

WGIC 2017 Berlin



Hochschule Neubrandenburg  
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# FLL – Indoor greening guidelines - 1997, 2002, 2011, update for 2018

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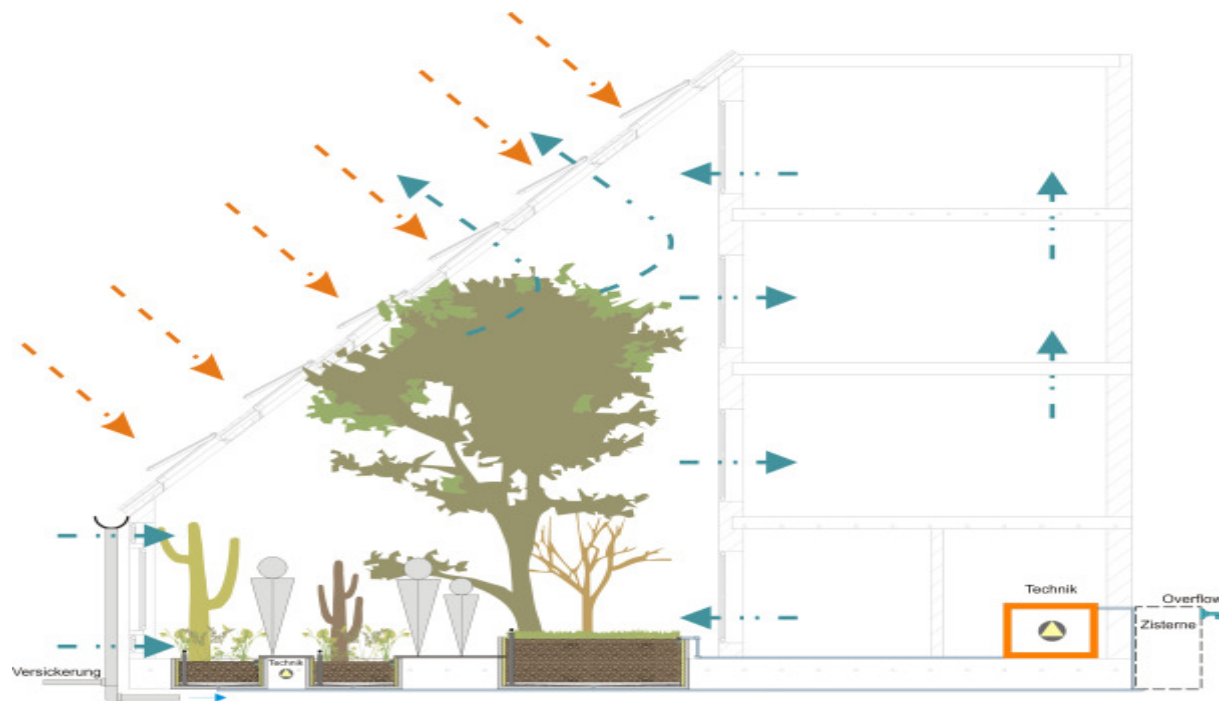


# Content, issue 2011, 10 chapter:

1. Aims
2. Norms – guidelines
3. Functional aspects – reasons for indoor greening
4. Requirements to the building
5. Systems-/ details
6. Light and temperature
7. Technical requirements
8. The plant list –Pflanzenliste-  
(including: Climber, palm trees, ferns, Cactus family, succulents, orchids)
9. Maintenance / plant care
10. Other
  
11. Updates for the upcoming issue: Systematic for vertical indoor greening.

# 1. Aim - Reason: What is an indoor greening?

- A permanent installation – lasting longer than 10 years.
- Immobile or mobile installed planters.



Source: Koehler et al. 2012.



## Examples in Germany (it could be more ... )

Tropical –                    mediterranean indoor garden –                    indoor Art installation.



## 2. Related norms and guidelines

- Constructional norms,
- Technical regulation (electricity, water, access),
- Regulation about gardening work.

### 3. Functional aspects:

Reasons for indoor greening:

- Positive effects on people,
- Climatization functions, such as:
  - better indoor climate,
  - better / healthier environment.
- Cost savings by indoor greening?

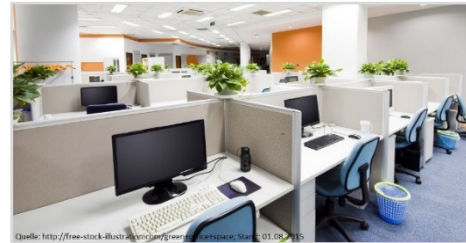
A survey study on this:

# Opening questions: office preferences:

office 1



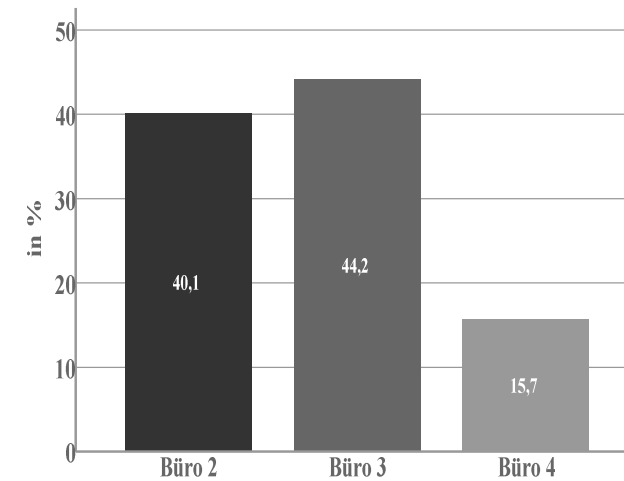
office 2



office 3



office 4





# Indoor greening in offices; Why?



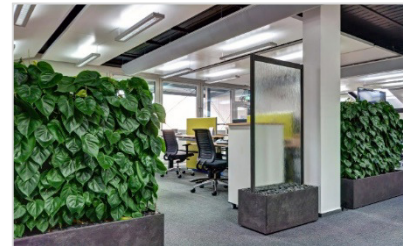
## X means-answers



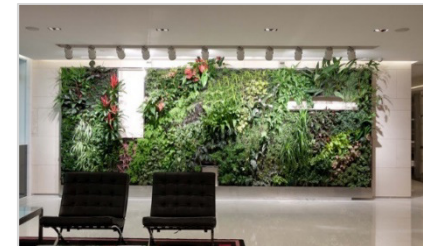
case 1



case 3



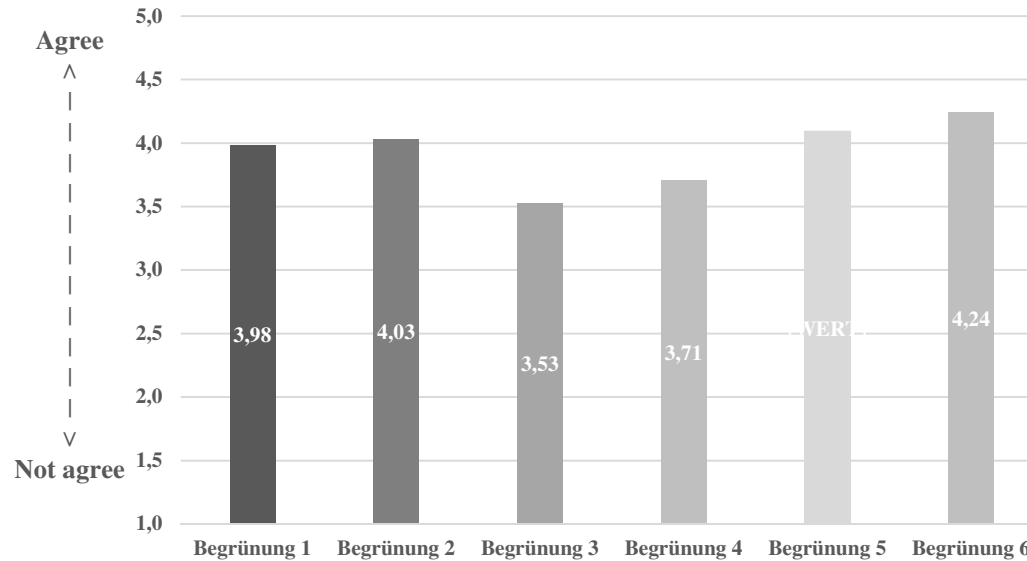
case 4



case 5



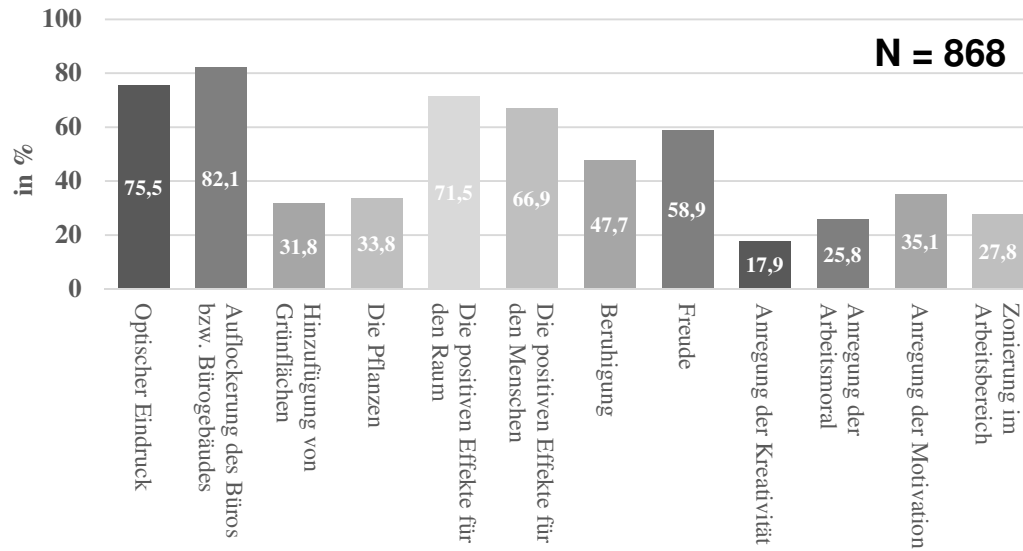
case 2



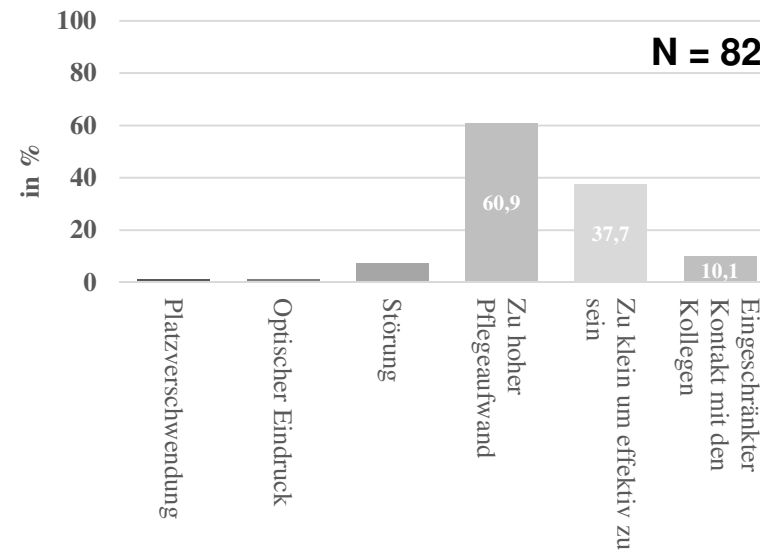
case 6



**Positive of indoor greening:**



**negative:**



**Study results:**

## 4. Technical requirements /

### Voraussetzungen:

- Structural load,
- Access to media (Water, electricity, space, access for periodic gardener work, ....,
- DIN – Norms taking into account,
- The correct selected soil / growing media (corn size distribution, nutrition),
- Alternative to the soil: e.g. „Hydroculture“,
- Illumination, (artificial or day light),

## 5. Systems-/ details

- Construction open (to the ground),
- Closed construction (bassin-, or box systems),
- One layer or multi layer systems - growing media structures,
- Location of the water storage in the system,
- Type of irrigation
- Type of water storage in an extra layer under the media,
- Definition of the growing media: Content of organic, nutrition and more,
- Extra chapter for Hydrokultur / Hydroponics.

# Automatic irrigation – here a small installation





# Automatic irrigation, larger installation



## 6. Light, temperature and other plant factors as criteria in the plant list:

- Light: from low: with 500-1000 Lux to high: more than 4300 Lux,
- Soil moisture: from low: W4: desert soil to W1: Swampland type Mangrove,
- Air humidity: L1: more than 60% to L3: low 30-45% Air humidity,
- Air temperature: from T1: tropical, T2: subtropical / mediterranean,  
T3: temperate, T4: Arid – desert.

## 7. Technical requirements

- Glass types,
- Air ventilation,
- Technical air purification

and other

8. The plant list –Pflanzenliste-  
(including: Climber, palm trees, ferns, Cactus family, succulents, orchids,

## **Indoor plants Top „100 Plant list“**

### **Criteria:**

**Available, suitable for indoor greening.**

**Finally: - around 250 (species-syntax);**

- **Tropic – subtropic – temperate – arid,**
- **Not too fast growing,**
- **Not too large at final stage,**
- **Attractive habitus,**
- **Easy maintenance.**

**From A to Z: some examples:**



## Abutilon species

e.g. *Abutilon megapotamicum*

Family: Malvaceae

Synonym: *Sida megapotamica*,

Schönmalve

About 200 species (left down: *A. indicum*).

Tropical





Yucca species, e.g.  
Yucca treculiana

Fam. Asparagaceae, origin: Mexico, 53 sub-species  
exist today, Palmilie  
Subtropic – Temperate - arid



<http://de.wikipedia.org/wiki/Palmilien>



Zamioculcas zamiifolia

Fam. Araceae, Origin: East Africa, easy to care,  
not too much irrigation, Zamia  
Tropic – Subtropic



[http://de.wikipedia.org/wiki/Zamioculcas\\_zamiifolia](http://de.wikipedia.org/wiki/Zamioculcas_zamiifolia)

# 9. Maintenance / plant care work

Low



moderate



high





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## 9. Maintenance / accessibility Good



## bad



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### 10. Other

-checklists to calculate the workloads,  
and other materials.



## 11. Updates in 2017 - under review:

- New chapter vertical indoor greening, examples from Hongkong and Zurich:



# Vertical indoor examples, Neubrandenburg



# Vertical indoor:

## Pros

- Less space is needed,
- indoor Air climatization
- 

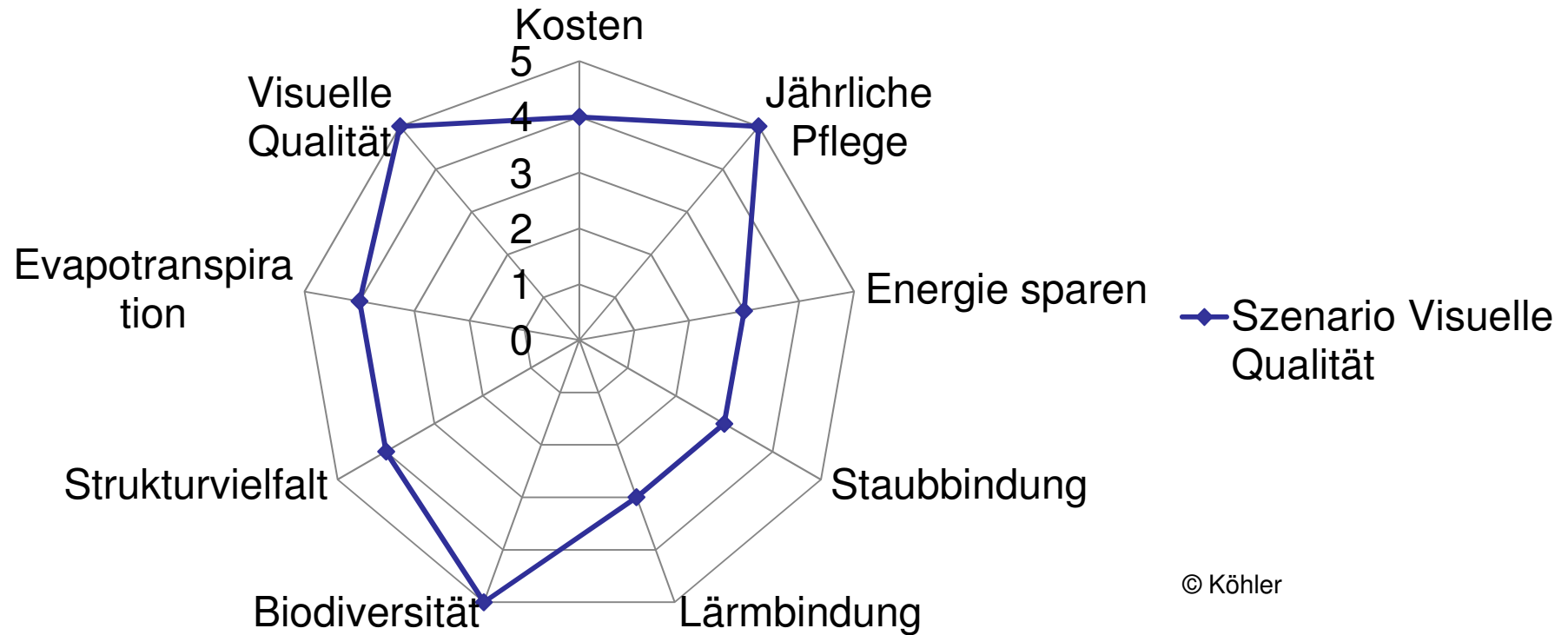
## Cons

- installation costs?
- maitenance costs?



# Relation between costs and functions.

## Optimization to “Visual Quality”



# Systematic of vertical indoor structures

Climber

*e.g.*

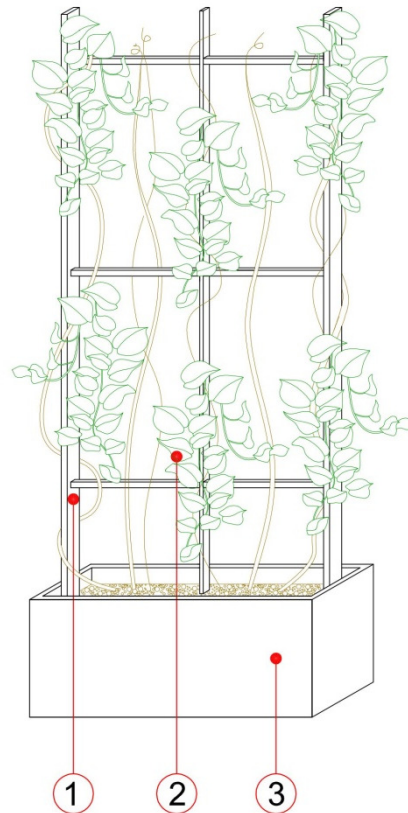
*Tetrastigma vionerianum*

Kastanienwein



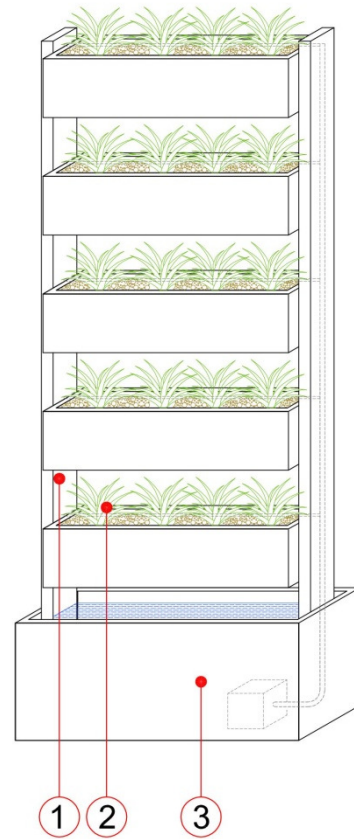
# Systematics of vertical indoor greening:

## - Climber

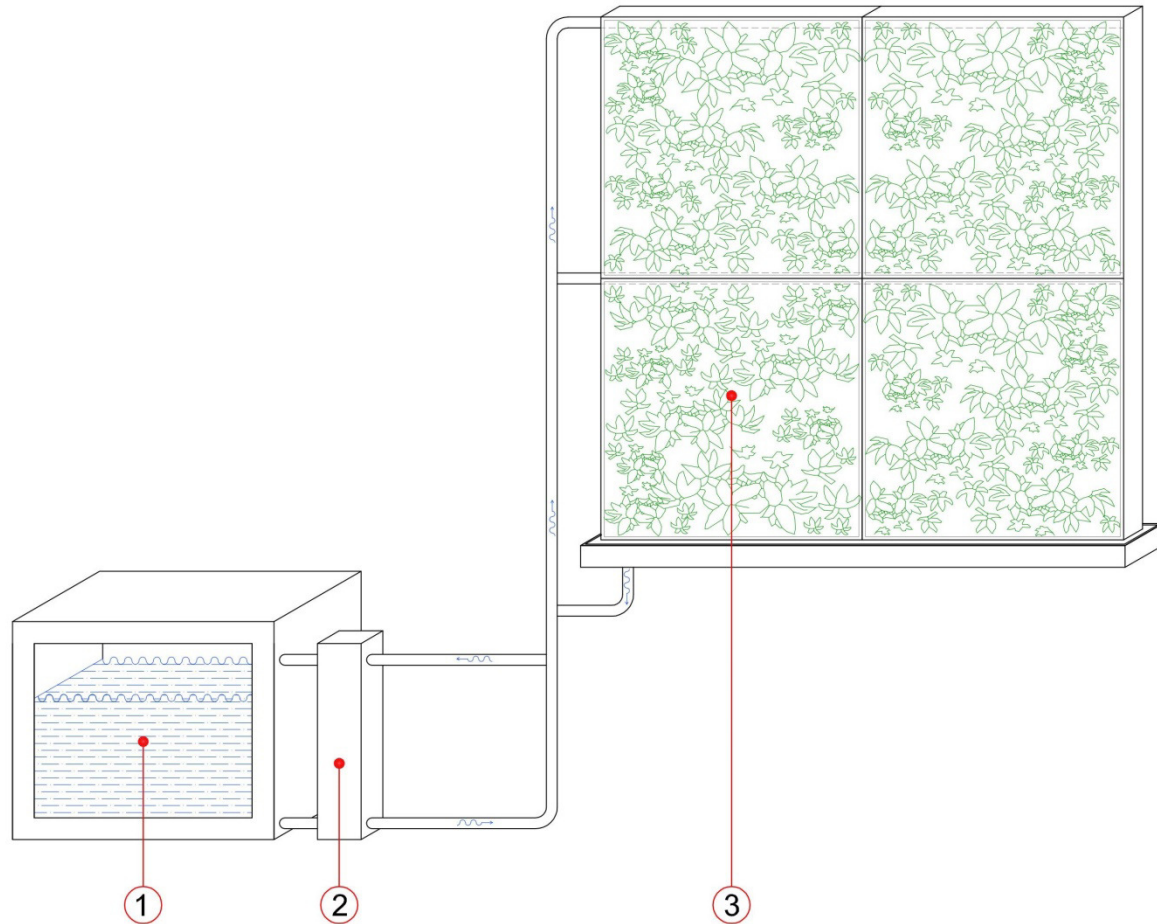




# Vertical boxes in horizontal structure



# Horizontal – module with irrigation reservoir



# Vertical – metall – small boxes -





## Investment: the bigger the lower sq-meter price.

Material \ Kosten	Größe (m <sup>2</sup> )	1	10	100	1000
Steuereinheit, Stck, ca. 6000 €		6000	600	60	6
Pflanzen 30 Stck/m <sup>2</sup> x 2€ ges.		60	600	6000	60.000
Technisches Aufbaumaterial (mittlerer Wert div. Anbieter). (Druckkompensierte Schläuche, ...)		10	100	1000	10.000
<b>Aufbaumaterial: Vliese, Halterungen, usw. (max.) /m<sup>2</sup></b>		<b>100</b>	<b>1000</b>	<b>10000</b>	<b>100.000</b>
Zusatzventile/pro Schaltkreis 30€ /Stck. Anzahl:		0	2	4	10
Kosten Ventile (€)			60	120	30
Pflegekosten 1x Anreise/Rüstzeit		200	200	200	200
Kosten/m <sup>2</sup> je Pflegegang 2€/m <sup>2</sup>		2	20	200	2000
Technische Inspektion der Bewässerung 2x im Jahr, pauschal		250	250	300	300

## Resume – outlook:

- Indoor greening opens opportunities in architecture,
- Esthetics and ecological functions are two connected arguments for indoor greening,
- Environmental health and better human performance are further arguments for more indoor greening,
- Indoor vertical plant installation are trendy,
- Larger projects means lower square-meter prices,
- A huge list of plant species is available.
- Many job opportunities are included in this topic.