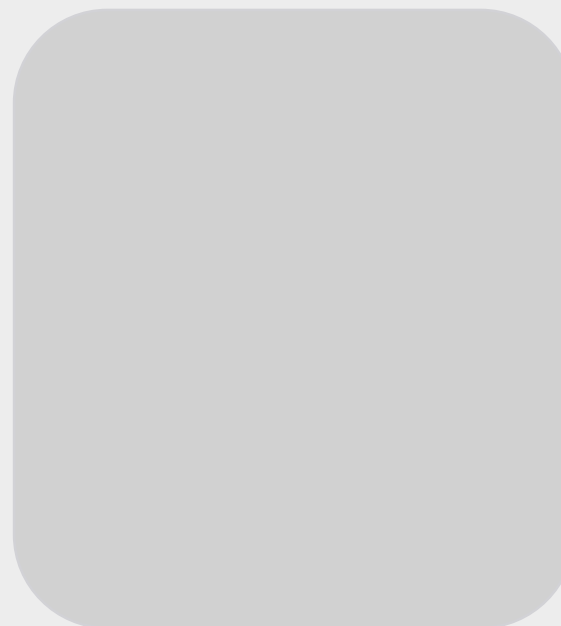


Digitalization of the District Heating Network: A Journey Toward a Real-Time Digital Twin

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Engineer in Network Management Dept.





About Kaunas

- Second-largest city in Lithuania
- Population: ~300,000
- Important center of technology, business, and innovation
- Well-developed district heating infrastructure
- Focus on sustainability and smart city solutions





About Company

Kauno Energija – One of Lithuania's Leading District Heating Companies

Established in 1963

Provides:

- District heating
- Cooling
- Domestic hot water



Petrašiūnai Power Plant, Kaunas

Mission


- Reliable and cost-efficient supply of district heating, cooling, and hot water.


Core Values

- Professionalism
- Innovation
- Transparency
- Teamwork
- Community Focus



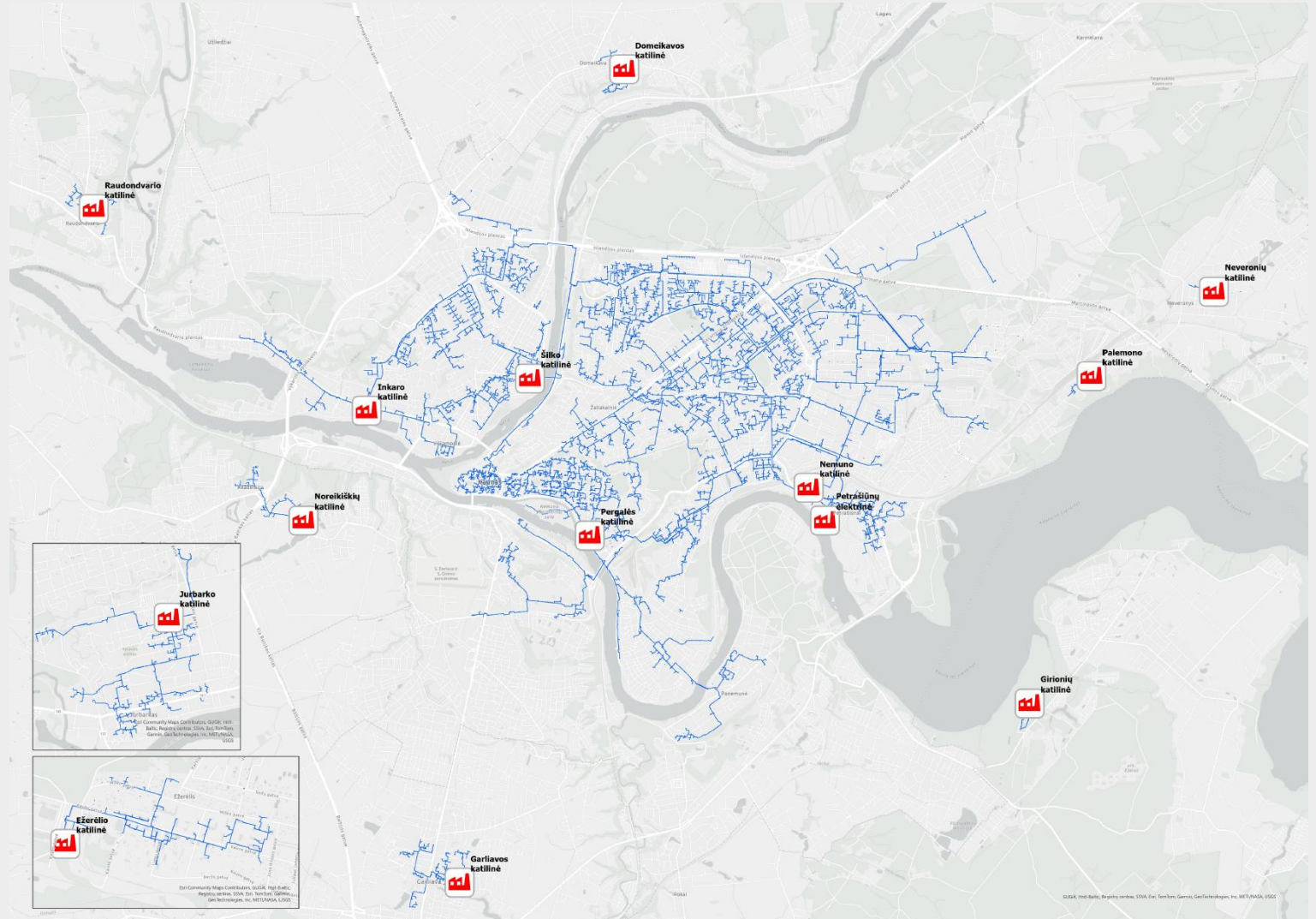
District Heating Network

 **482 km**
Network Length

 **534.7 MW**
Installed Capacity

 **14**
Main Heat Production Facilities

 **126k+**
Customers Served



The map shows the main heat production facilities across the district heating network.



Project Objective & Expected Outcomes

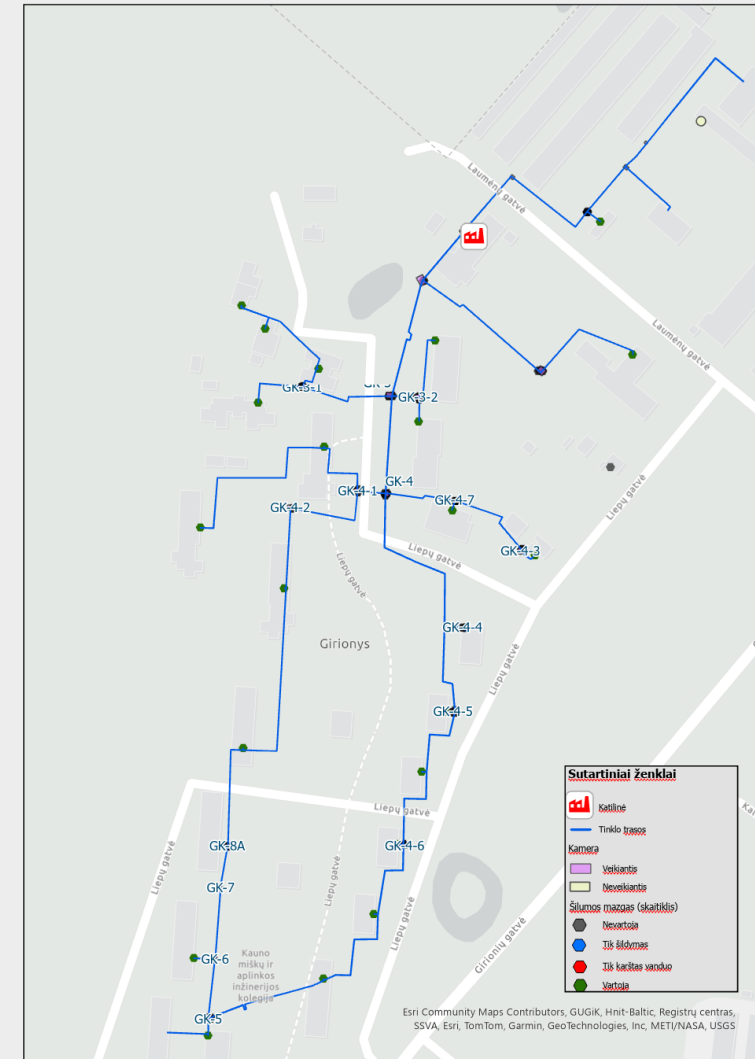
Project Objective

Developing a pilot GIS framework for district heating infrastructure management

Based on the Girionys network as a pilot model for future Kaunas city modernization.

Expected Outcome

- ✓ Standardized GIS methodology
- ✓ Unified data entry templates
- ✓ Validated pilot network workflow
- ✓ Foundation for city-wide modernization



Girionys pilot heating network



Key Tasks & Implementation

Data & Infrastructure



- Evaluate network data
- Validate primary data sources
- Digitize the Girionys network

GIS Model Development



- Develop technical templates
- Organize and input GIS data

Organization & Collaboration



- Establish a unified GIS structure
- Conduct weekly coordination meetings
- Implement rapid issue resolution processes



Starting Point



Data

- Outdated
- Incomplete



System

- **No unified geospatial platform**
- Data is fragmented



Process

- Unclear responsibility
- Lack of standards



Adapting the Heat Model to KE's Needs

Standard model

- Universal
- Redundant attributes



Our solutions

- Filtering
- Translation of attributes
- Structure standardization



Result

- Clearer model
- Easier to use
- Adapted to KE's needs

Example of attribute translation and filtering logic

DHC Line	Tinklo trasos				
			Unknown	Nenustatyta	
			Service Pipe	Aptarnavimo linija	Išversta
			Distribution Pipe	Skirstomoji linija	Išversta
			Transmission Pipe	Magistralinė linija	Išversta
			Station Pipe	Įvadinis tinklas	Išversta
			Customer Pipe	Vidaus tinklas	Išversta
				Tranzitinis tinklas	Naujas
			Sensing Pipe	Sensorinė trasa	Nereikia
			Bonding Line	Sutvirtinimo linija	Nereikia
			Test Lead Wire	Testavimo laidai	Nereikia
			Rectifier Cable	Rektifikatoriaus kabelis	Nereikia



Preparation of Technical Templates

- Remove unnecessary attributes
- Ensure all attributes are completed
- Use only accurate and up-to-date data

**Heating Pipelines
(47 attributes)**

**Heating Chambers
(25 attributes)**



**Heat Substations
(61 attributes)**

**Boiler Houses
(14 attributes)**

The prepared templates were submitted to relevant departments for data validation.



GIS Needs Assessment

 Using GIS	 Limited GIS Usage
<p>Commercial Division <i>(Sales, Operations Control, Customer Administration)</i></p> <p>Technical Division <i>(Network Management, Production, Technical Service, Project Management)</i></p> <p>Administration Division <i>(Quality Management, Human Resources, Occupational Health & Safety, Technology & Innovation)</i></p>	<p>Finance Division <i>(Finance & Accounting, Procurement)</i></p> <ul style="list-style-type: none">• Debt Administration• Legal• IT

GIS needs assessment helped identify departments requiring GIS solutions.



Network Data Update

Data Sources

- Surveying Data
- Operational Data (Field Teams)
- Orthophoto Maps
- Thermal Imagery

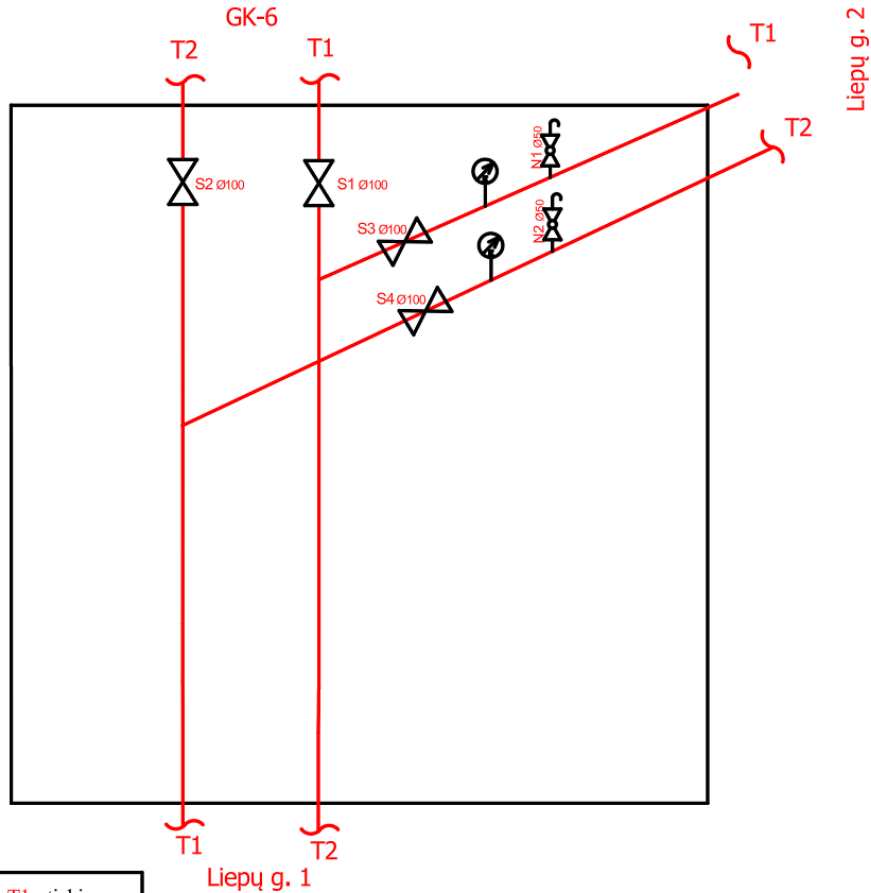


Network updated using multiple data sources



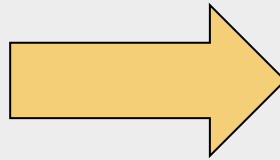
Chamber Integration into GIS

GK-5



T1 - tiekiamas
T2 - grįžtamas

Integrated into GIS





GIS and Cadastre Length Alignment

Problem

- Length discrepancies between GIS and cadastre data



Solution

- Compared data with thermal imaging maps
- Cadastre lengths were used as the reference baseline

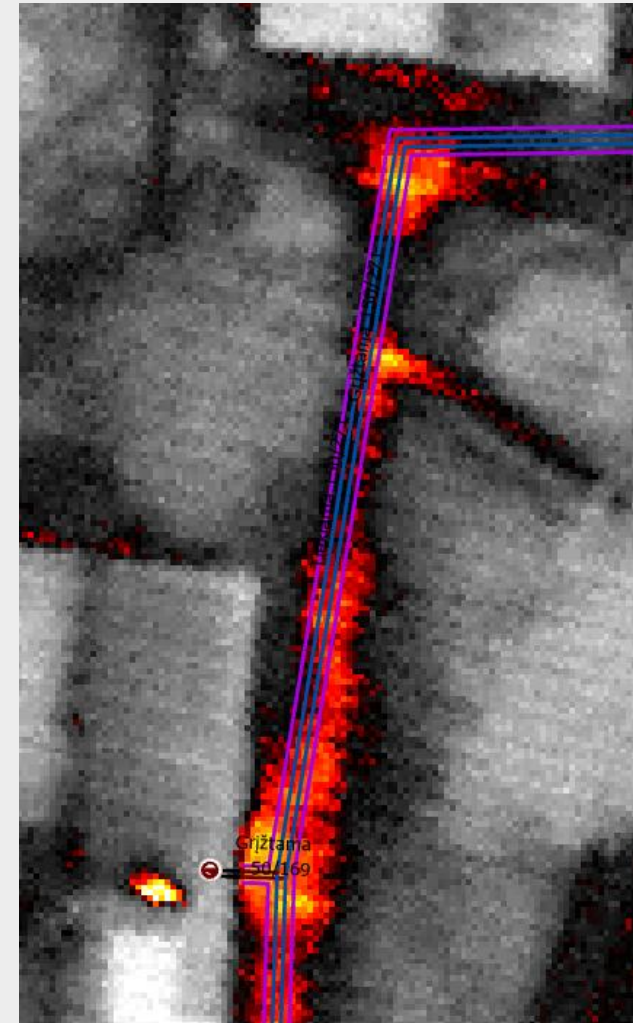


Rule

- Segment length field – cadastre length
- Hydraulic length field:
 - If GIS < cadastre length → calculated length is used
 - If GIS > cadastre length → GIS length is used
- GIS length is used inside chambers

Length comparison

SHAPE_Length	Ruožo ilgis, m	Hidraulinis ilgis, m
52,290322	54	54

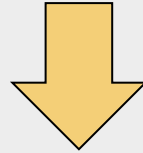


Network alignment using thermal imaging data



Automatic Pipe Attribute Filling

Pipe type selection



Attribute values are retrieved from the pipe table

Vamzdžio tipas	Vamzdžio medžiaga	Izoliacinė medžiaga	DN, mm	Nominalus apvalkalo skersmuo, mm	Vamzdžio išorinis skersmuo, mm
DN32_E1	Plienas	Poliuretanas	32	110	42,4
DN40_E1	Plienas	Poliuretanas	40	110	48,3
DN50_E1	Plienas	Poliuretanas	50	125	60,3
DN65_E1	Plienas	Poliuretanas	65	140	76,1
DN80_E1	Plienas	Poliuretanas	80	160	88,9
DN100_E1	Plienas	Poliuretanas	100	200	114,3



Pipe attributes are populated automatically

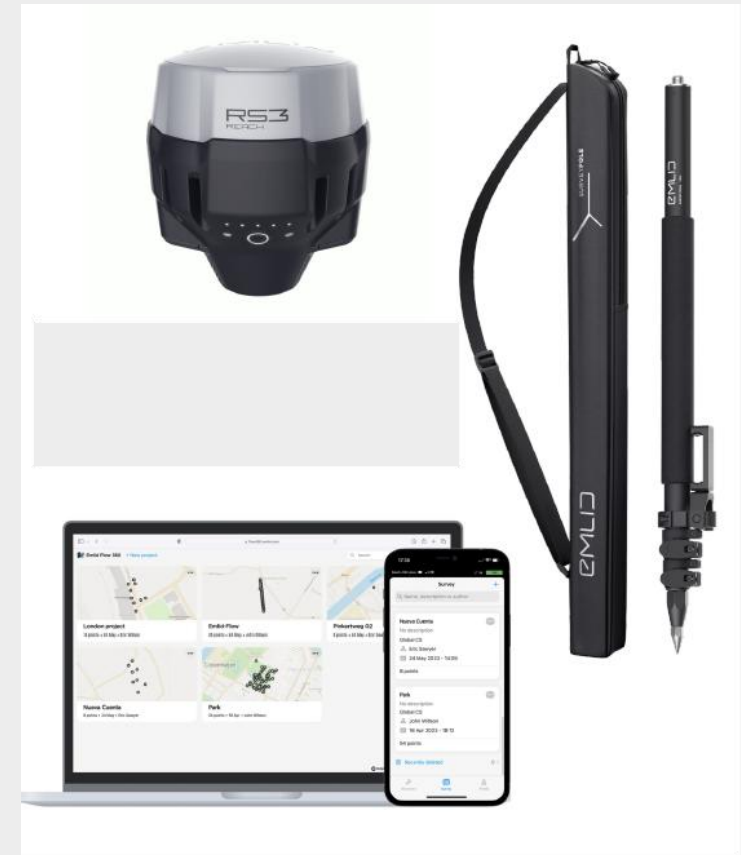
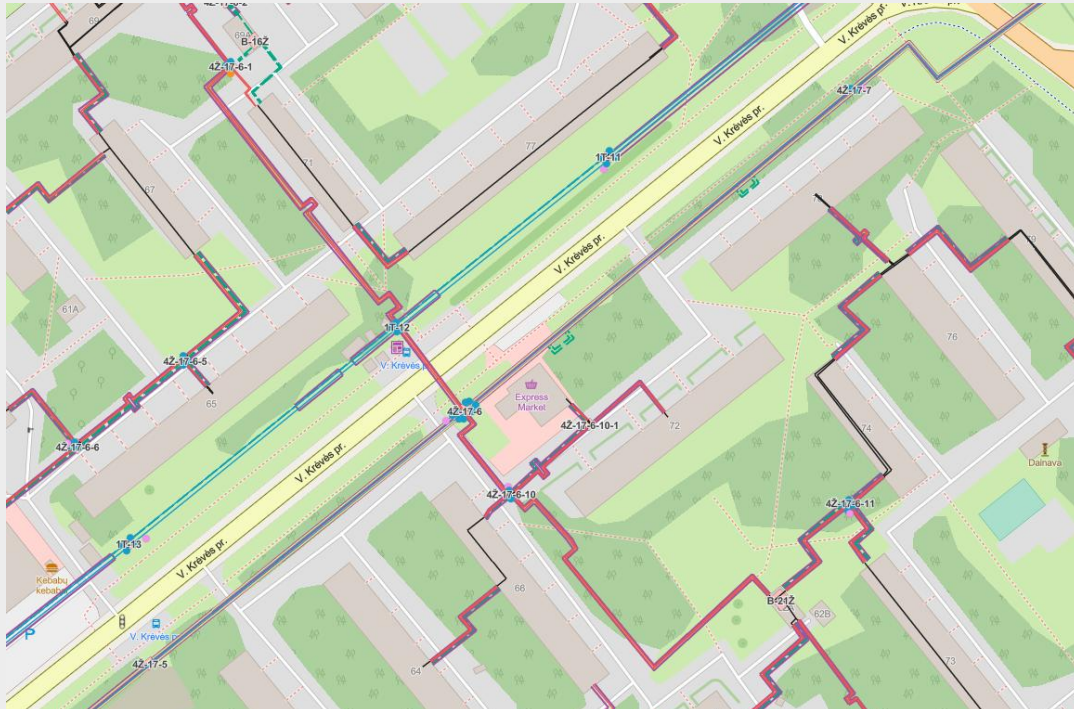


Data Collection and Integration

Project Timeline



Software and equipment used





Monitoring Survey Progress

A dashboard was created to monitor manhole survey progress.





Data Collection

Data Collection Approach

- Chambers are measured from the inside
- Technical parameters are recorded

Tools:

- Survey123 – data collection
- Field Maps – asset mapping

Survey123 Form (Data Collection)

Kameros ilgis, cm (ilgesnė dimensija) *	Žodžių debesis
Kai žodžių debesyje rodoma daugiau negu 500 atsakymų, naršyklės gali tinkamai neveikti. Rodyti vis tiek	

Kameros plotis, cm (trumpesnė dimensija) *	Žodžių debesis
Kai žodžių debesyje rodoma daugiau negu 500 atsakymų, naršyklės gali tinkamai neveikti. Rodyti vis tiek	

H1 - aukštis nuo liuko iki kameros grindų, cm *	Žodžių debesis
Kai žodžių debesyje rodoma daugiau negu 500 atsakymų, naršyklės gali tinkamai neveikti. Rodyti vis tiek	

H2 - aukštis nuo kameros perdangos iki kameros grindų, cm *	Žodžių debesis
Kai žodžių debesyje rodoma daugiau negu 500 atsakymų, naršyklės gali tinkamai neveikti. Rodyti vis tiek	

H3 - aukštis nuo kameros perdangos iki tiekiamo vamzdžio vidurio, cm *	Žodžių debesis
Kai žodžių debesyje rodoma daugiau negu 500 atsakymų, naršyklės gali tinkamai neveikti. Rodyti vis tiek	

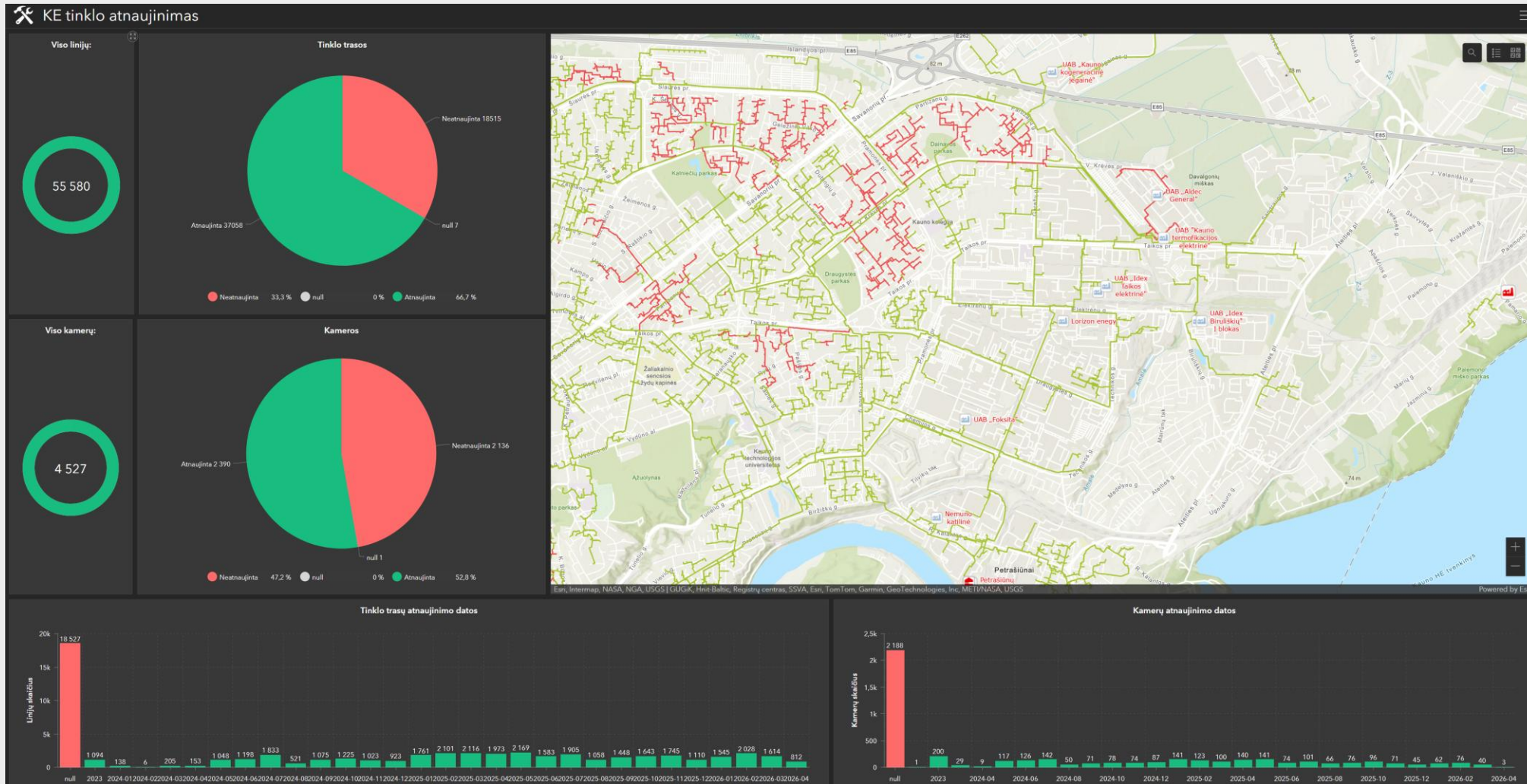
Kameros liukų skaičius, vnt *	Stulpelinė	Juostinė	Skritulinė	Žemėlapis														
<table border="1"><caption>Kameros liukų skaičius, vnt</caption><thead><tr><th>Kategorija</th><th>Skaičius</th></tr></thead><tbody><tr><td>1</td><td>450</td></tr><tr><td>2</td><td>700</td></tr><tr><td>3</td><td>120</td></tr><tr><td>4</td><td>450</td></tr><tr><td>5</td><td>0</td></tr><tr><td>6</td><td>0</td></tr></tbody></table>	Kategorija	Skaičius	1	450	2	700	3	120	4	450	5	0	6	0				
Kategorija	Skaičius																	
1	450																	
2	700																	
3	120																	
4	450																	
5	0																	
6	0																	

[Slėpti lentelę](#) Tuščios kategorijos Rūšiuoti



Monitoring and Analysis

A dashboard was created to monitor heating network update progress

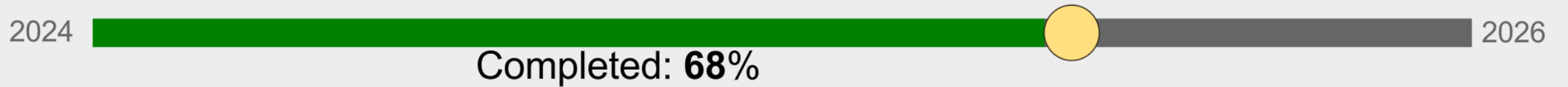


- Real-time progress tracking
- Displays updated vs. non-updated network sections
- Identification of problem areas



Final Goal

Full heating network update planned by the end of 2026



- Data-driven planning and decision-making
- Continuous progress monitoring
- Efficient workflow management



Thank you for your attention