



# Local Emission Charges in Europe



Emanuel Fleuti  
Unique (Flughafen Zürich AG) Head of Environmental Services



## Outline



1. Europe and its Air Quality Standards
2. Reason for Local Emission Charges (Zurich)
3. Implementation and Results
4. Transition to European Harmonisation and Scheme
5. Local Emission Charges in Europe
6. Conclusions



# Europe



## Europe:

10.5 million km<sup>2</sup>

730 million people

43 states (25 in EU)

> 400 airports



## European Air Quality Regulation:

- EC Directive 1999/30 (April 1999): SO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> and Pb
- EC Directive 2000/69 (November 2000): Benzene, CO

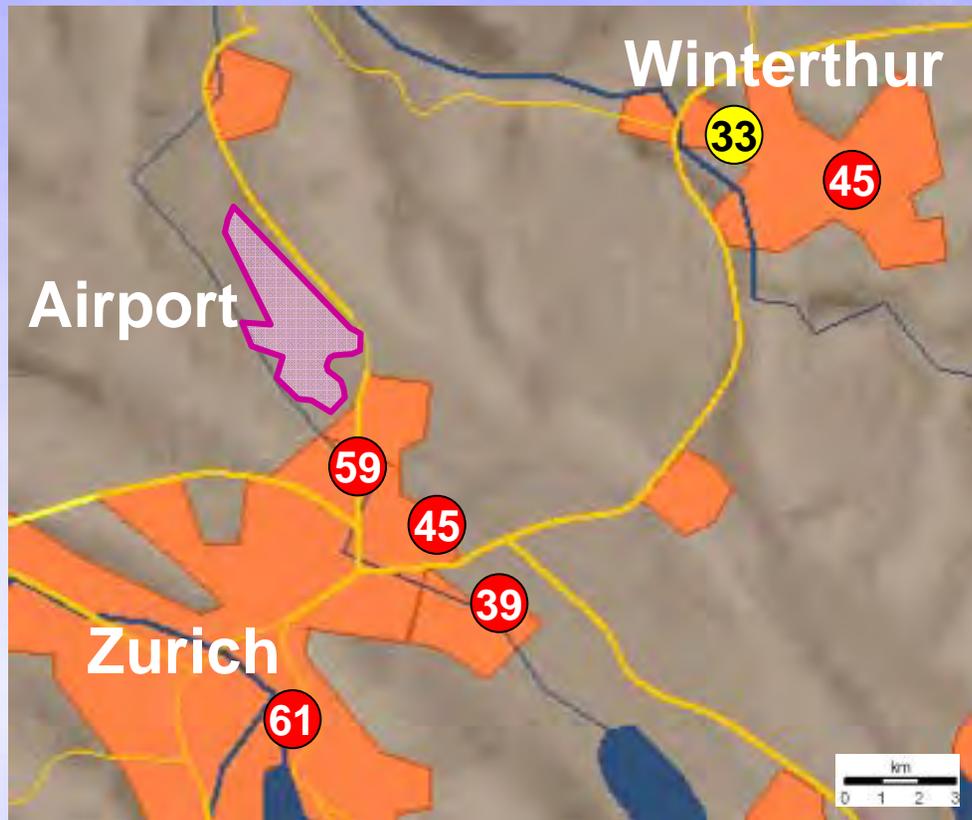
## National Regulation:

- Switzerland (LRV, 1986)

<u>Pollutant</u>	<u>EU</u>	<u>CH</u>
NO <sub>2</sub> (µg/m <sup>3</sup> /a)	40	30
PM10 (µg/m <sup>3</sup> /a)	40	20
SO <sub>2</sub> (µg/m <sup>3</sup> /a)	20	30
O <sub>3</sub> (µg/m <sup>3</sup> /8-hr)	120	-



## Zurich: The NO<sub>2</sub>-Situation in 1998



(µg/m<sup>3</sup> annual mean)

- Below the standard
- Within the standard
- Above the standard



*Large scale NO<sub>2</sub> non-compliance  
(and PM<sub>10</sub> as well)*

⇒ *Similar expectations elsewhere  
in Europe*



## Airport Growth in this Context



### Environmental Report 1990:

- Movements from 163,000 (1989) to 250,000 in 2000
- Passengers from 12 mio to 23 mio
- NO<sub>x</sub> Emissions from 1,265 to 1,925 tons/a



### EIA for airport expansion 1997:

- Movements from 270,000 (1997) to 421,000 in 2010
- Passengers from 18 mio to 36 mio
- NO<sub>x</sub> Emissions from 1,585 t to 3,209 t
- NO<sub>2</sub> regional share from aircraft raising from 5-20% up to 13-30%



Federal/cantonal requirement to submit mitigation plan, reflecting all emission sources:

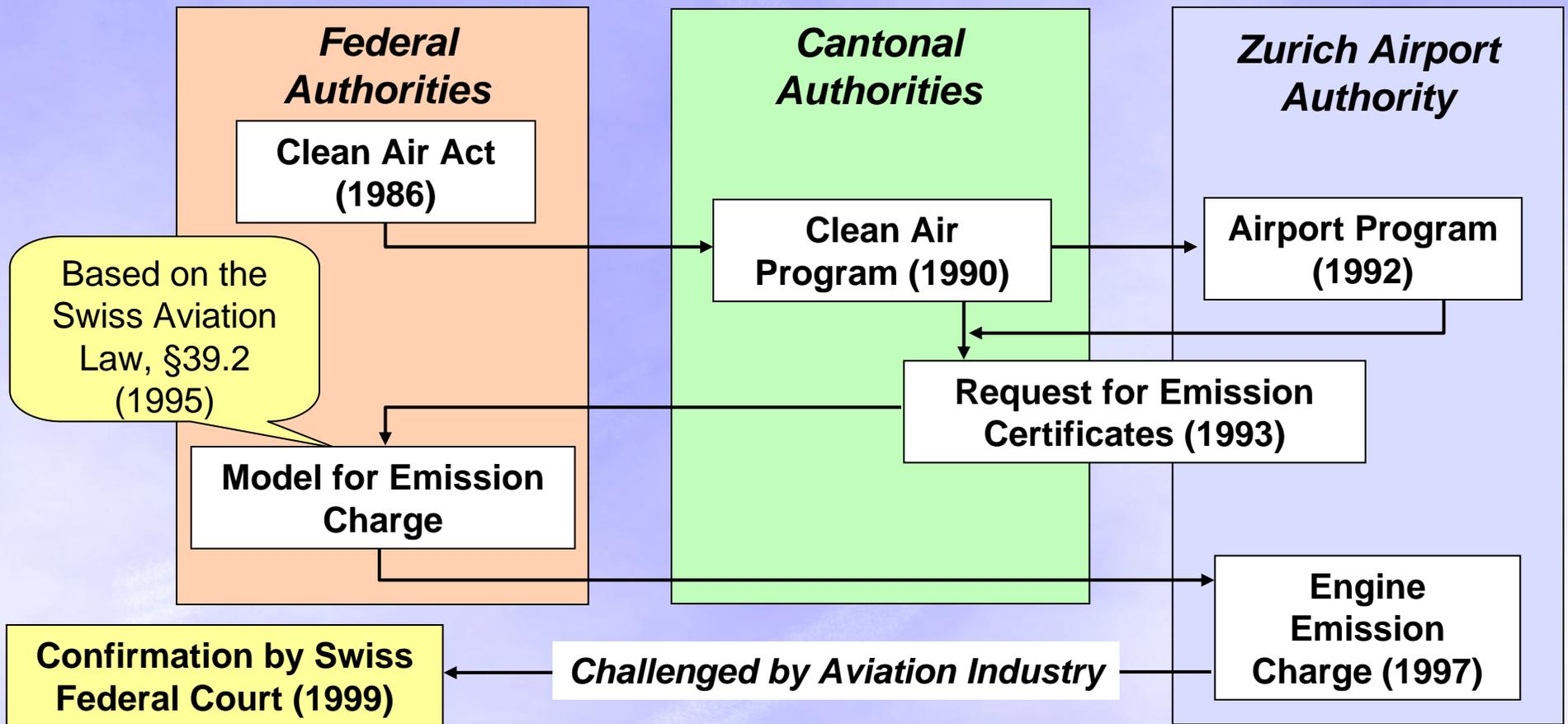
- Request for legal basis for local emission charge (1993)
- Other measures

### Permit under conditions:

- Emission Cap (2,400 t NO<sub>x</sub>)
- Emission Charges requirement
- Additional mitigation plan



# Emission Charges Implementation in Zürich





## Multiple Results



### Assessment

#### Operational and Financial Results

- Improvement in technology (depends heavily on home carrier's fleet planning ⇒ limited comparability)
- System revenue neutral at beginning



#### Environmental Results

- Limited direct effects (aircraft emissions)
- Considerable system effects (through other emission sources)
- Considerable avoidance effects in anticipation of charge

#### Added-value Results

- Public/political acceptance for airport expansion program ("License to grow")
- Immediate industry response to market forces





## Added-value Results

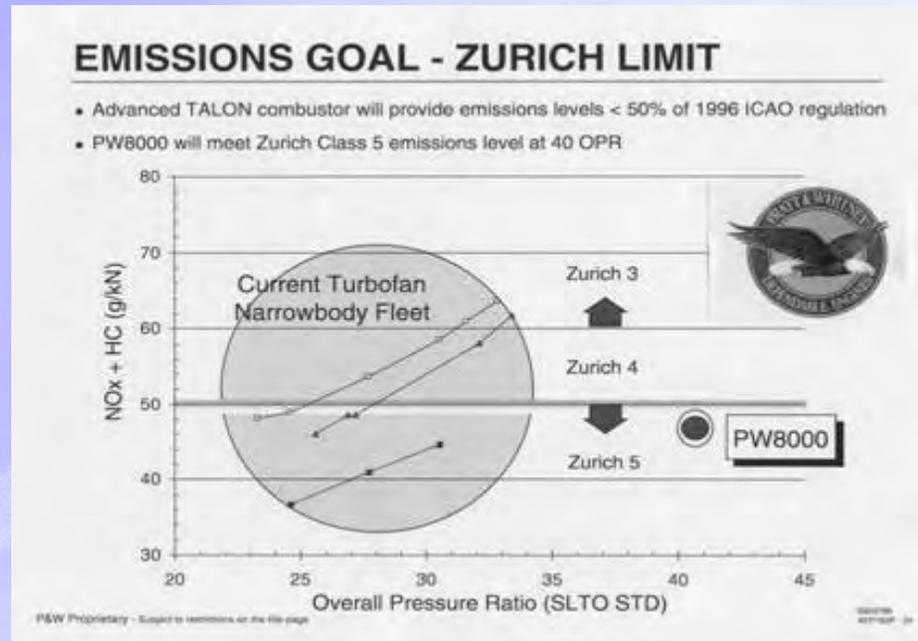


- Public/Political Response
  - Construction Permit for 5<sup>th</sup> Expansion Program (2 billion CHF)
  - Compliance with Clean Air Act Regulation (Mitigation Plans for all Sources)
- Aviation Industry Response

(1997)



(1998)



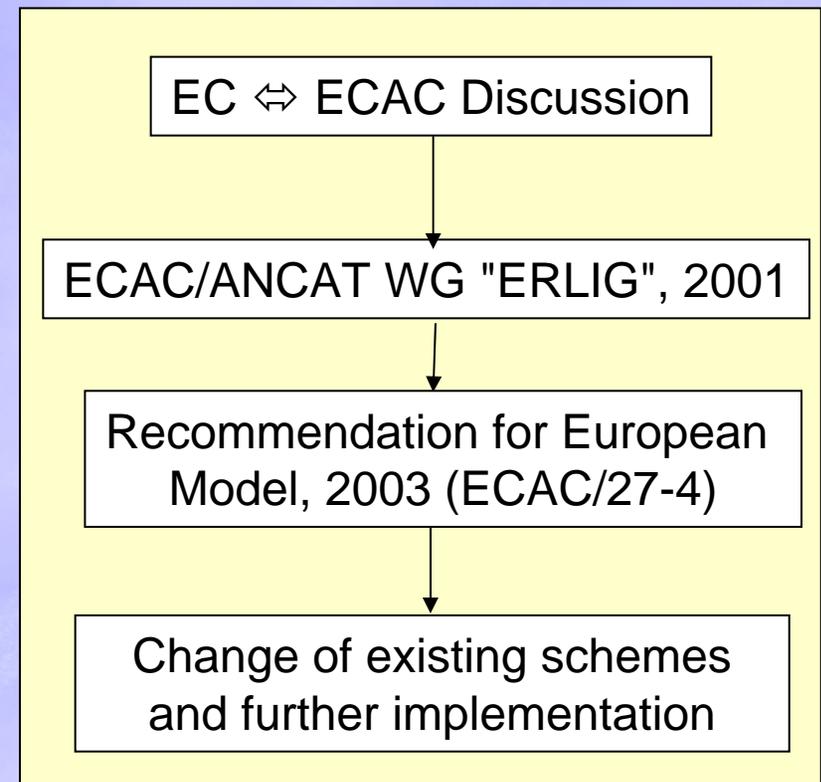


## Harmonisation Process in Europe



The main drivers to develop a harmonised methodology are:

- the industry's demand for the harmonisation of existing models (2000)
- the EC activities for environmental incentives in transportation
- the arising local airport air pollution problems due to EU standards:
  - EC Directive 1999/30: SO<sub>2</sub>, NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> and Pb
  - EC Directive 2000/69: Benzene, CO





## European Recommendation ECAC 27-4 (July 2003)



$$EmissionValue_{Aircraft} = a * Engines * \sum_{LTO-modes} (60 * time * fuelflow * NOx - index \div 1000)$$

- Basically: absolute NOx-emissions in the standard certification LTO-cycle
- HC to consider (older or newer) engine technology (factor 'a' for regulated engines)
- Continuous scale



## Coverage and Extension



### ECAC Recommendation:



- Aircraft > 8,618 kg MTOM
- Calculated Emission Values:
  - Regulated engines (ICAO Data)
  - Unregulated engines (FOI Data)

### Swiss/Swedish Recommendation:



- Aircraft  $\leq$  8,618 kg MTOM
- Default Emission Values  
(Matrix with #, type and size of engine)



## Recommended Completion



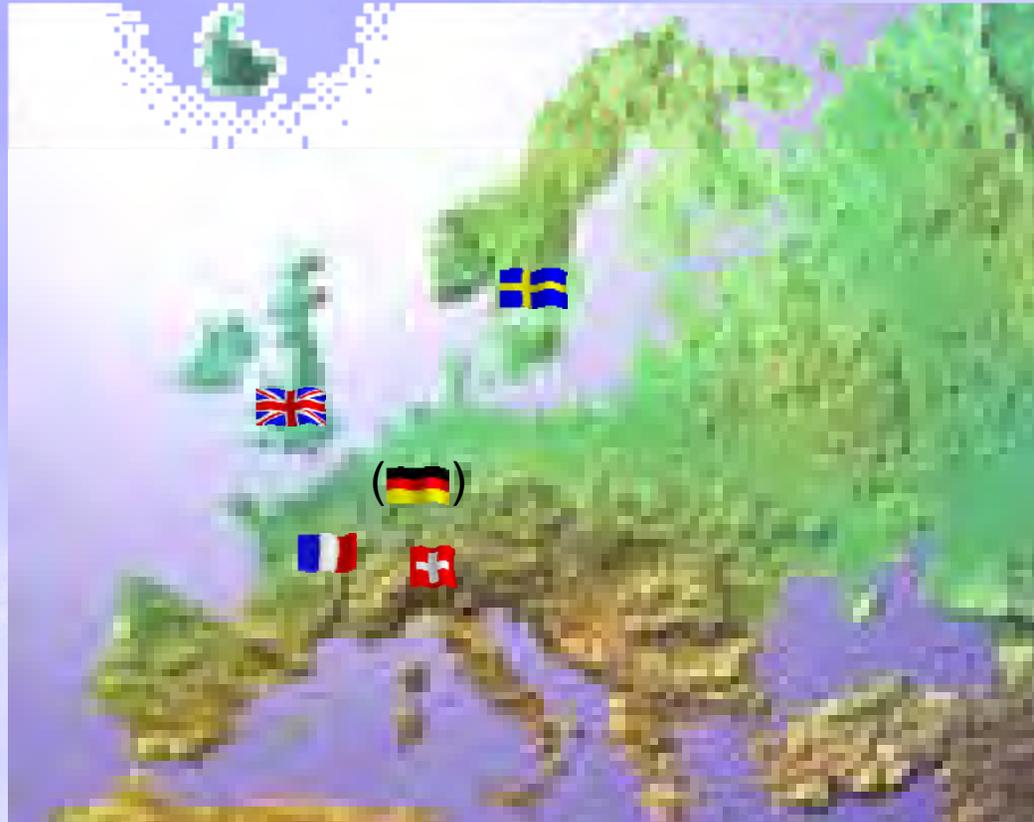
- Emission Values <sub>Aircraft</sub> according to engine type, size and number of engines
- Applicable to all aircraft  $\leq 8,618$  kg MTOM (and above if no detailed emission data is available)

# Eng.	Ecolight	Piston up to 200 hp	Piston 200-400 hp	Piston >400 hp	Helicopter <1000 hp	Helicopter > 1000 hp	Business-Jets (<16 kN)	Business-Jets (>16 kN)	Turbo-Props*
1	0.1	0.2	0.4	0.5	0.2	0.7	0.5	1.0	0.8
2		0.4	0.8	1	0.4	1.4	1.0	2.0	1.6
3			1.2	1.5		2.1	1.5	3.0	2.4
4			1.6	2		2.8			3.2

\* not all turboprop engines are contained in the FOI database



# Local Emission Charges in Europe





## Switzerland / (France)



### Switzerland (beginning 1.9.1997):

- Based on Federal Aviation Legislation
- Original Model: g (NO<sub>x</sub>+VOC)/kN thrust; 5 emission classes;
- Surcharge to landing charge of 0%, 5%, 10%, 20% and 40%
- Landing Charge reduction of 5% (= revenue neutral at starting date)
- applied at Zurich, Geneva (1998) and Bern (2001) for all aircraft
- introduction in Lugano in 2007 (some open issues)

### France (1.1.2003):

- applied at Basel: same model as currently applied in Switzerland;
- landing charge multiplier of 0.94, 1.05, 1.10, 1.20 and 1.30 (respective of emission class)
- Landing Charge reduction of 5% (= revenue neutral at starting date)



Sweden



Sweden (beginning 1.12.1998):

- original model with NO<sub>x</sub> and VOC; technology classes;
- reduction of weight based landing charges

(changed per 1.3.2004):

- ECAC-Recommendation and Swiss/Swedish Matrix for other aircraft;
- SEK 50.00 per kg Emission Value (basically NO<sub>x</sub>)
- Applicable at all airports for all aircraft



## United Kingdom



United Kingdom (beginning 1.4.2004):

- Based on ECAC Recommendation and Swiss/Swedish Matrix
- applied at BAA London-Heathrow, (as from 1.4.2004)
- only for aircraft >8'618 kg MTOW
- Bonus/Malus-System
- GB£ 1.10 per kg NO<sub>x</sub> > 23 kg (and rebate of GB£ 1.10/kg NO<sub>x</sub> < 23 kg)
  
- also applied at BAA London-Gatwick (as from 1.4.2005);
- same charges level and system as in LHR, but NO<sub>x</sub>-threshold of 16 kg



Germany



### Germany:

- possible non-compliances with EU Directives at some airports through expansion programs;
- in the process to pass legislation at federal level to enable states to introduce local emission charges on voluntary level;
- Basis is ECAC Recommendation and possibly CH/S-Matrix;
- airports can apply for local emission charges introduction;
- process of Frankfurt and Munich airports to introduce emission charges, beginning on 1.1.2008



## Conclusions



- Local Emission Charges respond to local problems and circumstances
- They are usually part of an overall mitigation plan to address air quality problems
- Harmonisation of the method is important for predictability
- LEC are also implemented in the absence of global solutions



All such measures have only local effects; global effects need different approach:

- Engine emission stringencies (aircraft, APU, GSE, vehicles)
- Agreed and implemented emission reducing procedures



Thank you



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