

# **Verona Trolleybus system: A pro-active approach (against all odds)**

**Antonio PIOVESAN, Technical Manager  
ATV - Verona, Italy**

23<sup>rd</sup> Trolleybus Committee meeting  
01 – 02 October, Malatya, Turkey

# Summary

## PROJECT OVERVIEW

Verona city

Project abstract and goals

Transport project

Costs and Funding

New depot

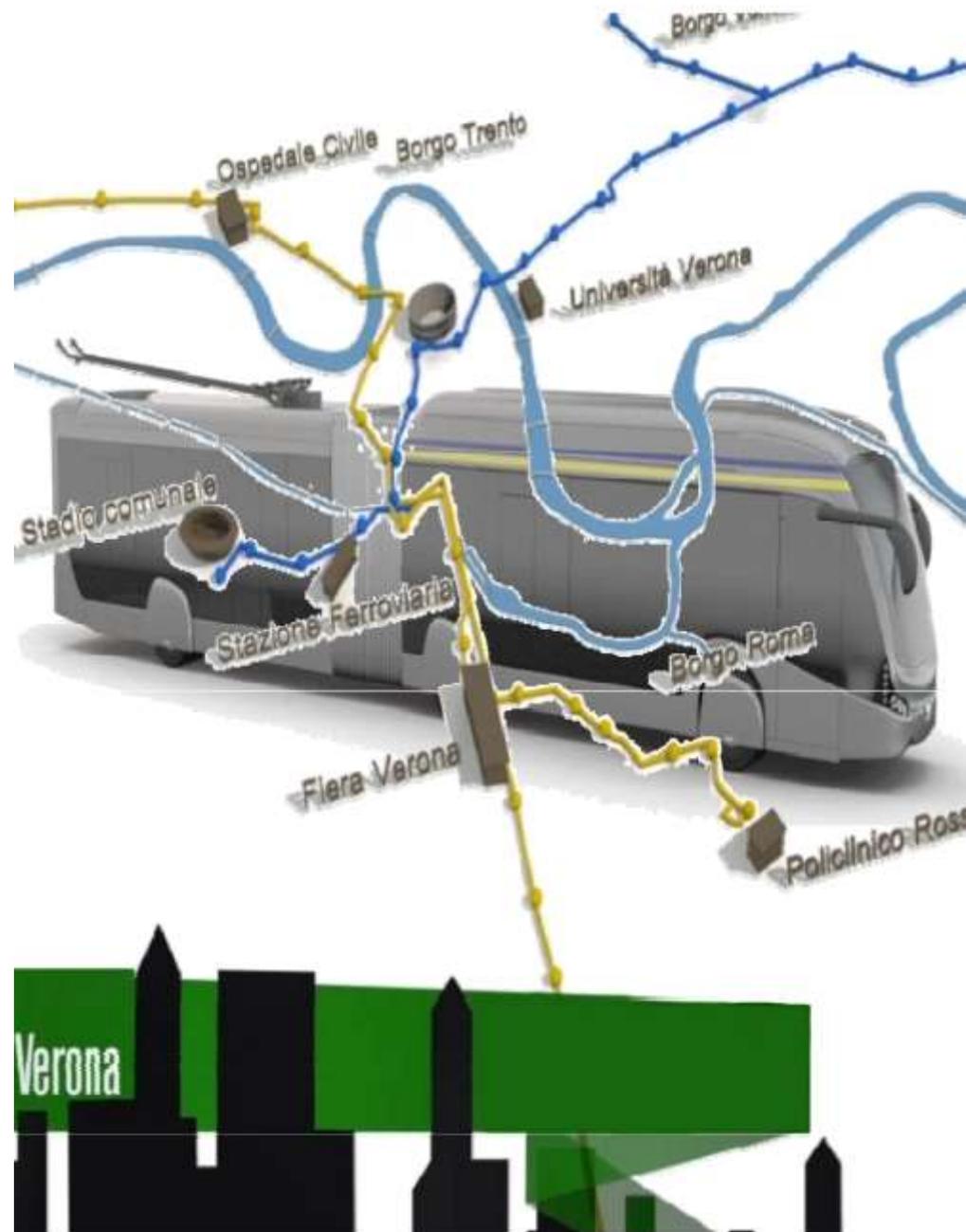
## PROJECT TIMELINE

Why did it take so long?

## CHANGE OPPORTUNITIES

The hybrid electric option

Happy ending...



# The (beautiful) city of Verona

260,000 inhabitants

Roman city

8<sup>th</sup> most visited Italian city in 2014

UNESCO Heritage site

City of love...



# Verona bus public transport (ATV)

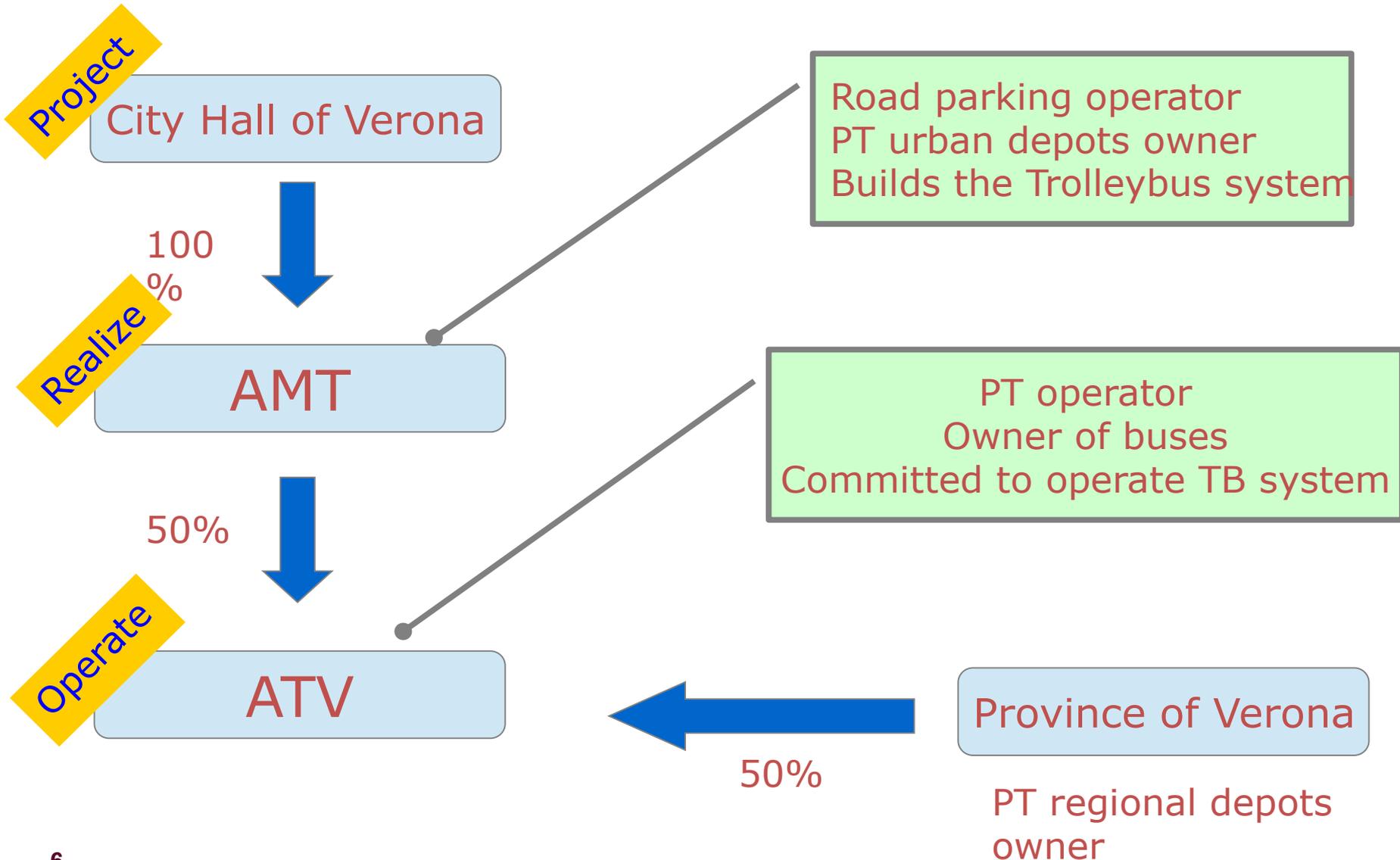
600 buses (190 urban of which 107 CNG)  
20 mln km (7 urban)  
770 workers (about 600 drivers)  
19 urban daytime routes  
urban daytime commercial speed 15,4 km/h  
ATV is a healthy public owned company



# OVERVIEW – Abstract and goals

1. Give a new backbone to urban TPL in Verona, with higher commercial speed and capacity
2. Less polluting (then buses)
3. Protect the new system from traffic jam, but without barriers
4. Without rails and without aerial line in the city center
5. 60% public funding (formerly for a tramway system) – not to loose...
6. Build a new depot
7. Road improvement when necessary
8. Automatic driving system at bus stop

# The players





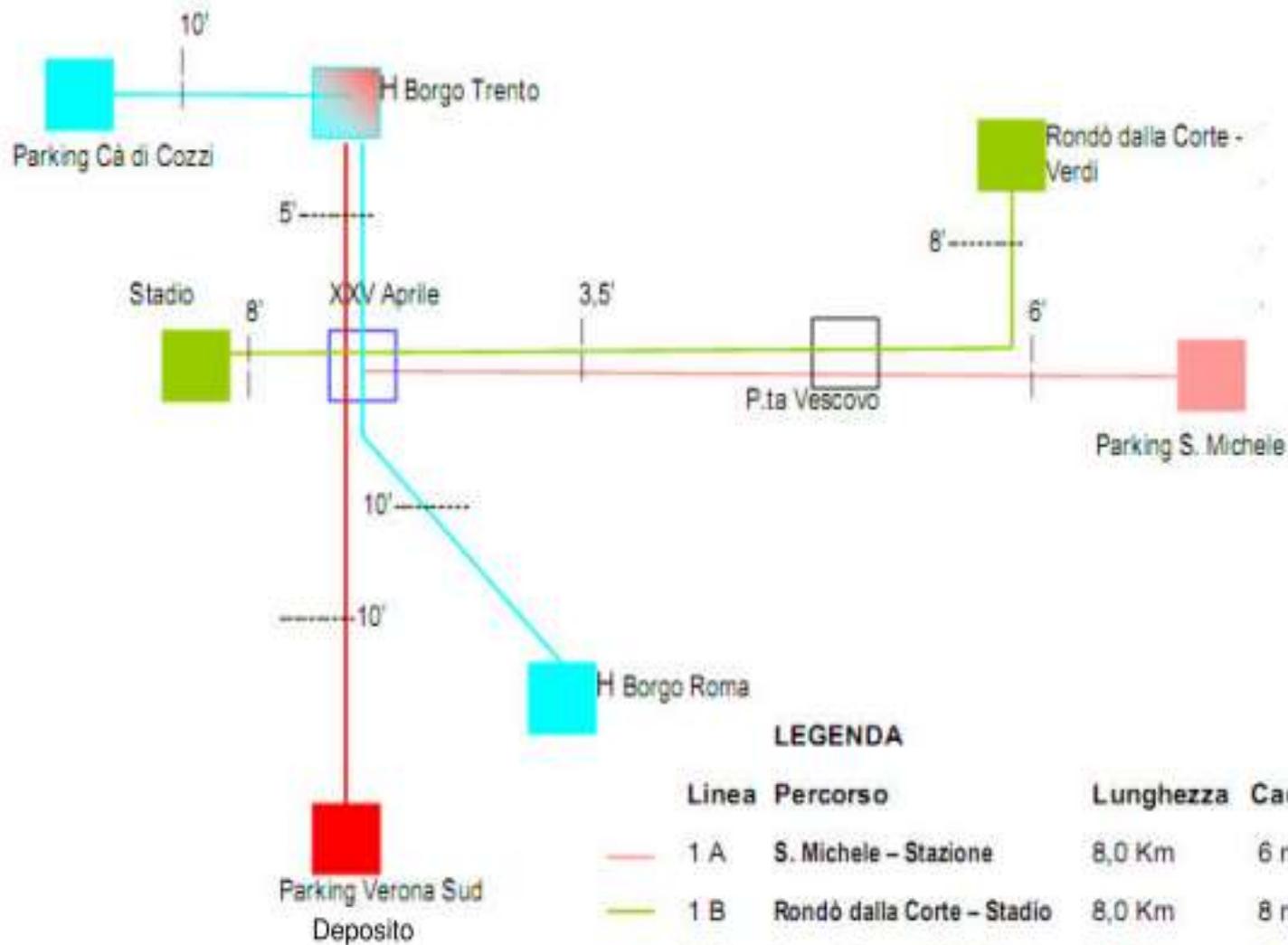
Hence, the implementation of an electric urban bus system with overhead contact lines over only about 30 to 50 % of the line becomes possible. It is thus possible to avoid line sections with overhead contact lines in:

- Sensitive urban areas where the overhead contact line itself, but also its suspension poles or outside walls, is regarded as extremely obstructive;

- Areas in which very complicated and cost-intensive crossings and switches would be needed for the overhead contact line;



# Transport Project



## LEGENDA

Linea	Percorso	Lunghezza	Cadenza
1 A	S. Michele - Stazione	8,0 Km	6 min
1 B	Rondò dalla Corte - Stadio	8,0 Km	8 min
2 A	Borgo Roma - Cà di Cozzi	9,5 Km	10 min
2 B	Borgo Trento - Verona Sud	8,0 Km	10 min

# Pre-tender project

2+2 lines: 1A+1B (2450 pax/h)  
2A+2B (1680 pax/h)

34+3 trolleybuses 18 mt (longer is forbidden...)

diesel APU, automatic driving system, supercaps

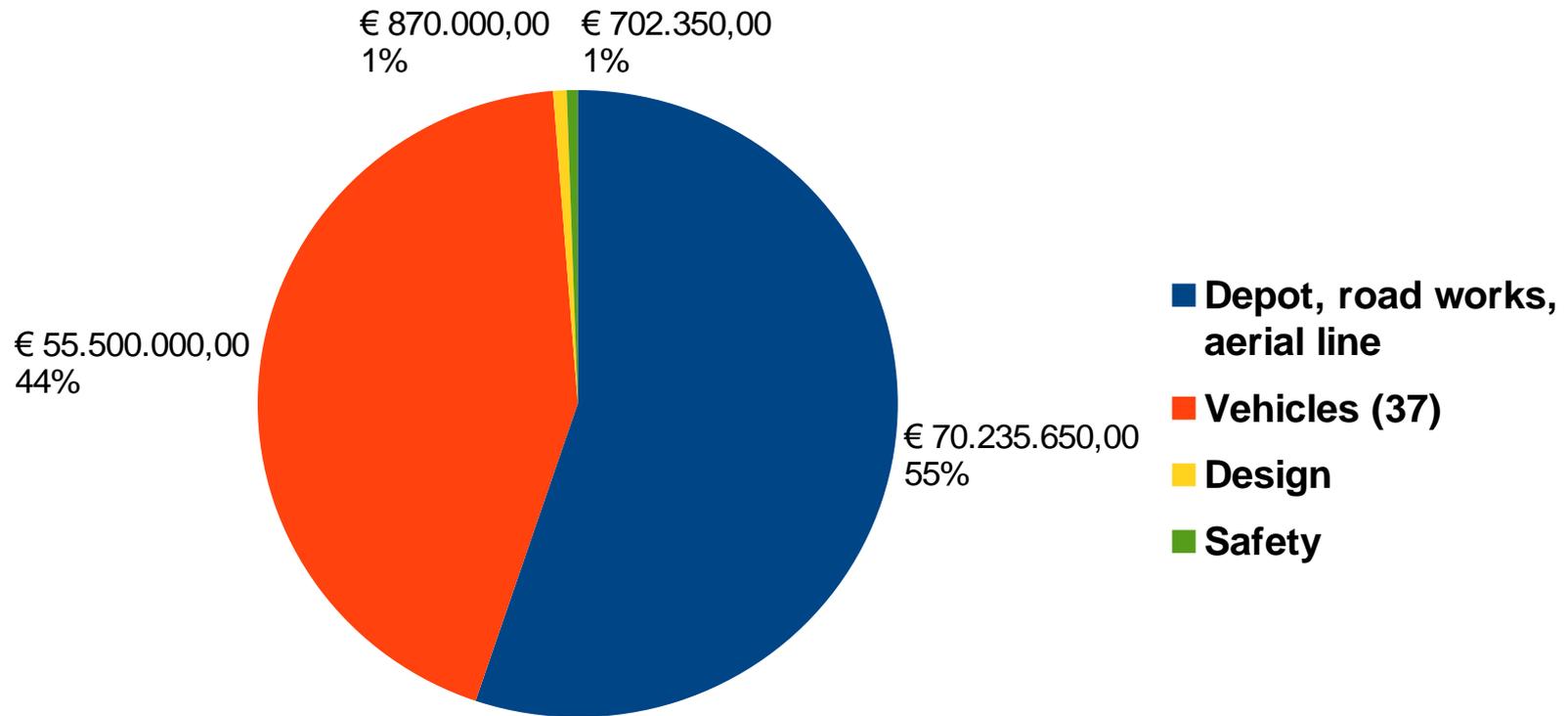
11 power sub stations, 750 Vcc

New depot and workshop (prepared for buses)

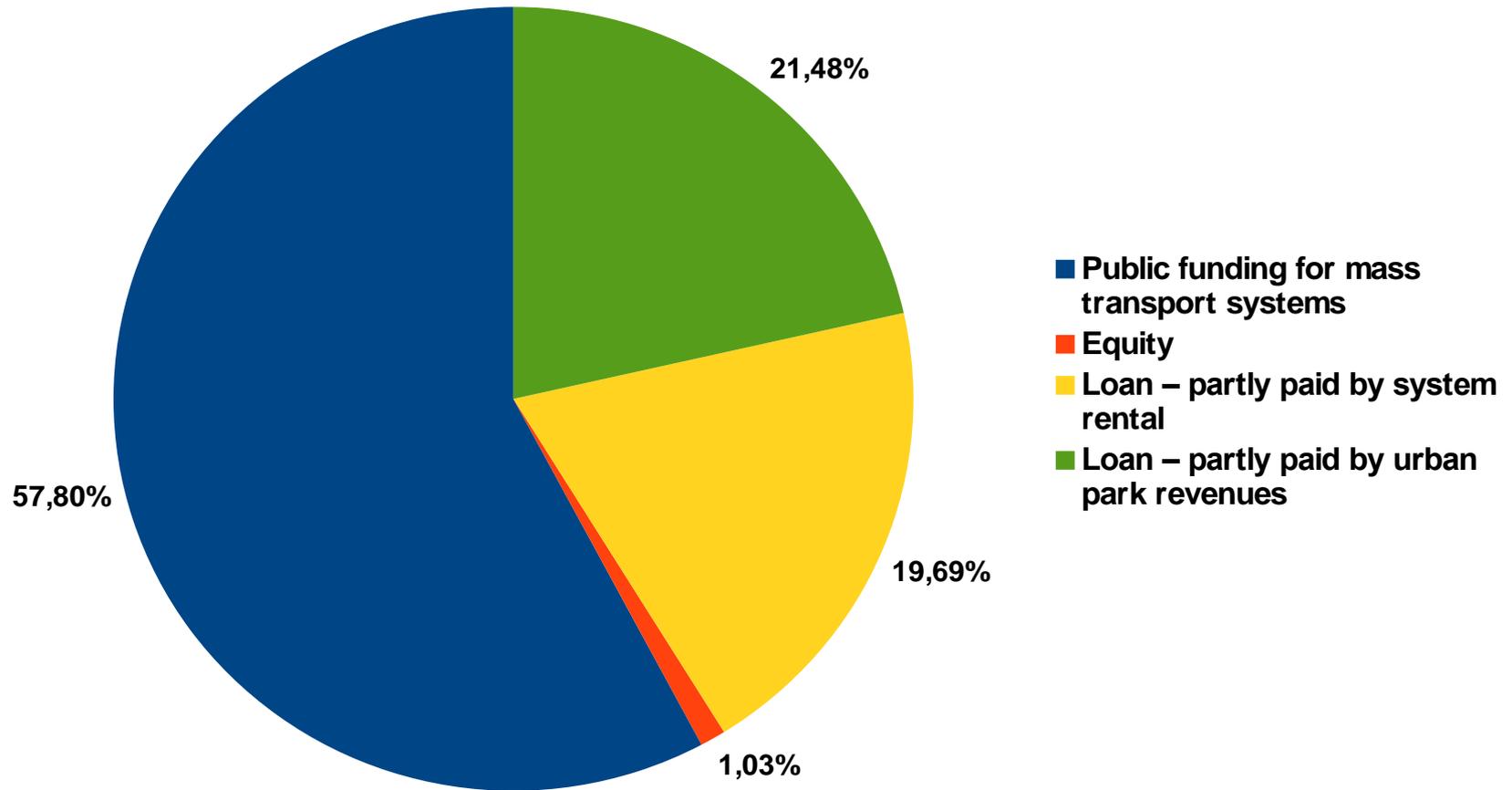
New 4-lanes underpass at a critical crossing

Park-and-ride facilities at line terminals

# Investment Breakdown



# Funding breakdown



# Cost/km

16,7 km with aerial line

7,12 km no aerial line (but with vehicles)

**20 km**

Final tender price: 115,6 MLN €

Considering some other expenses 120 MLN

**6 MLN/km**

## CAPITAL AND OPERATIONAL BUDGET PLANNING

Many cities would like to make their public transportation both noise and emission free and

considered to build a capital expenditure budget and an operating budget. Each of the elements can be weighed as a function of local specifics.

Accordingly, trolleybus implementation costs can be as low as €1M or as high as €20M per kilometre.

# New depot

Winning project

New area

Modified

PROGETTO DEFINITIVO



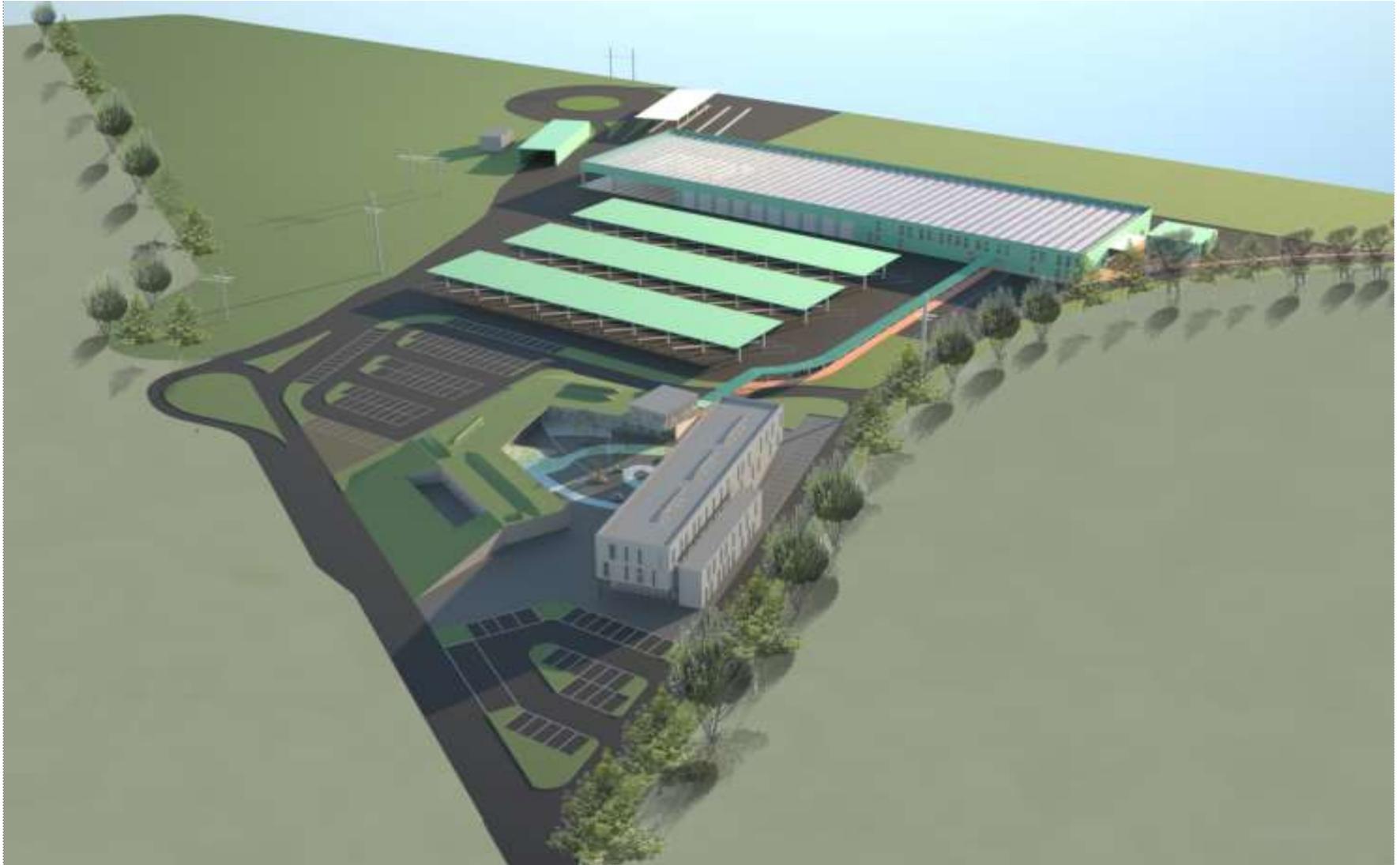
NUOVA AREA MESSA A DISPOSIZIONE DAL COMUNE DI VERONA



PROGETTO DEFINITIVO AGGIORNATO



# New depot (first version)



# Timeline

2010

Tender start

2011

Tender award (with final project)

2012

Project approval (for funding), First board of stakeholders (Conferenza di servizi), Contract award, second board of stakeholders with request for project changes

2013

Project adjustment for changes, final board of stakeholders

2014

Various approvals (technical, for funding, etc,), construction planning starts, APTS bankruptcy, CDC bankruptcy

2015

New contractor (same group), analysis for a new vehicle

# Why did it take so long ?

## 1 – TOO MANY HEADS?

A lot of stakeholders with decisional power, they can require project changes

# Stakeholders (main)

## 1. Municipality of Verona:

Urban transport authority

Stazione appaltante through AMT (owned company)

Co-owner of ATV (TB system operator)

Political commitment

Committed with 21% of funding, payed with parking revenues

## 2. ATV – TPL operator in Verona.

Committed with 20% of funding, payed by TB system renting

## 3. Transport ministry: committed with 58% of funding

## 4. Province of Verona: co-owner of ATV, area transport authority

## 5. Residents in the trolleybus areas: waiting for a period of roadworks followed by PT improvement

# Stakeholders (others)

6. Authority for monumental and historical conservation (2x)
7. Underground utilities owner/manager (7X)
8. Environmental authority (2x)
9. Highway management company
10. City hospital
11. Fire Department
12. Central train station owner
13. City Prefect
14. Veneto Region authority
15. USTIF (Electric transport systems authority)
16. Canal and river authorities (2x)

**Total: 32 sitting at the decisory board**

# Why did it take so long ?

1 – Too many heads? A lot of stakeholders with decisional power, they can require project changes AFTER the tender

## 2 – **TOO MUCH REVOLUTION?**

Big and comprehensive project, with many critical focuses: infrastructure, urban mobility, car parking, underpass, new depot (prepared for all buses...), vehicle with long-range wireless capability

# Why did it take so long ?

1 – Too many heads? A lot of stakeholders with decisional power, they can require project changes AFTER the tender

2 – Too much revolution? Big and comprehensive project, with many critical focuses

## 3 – **PUBLIC FUNDING SIDE EFFECTS?**

Public funding is for sure a big help in realizing such an expensive project, but multiple reporting and approval process on all project phases can waste precious time

# Why did it take so long ?

- 1 – Too many heads? A lot of stakeholders with decisional power, they can require project changes AFTER the tender
- 2 – Too much revolution? Big and comprehensive project, with many critical focuses
- 3 – PUBLIC FUNDING SIDE EFFECTS? Multiple reporting and approval process can waste time
- 4 – Bankruptcy & winding-up.

# Winding-up and others

CONCORRENTE  
ATI:

**SOVECO**  
COSTRUZIONI SPA

**APTS**  
Advanced Public  
Transport Systems by



CONSORZIO COOPERATIVE COSTRUZIONI  
CCC

Società cooperativa  
(MANDATARIA/CAPOGRUPPO)

**ALPIQ**  
Alpiq InTec Verona S.p.A.



**MAZZI**

Impresa Generale Costruzioni  
S.p.A.

**Balfour Beatty**  
Rail

PROGETTAZIONE  
COSTITUENDO R.T.P.:



(MANDATARIA/CAPOGRUPPO)

DIRETTORE TECNICO

Dott. Ing. Massimo Raccosta



DIRETTORE TECNICO

Dott. Arch. Valentina Butterini

# Winding-up and others

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PROGETTAZIONE  
COSTITUENDO R.T.P.:

**FB** **FRANCESCO**

(MANDATARIA/CAPOGRUPPO)  
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**CCIRRA**

DIRETTORE TECNICO

Dott. Arch. Valentina Butterini

# In the middle of difficulty lies opportunity...

We need to change the vehicle



Euro 6 – problems with diesel APU



New battery technology available



**OPPORTUNITY**

# Going toward hybrid technology ?

extended periods of time, trolleybus operations can be planned to allow driver rotation on customer routes, hence minimising non-productive travel back to the depot. The electric battery buses commercially available today have not yet attained, for major bus routes with heavy ridership, a level of operational efficiency and economic performance akin to those of today's diesel buses.

The trolleybus is a dynamically charged electrobus (electric bus). The dynamic charge is provided through direct contact between the trolleybus' poles and the overhead contact line; direct contact is the most efficient method to transfer electrical energy from one electrical circuit to another. It can remain in customer service as long as operationally required and can travel autonomously over short distances up to approximately 10 kilometres, without contact with the overhead contact line; relying solely on the electrical energy stored in on-board batteries. As the capacity and performance of on-board energy charging, storage, and management systems improve, and as the energy requirement of sub-systems decreases through improvements resulting from R&D efforts;



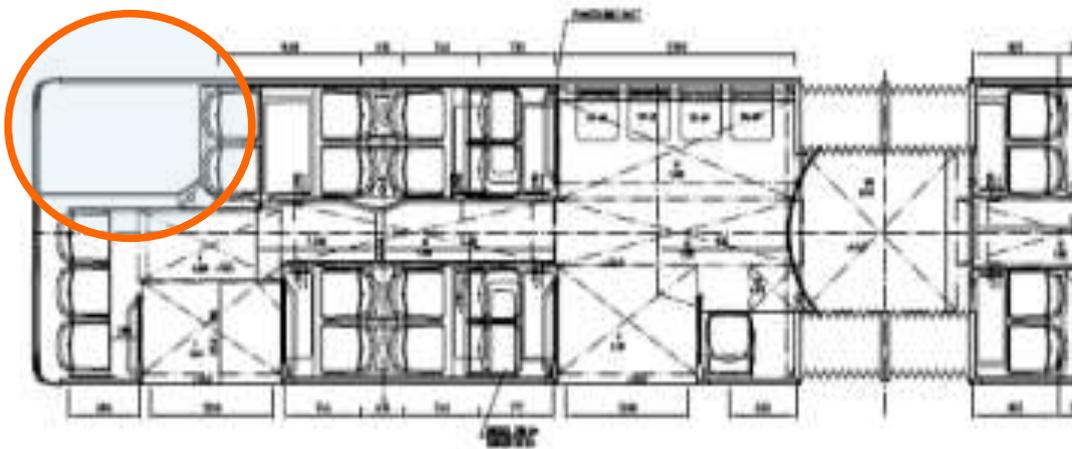
Figure 2: Hybrid electric bus from Eberswalde, Germany (photo by Bornim Bus Company mbH)

Today's trolleybuses can be regarded as «hybrid electric buses», hence a cross between a traditional trolleybus and a battery bus. The hybrid electric bus (today's trolleybus) can charge its energy storage units under the overhead contact line of a trolleybus during the journey and thus drive, both on line sections with an overhead contact line, and on line sections without an overhead contact line. In this way, the disadvantages of the trolleybus (i.e. overhead contact line needed) and of the battery bus (i.e. low range) can be overcome by the hybrid electric bus.

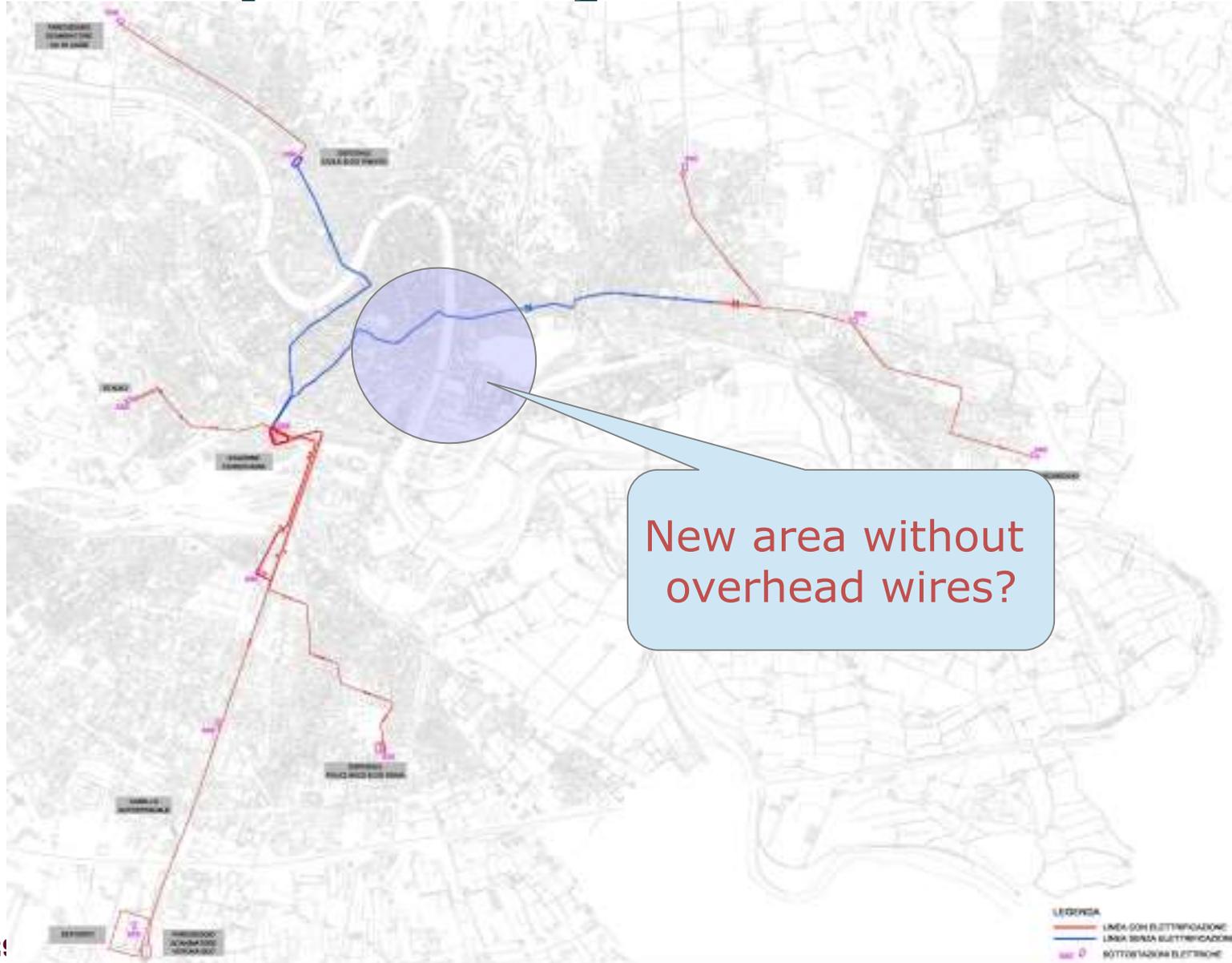
## Hybrid electric

- + no local pollution
- + noiseless
- + more power in wireless mode
- + more room for passengers
- + no supercaps
- + no gas station
  
- limited range
- leans strongly on battery technology
  
- ??? maintenance

# Tender Vehicle



# Transport Project





**TO** **BE**  
**CONTINUED...**

THANKYOU FOR YOUR  
ATTENTION

[antonio.piovesan@atv.verona.it](mailto:antonio.piovesan@atv.verona.it)