



Irisbus
IVECO

Product Management

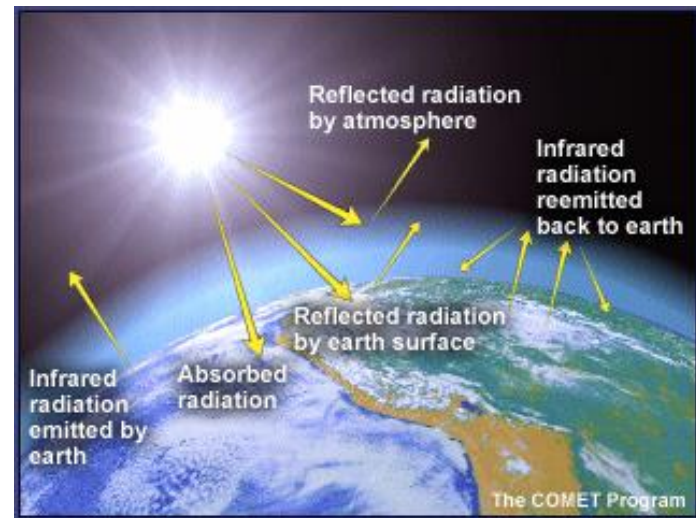
UITP Trolleybuses Salzburg

20th April 2006

Philippe Grand

Introduction

- Buses are responsible for less than 5% of pollution downtown cities, but...
- Public Transportation authorities **have to be more and more involved** in clean transportation programs to **show the way** to a better world to others



Challenges to meet for the future :

- Local requirements regarding **Noise and Pollution**
- **Emission of greenhouse-effect gases** : In France for example, transportation is responsible for 26% of CO2 emissions
- **Energy resources** : the consumption of oil is growing-up dramatically and resources are limited

Introduction

Irisbus has got different solutions to comply with clean transportation requirements :

- ➔ **Clean diesel technology (Euro4, Euro5, EEV)**
- ➔ **Natural gas (more than 3000 buses in operation worldwide)**
- **And electrical solutions !**
 - ✓ **CRISTALIS, CIVIS Trolleybus and guided vehicle**
 - ✓ **CITELIS Trolleybus**

 - ✓ **EUROPOLIS Electric Midibus with batteries**
 - ✓ **Hybrid Autobus (more than 100 bus in operation)**
 - ✓ **Fuel cell prototypes (CITYCELL program)**

Cristalis, Civis Trolleybus

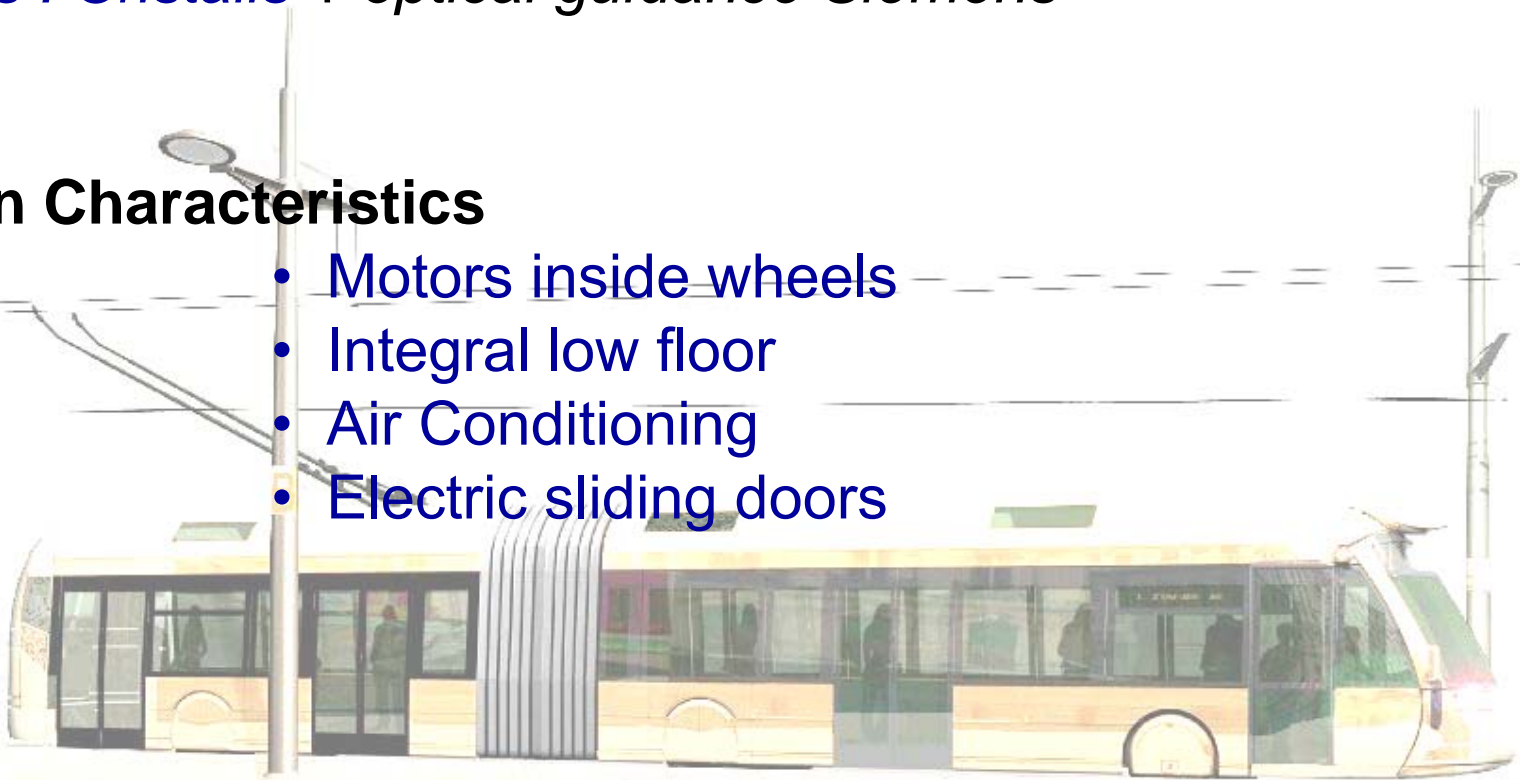
New generation trolleybus

Cristalis : Trolleybus

Civis : Cristalis + optical guidance Siemens

Main Characteristics

- Motors inside wheels
- Integral low floor
- Air Conditioning
- Electric sliding doors

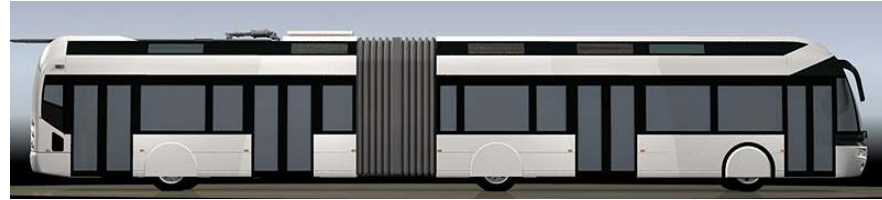


Cristalis, Civis Trolleybus - Range



Trolleybus 12m

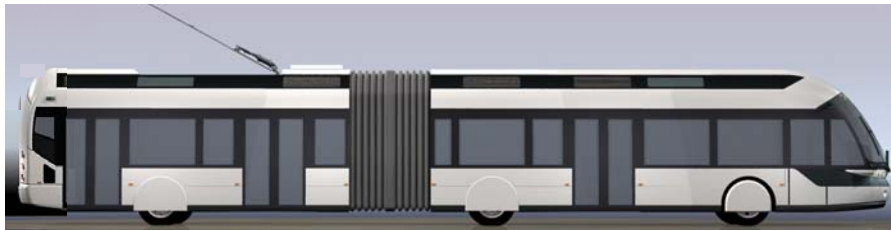
Lyon, St Etienne, Limoges



Trolleybus 18m

Lyon, Milano

In operation



Trolleybus 18.5m

Bologna

Cristalis, Civis Trolleybus - Versions

- Two different fronts

Classic
Left hand drive

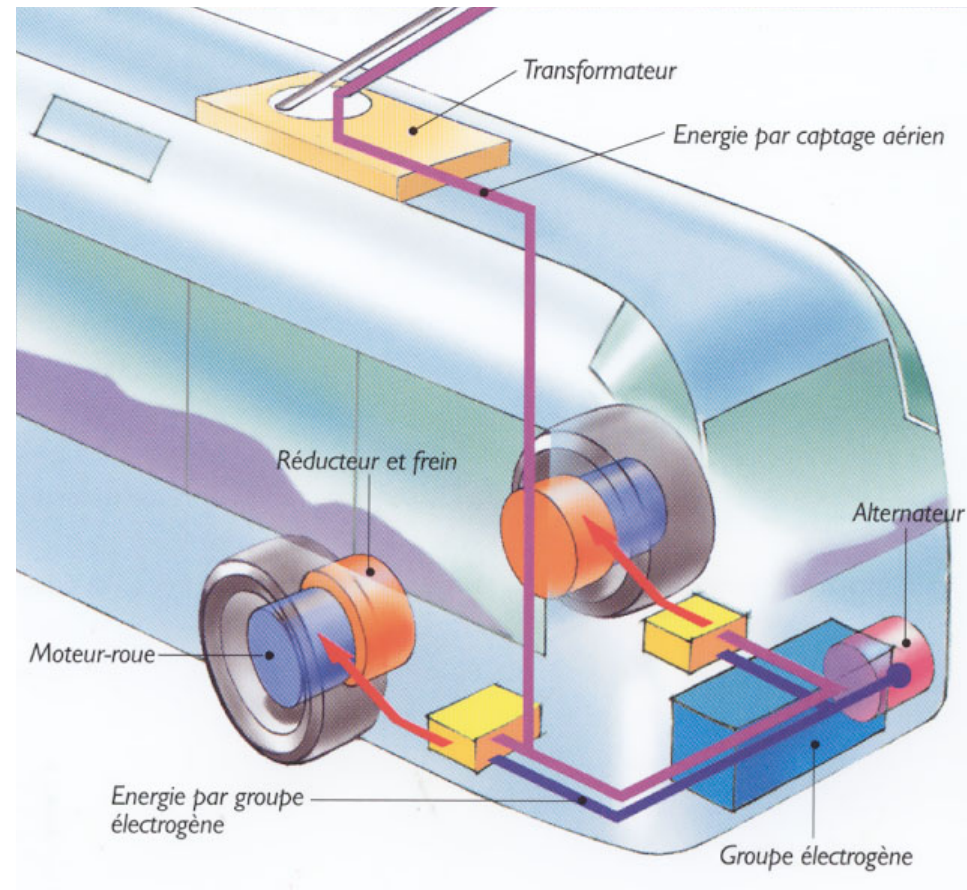
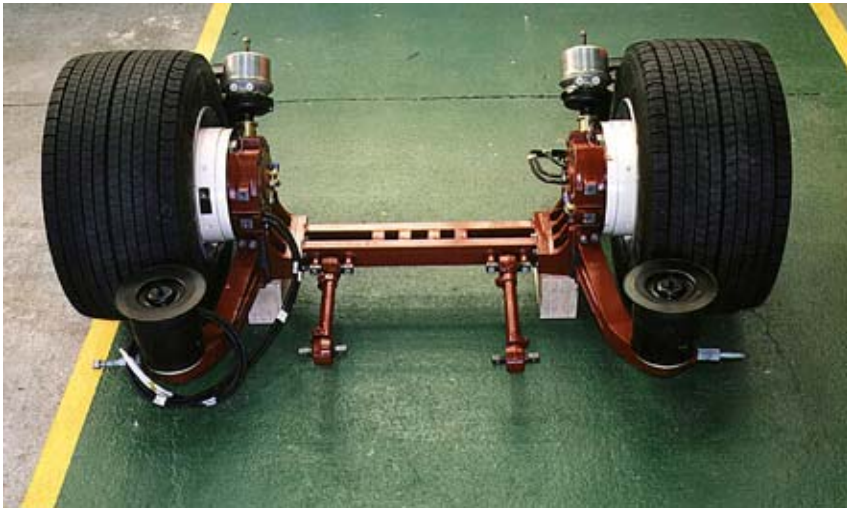
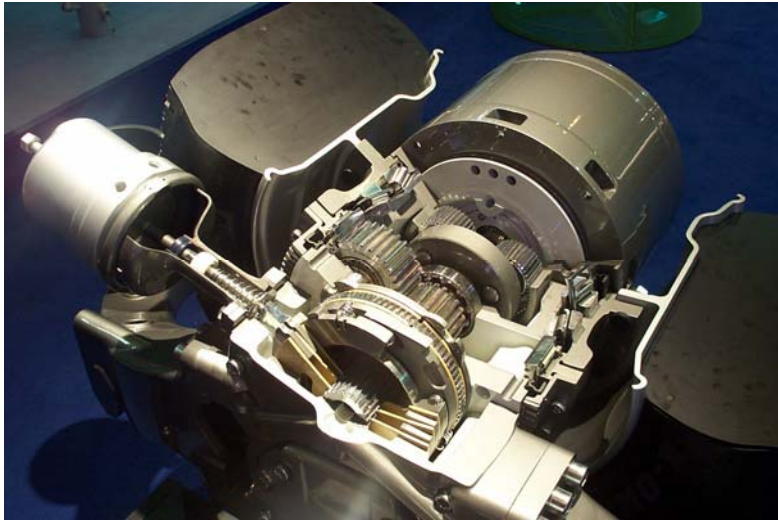


Tramway type
Central drive



Cristalis, Civis Trolleybus : Alstom Drive line

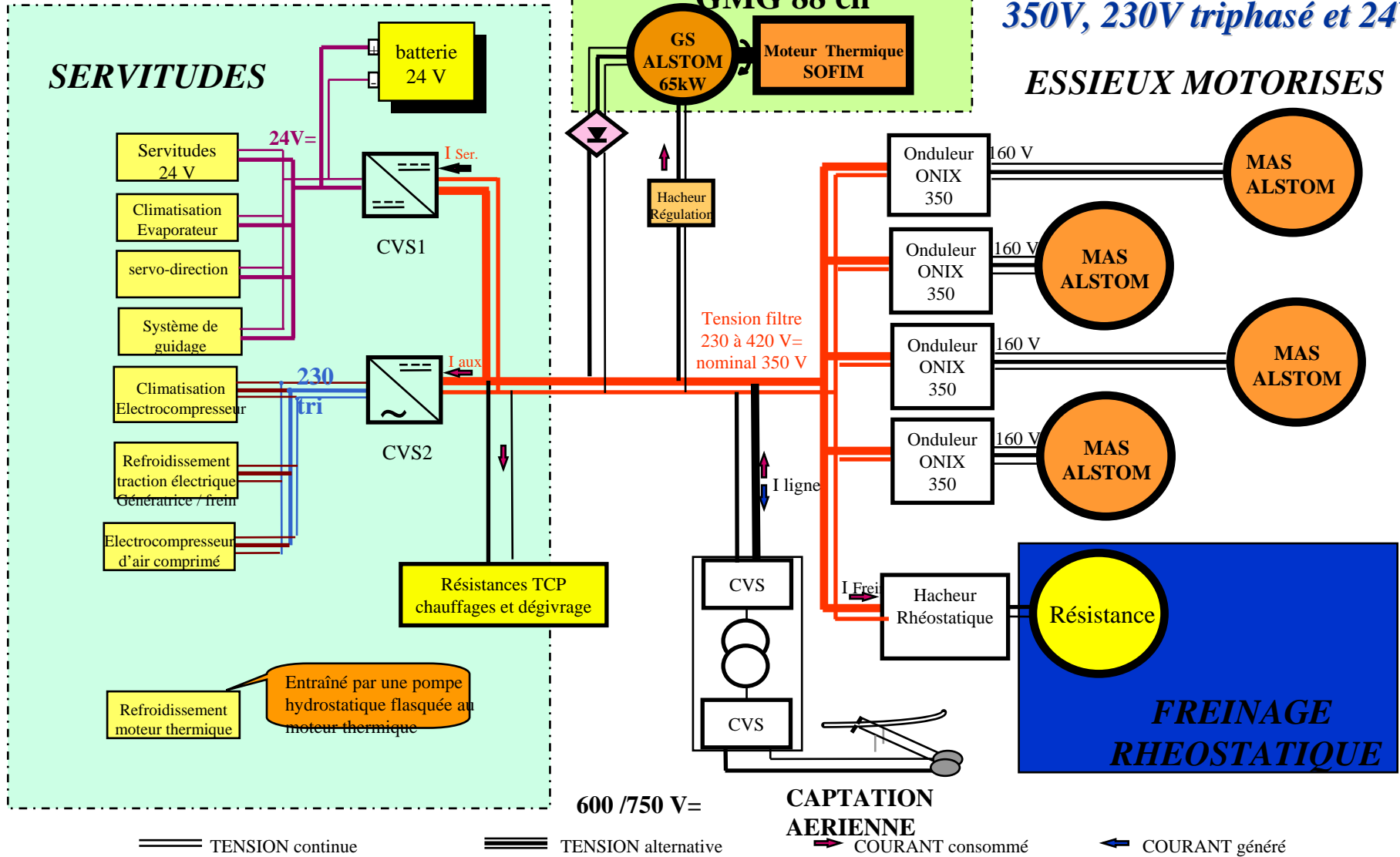
Motors are inside the wheels



Cristalis, Civis Trolleybus : Alstom Drive line

18 meters long version

Architecture des réseaux
350V, 230V triphasé et 24V



Cristalis, Civis Trolleybus : Line

Nominal voltage : 600 V= or 750 V= (EN 50 163)

Automatic detection of trolley being out of the lines

Height of the line : From 3,90 m to 7,00 m

Maximum angle deviation from the line : 49°

Automatic system to lift the trolleys up (with camera)



Cristalis, Civis Trolleybus : Lyon

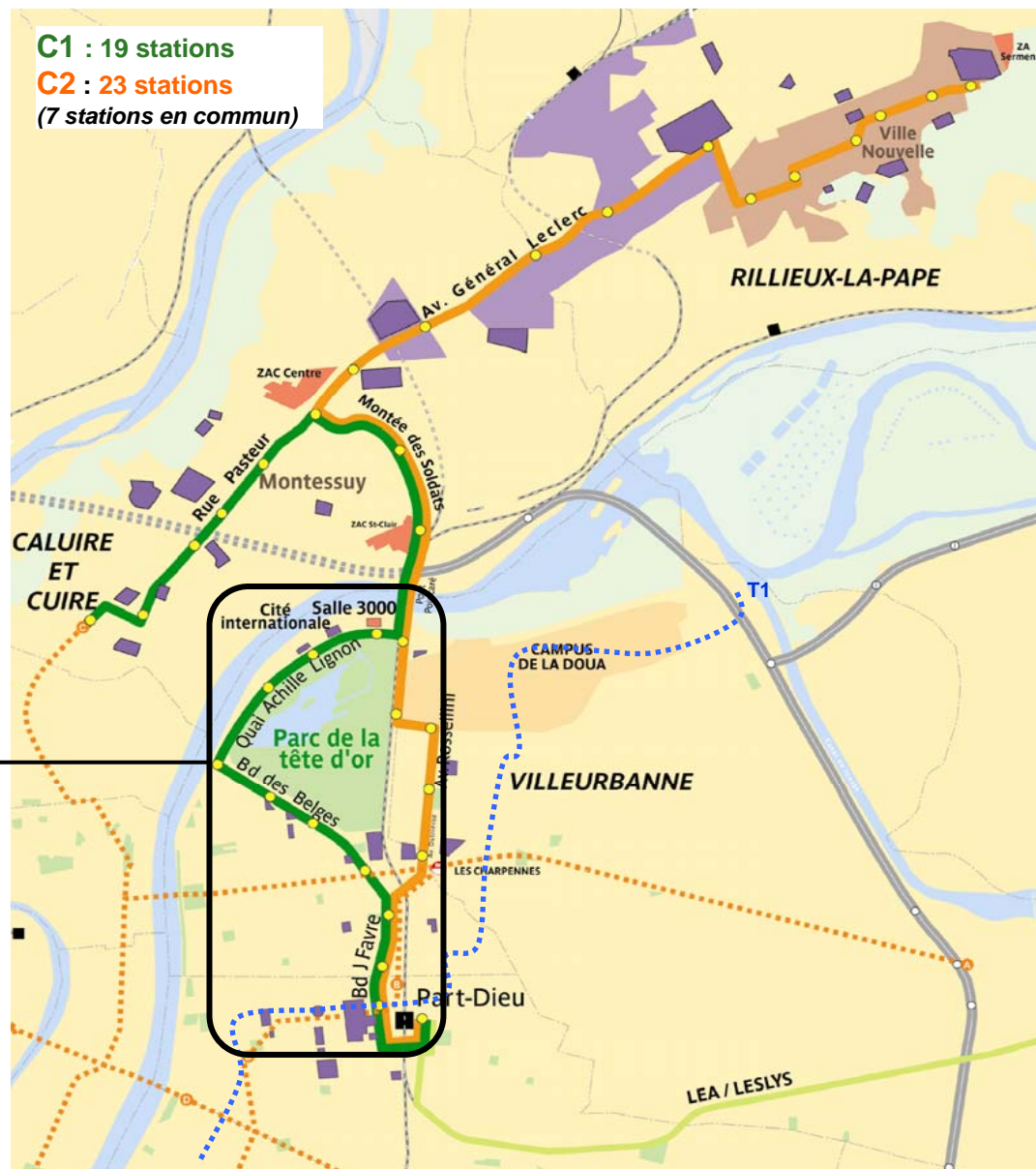
- 95 vehicles in operation (2001-2004), on 6 different lines
- 70 000 passengers per day and more than 6.5 Millions km
- 18 more vehicles ordered (2006)



Cristalis, Civis Trolleybus : Lyon extension

C1 = 7.8 km
C2 = 10.5 km

24 Cristalis 18 m
Budget = 60 M€

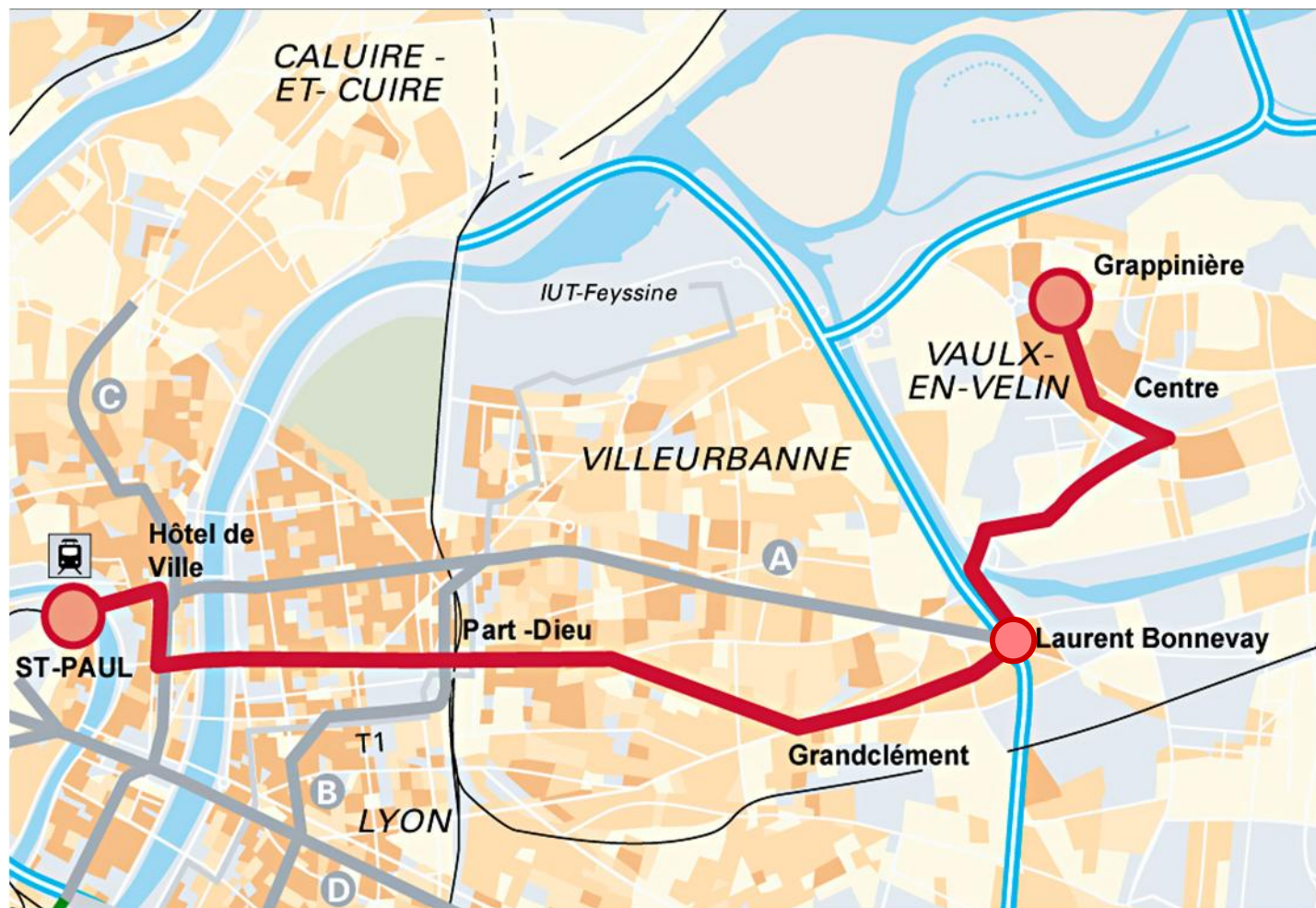


2010

End of First Phase - 2006

2009

Cristalis, Civis Trolleybus : Lyon extension



Extension
Of **line C3**
End 2006

10 more
vehicles

Existing line

Cristalis, Civis Trolleybus : Other contracts

Saint-Etienne : 11 x 12 m (2004)



Milano : 10 x 18 m (2006)



Limoges : 15 x 12 m (2006)



Bologna : 49 x 18,5 m (2009)

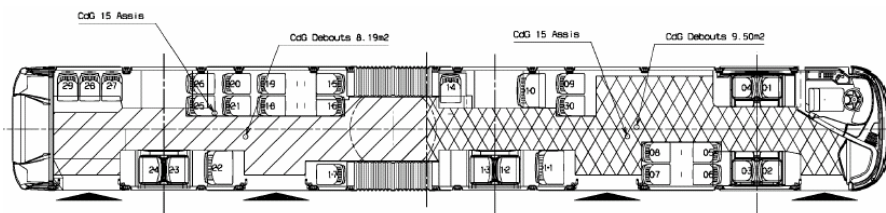


Cristalis, Civis Trolleybus : Milano

- Number of vehicles : **10**
- Type : **Cristalis 18 meters**
- 3 vehicles are currently in revenue service (the first one since Nov 05)
- Entire fleet expected to be delivered within Mid June 06



Cristalis, Civis Trolleybus : Milano

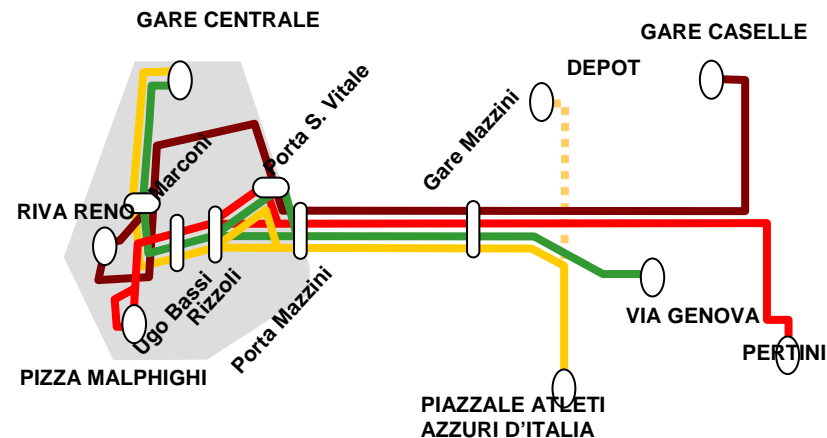


Caratteristiche generali

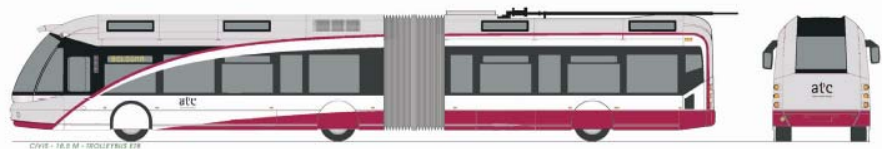
Tipo di veicolo	autosnodato 2 casse
Posto guida	sinistro
Lunghezza	17980 mm
Larghezza	2550 mm
Altezza massima	3400 mm
Altezza delle soglie d'accesso	320 mm
Larghezza corridoio in corrispondenza delle ruote	900/860 mm
Massa complessiva (cod. strada)	30000 Kg
Raggio minimo di volta	11718 mm
Fascia d'ingombro con raggio di sterzata di 12,5 m	6393 mm
Posti a sedere	n° 30
Posti in piedi (6 p/m ²)	n° 109
Spazio posto disabili	n° 1
Posti totali (6 p/m ²)	n° 140
Parte scorrevoli a doppia anta	n° 3
Parte scorrevoli ad anta singola (anteriore)	n° 1
Tensione di alimentazione (da rete aerea)	600/750 V
Potenza	250 kW
Velocità massima	70 km/h
Accelerazione max allo spunto	1,2 m/s ²
Accelerazione media (0-40 km/h) in piano	0,7 m/s ²
Decelerazione max con frenatura elettrica	1,3 m/s ²
Decelerazione max	>5 m/s ²
Pendenza max superabile allo spunto (con alimentazione da rete)	18%
Pendenza max superabile allo spunto (con generatore auton.)	12%
TRAZIONE	motori su 2° e 3° asse
Motori elettrici	n° 4 asincroni trifase raffreddati ad acqua
Potenza continuativa	4x60 kW
Potenza max	4x80 kW
MOTO-GENERATORE per marcia autonoma	Diesel + Alternatore
Potenza utile di trazione	65 kW
FRENI	Asse anteriore a disco / Asse motore a multidisco
Sospensioni pneumatiche	a controllo elettronico
ABS/ASR	
Pneumatici asse anteriore	315/60 R22,5
Pneumatici asse centrale	495/45 R22,5
Pneumatici asse posteriore	495/45 R22,5

Cristalis, Civis Trolleybus : Bologna

- Project Partners : CCC (civil works)
- Number of vehicles : 49
- Type : Civis 18.5 meters with optical guidance system
- Network lines : 4 (approx. 40 bus stops)
- Tot line length \approx 20 km
- Delivery of complete system (vehicles + civil work + substation) expected beginning 2009



Cristalis, Civis Trolleybus : Bologna



Caratteristiche generali

Tipo di veicolo	autosnodato 2 casse
Posto guida	centrale
Lunghezza	18430 mm
Larghezza	2550 mm
Altezza massima	3400 mm
Altezza delle soglie d'accesso	320 mm
Larghezza corridoio in corrispondenza delle ruote	900/860 mm
Massa complessiva (cod. strada)	30000 Kg
Raggio minimo di volta	11718 mm
Fascia d'ingombro con raggio di sterzata di 12,5 m	6393 mm
Posti a sedere	n° 29
Posti in piedi (5 p/m²)	n° 112
Spazio posto disabili	n° 1
Posti totali (5 p/m²)	n° 141
Porte scorrevoli a doppia anta	n° 3
Porte scorrevoli ad anta singola (anteriore)	n° 1
Tensione di alimentazione (da rete aerea)	600/750 V
Potenza	250 kW
Velocità massima	70 km/h
Accelerazione max allo spunto	1,2 m/s²
Accelerazione media (0-40 km/h) in piano	0,7 m/s²
Decelerazione max con frenatura elettrica	1,3 m/s²
Decelerazione max	>5 m/s²
Pendenza max superabile allo spunto (con alimentazione da rete)	18%
Pendenza max superabile allo spunto (con generatore autonomo)	12%

TRAZIONE	motoruote su 2° e 3° asse
Motori elettrici	n° 4 asincroni trifase raffreddati ad acqua
Potenza continuativa	4x60 kW
Potenza max	4x80 kW

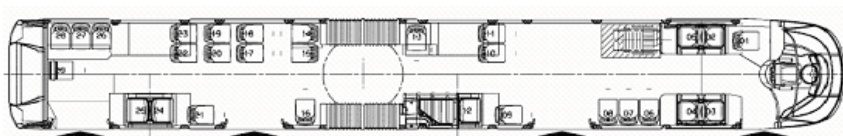
MOTOGENERATORE per marcia autonoma	Diesel + Alternatore
Potenza utile di trazione	65 kW

FRENI Asse anteriore a disco / Asse motore a multidisco

Sospensioni pneumatiche a controllo elettronico

ABS/ASR

Pneumatici asse anteriore	315/60 R22,5
Pneumatici asse centrale	496/45 R22,5
Pneumatici asse posteriore	496/45 R22,5



Cristalis, Civis Trolleybus : Saint-Etienne, Limoges

Saint-Etienne

- N of vehicles : **11 in operation**
- Type : **Cristalis 12 meters**



Limoges

- N of vehicles : **15 delivered**
- Type : **Cristalis 12 meters**

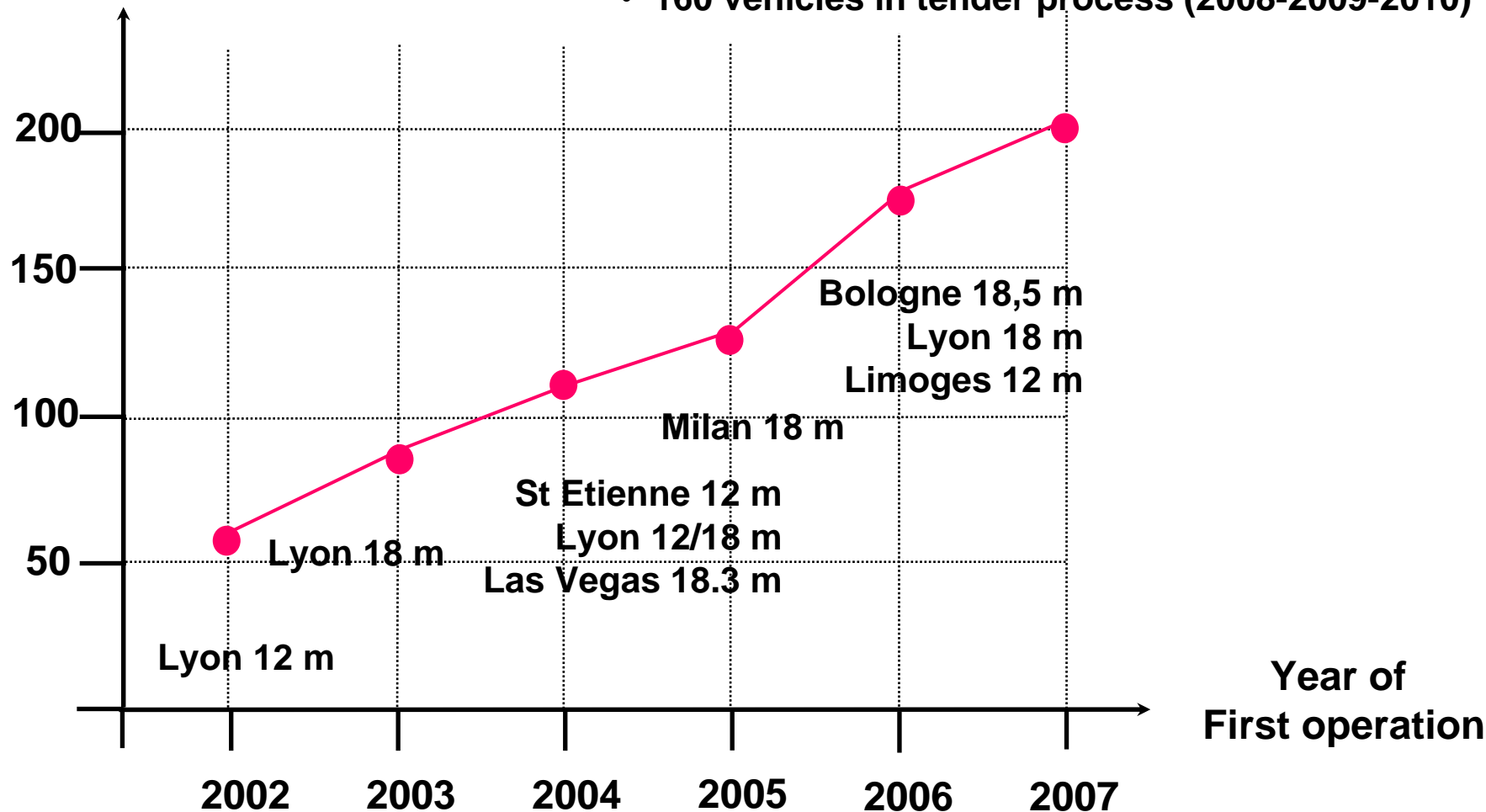


Cristalis, Civis Trolleybus : Commercial situation

In January 2006 :

- 120 vehicles in operation
- 100 vehicles ordered
- 160 vehicles in tender process (2008-2009-2010)

Number of
vehicles



Citelis Trolleybus : Skoda and Astrabus

In order to have an alternative to Cristalis / Civis, Irisbus decided to cooperate with 2 major electric Drive line suppliers in Central Europe :

- Skoda Electric (Cz)
- Astra Bus (Ro)

The first body : **Agora** (2004),
The new body : **Citelis**



Agora With Astrabus



Agora With Skoda electric

Citelis Trolleybus : Skoda and Astrabus

Citelis With Skoda electric

Main characteristics:

- Anticorrosive **cataphoretic vehicle body protection**
- **Modular design** system allowing to construct the vehicle on the basis of unit assembly system according to the requests and needs of the customer.
- The possibility of using the **service network of IRISBUS / IVECO**
- Concluded contracts or final negotiations for the deliveries of
 - ✓ **70 trolleybuses ŠKODA 24 Tr / 25 Tr** to various European customers
 - ✓ and **30 trolleybuses ASTRABUS to Cluj (Romania)**



Citelis Trolleybus : Skoda and Astrabus

Passengers compartment



Citelis Trolleybus : Skoda 24 Tr Irisbus

Length / width / height	11 990 / 2 500 / 3 500 mm
Entrance step	330 mm
max. speed	65 km/h
Number of seats	30
Standing passengers	69
Front axle	Renault E 70 XH
Rear axle	ZF-EBZ 4472635154
Traction motor	Asynchronous 210 kW
Traction power	AC propulsion with IGBT technology
Heating	Water heating with heat exchanger

Available in 2007 in Western Europe Countries



Citelis Trolleybus : Skoda 25 Tr Irisbus

Length / width / height	17800 / 2 500 / 3580 mm
Entrance step	330 mm
max. speed	65 km/h
Number of seats	45
Standing passengers	110
Front axle	Renault E 70 XH
Middle axle	Renault EM 10 A
Rear axle	ZF AV 132.80
Traction motor	Asynchronous 240 kW
Traction power	AC propulsion with IGBT technology
Heating	Water heating with heat exchanger

Available in 2007 in Western Europe Countries



Citelis Trolleybus : Skoda electric

Power propulsion

Traction engine

Asynchronous ŠKODA 18ML 3550 K/4
240 kW



Main inverter

- Air cooled traction inverters using IGBT technology
- For 600 V DC and 750 V DC line voltages
- Microprocessor- based control circuits
- Regenerative and resistive braking
- Diagnostic system of the main drive
- Control via CAN communication



Citelis Trolleybus : Skoda electric

Collector poles

Semiautomatic collector poles with pneumatic control

Control thru CAN communication

Auxiliary power unit

Diesel – generator KIRSCH

Power 100 kW

EURO IV

Fuel tank 240 l



Citelis Trolleybus : Astra Bus

Length / width / height	11 990 / 2 500 / 3 500 mm
Entrance step	330 mm
max. speed	65 km/h
Number of seats	30
Standing passengers	69
Front axle	Renault E 70 XH
Rear axle	ZF-EBZ 4472635154
Traction motor	DC
Traction power	DC propulsion

Available soon in Citelis version



Conclusions

- Irisbus considers Trolleybuses as being a very good alternative to Diesel vehicles
- Three different products are available for different markets :
 - ✓ Cristalis and Civis for Western Europe countries. High level service
 - ✓ Citelis with Skoda propulsion for countries all over the world (Europe, South America)
 - ✓ Citelis with Astrabus for Eastern Europe Countries
- Lets the customers make their choice between Irisbus products !



Thanks for your attention



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