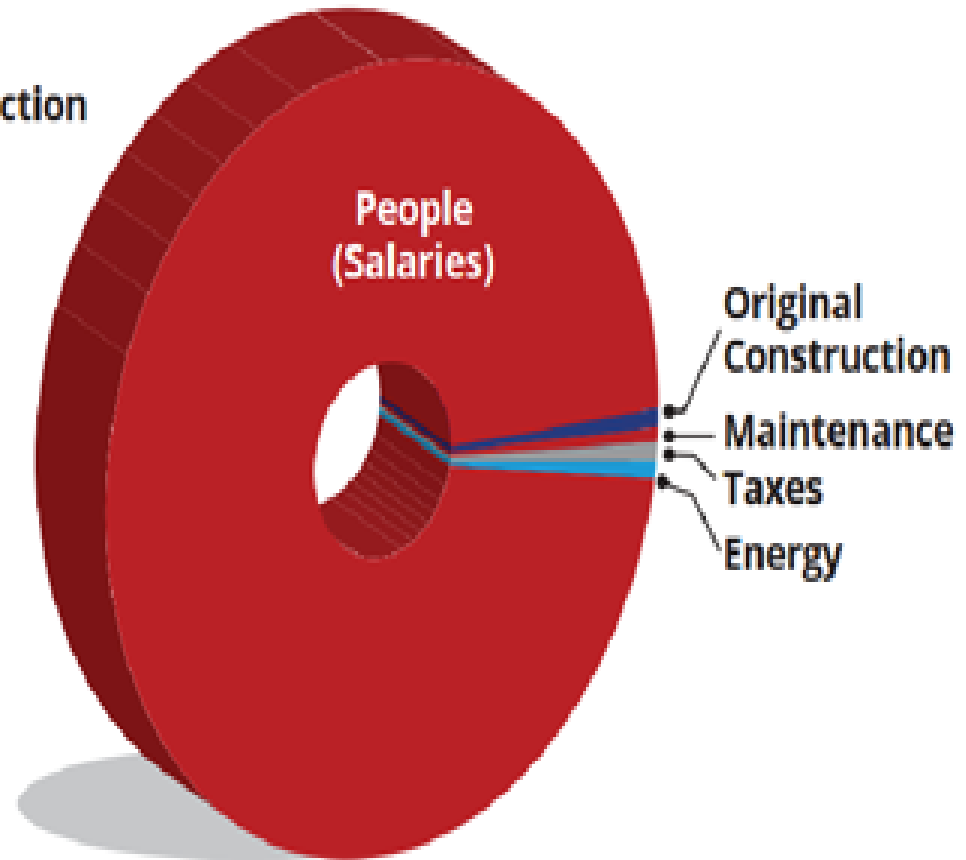


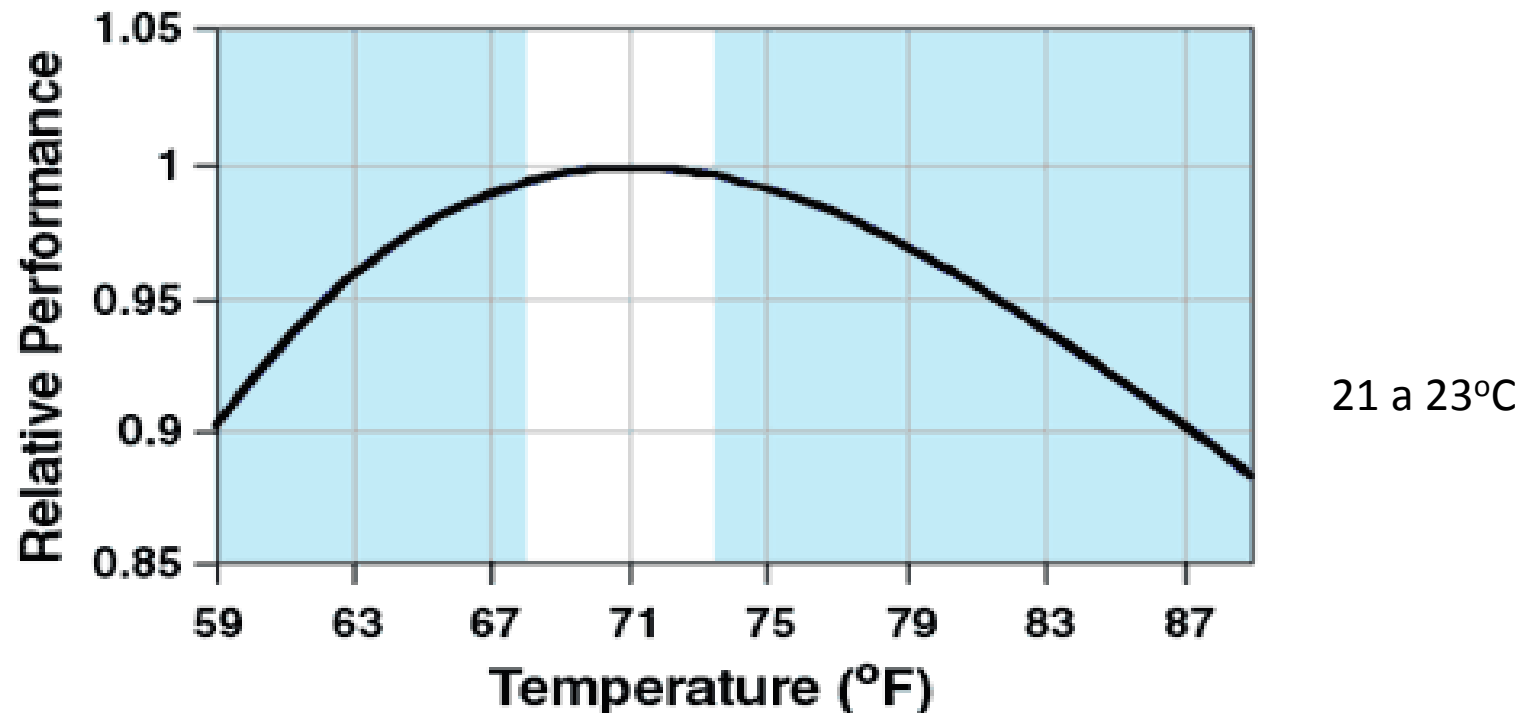
Figure 2 makes it clear that what we traditionally consider to be building costs are dwarfed by the salaries of the people who work inside the building.

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

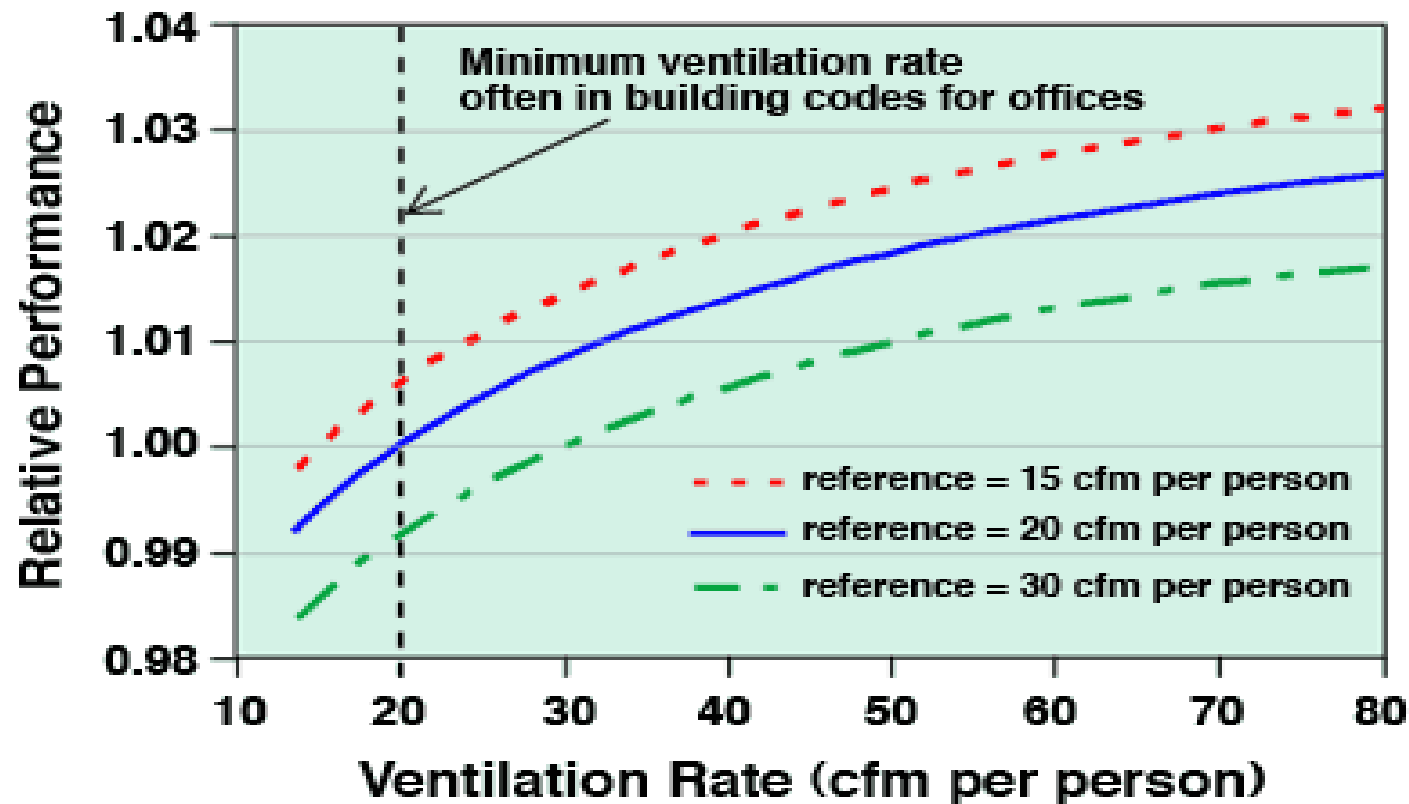
RELAÇÃO PRODUTIVIDADE X TEMPERATURA

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.



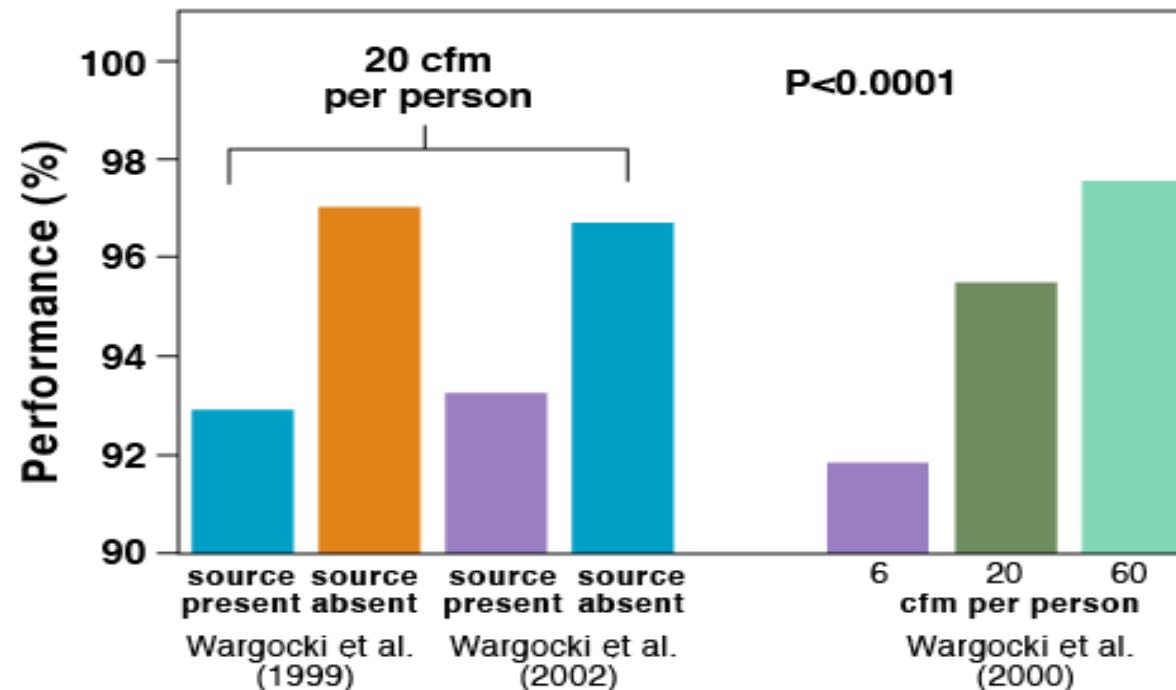
RELAÇÃO PRODUTIVIDADE X VENTILAÇÃO

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.

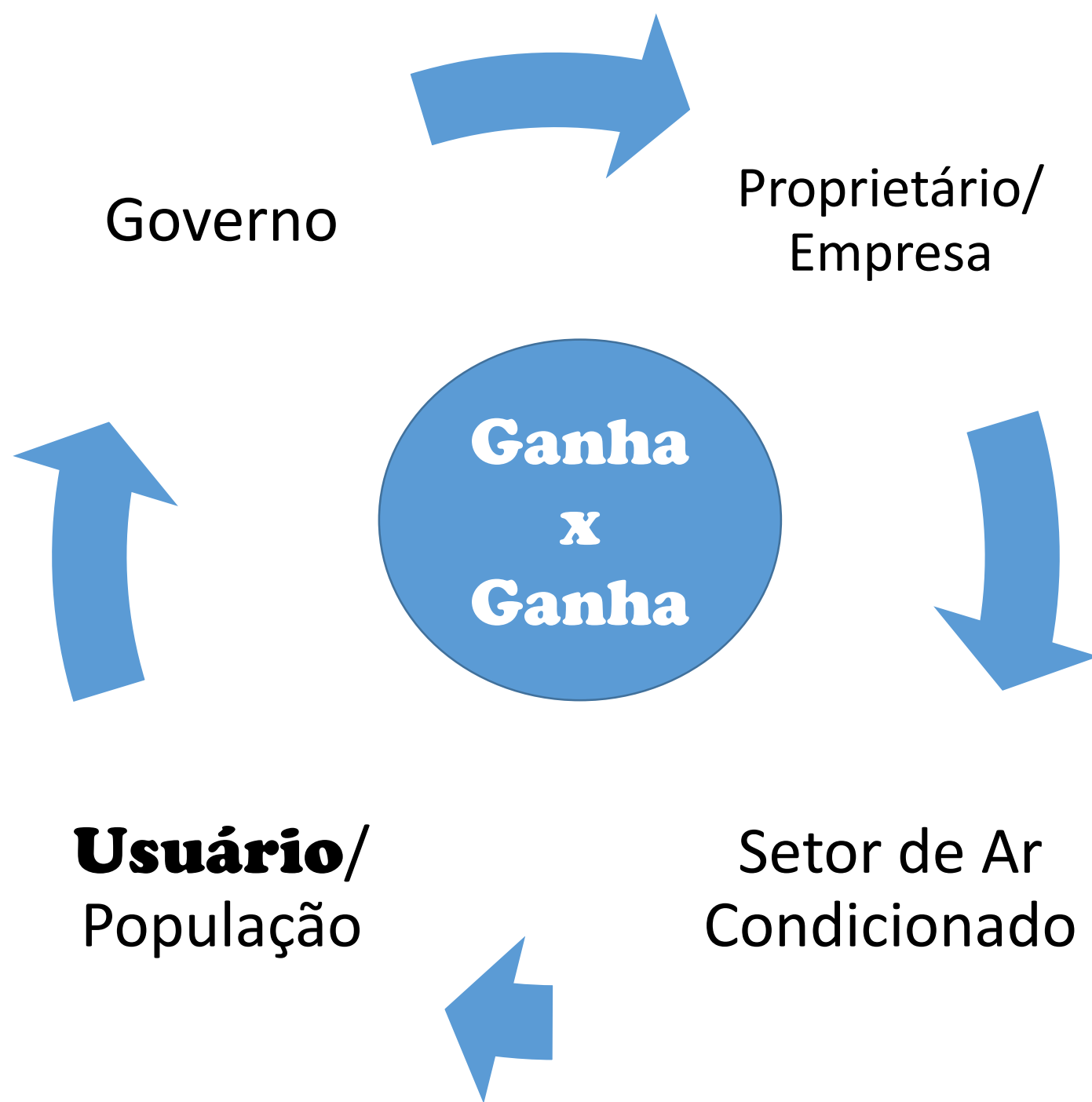


Estudo de Caso - CUSTO INICIAL DE INSTALAÇÃO		
	caso 1	caso 2
Ambiente	escritório	call center
Local	São Paulo	São Paulo
Numero de pessoas estimada	100	200
Area (m2)	2000	2000
Custo inicial (projeto, instalação e equipamentos) de um sistema COM filtragem e renovação do ar adequada	R\$ 850.000,00	R\$ 1.190.000,00
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





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

Dúvidas:
leonardo@conforlab.com.br
Tel.(11) 97611-8548