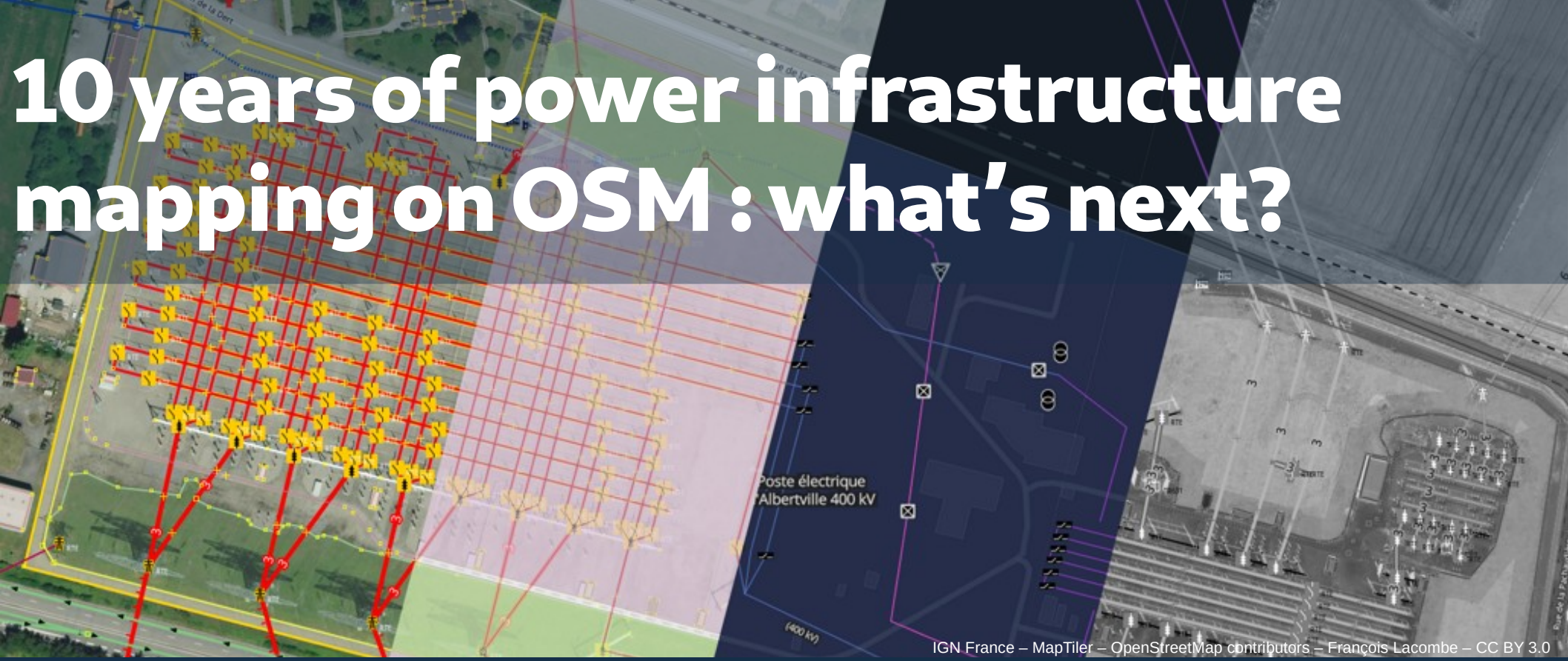
10 years of power infrastructure mapping on OSM : what's next?



IGN France – MapTiler – OpenStreetMap contributors – François Lacombe – CC BY 3.0

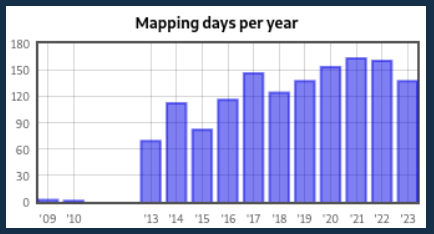
François Lacombe

State of the Map Europe – November 12, 2023

InfosReseaux

CC BY SA

Bonjour !



I’ve been contributing to OSM since 2012

- mostly involved on infrastructures topics and tagging
- OSM French board member since 2018

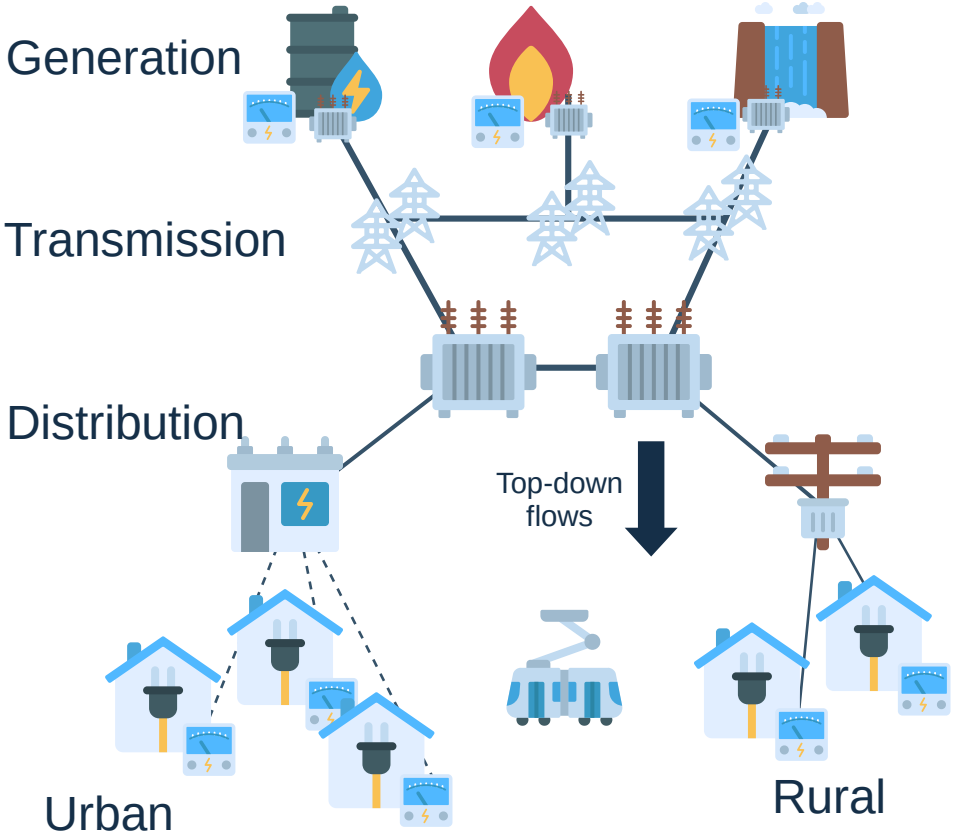
Let’s get in touch on wiki or osm.org

https://wiki.openstreetmap.org/wiki/User:Fanfouer

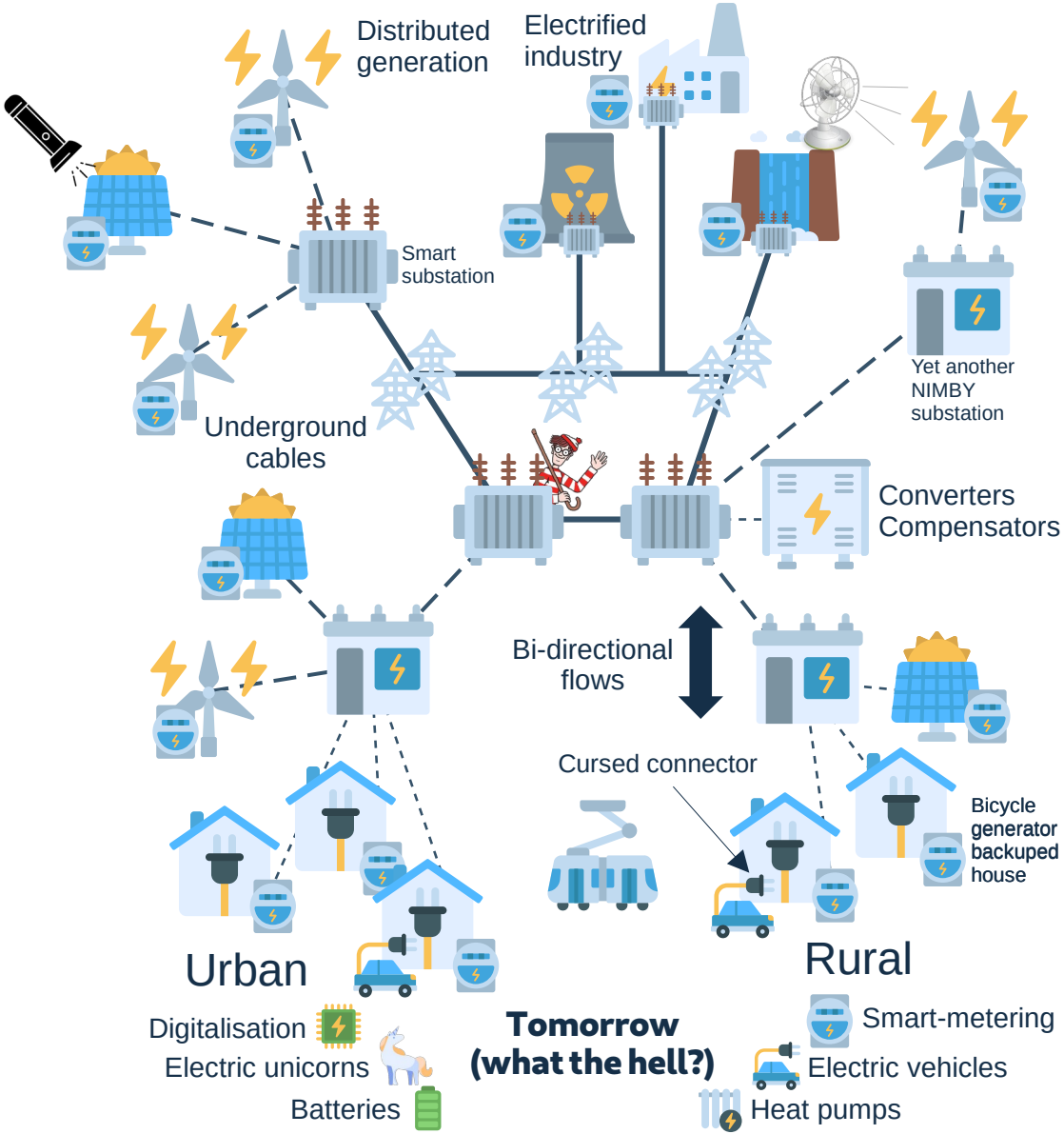
François Lacombe (CC BY-SA 4.0) - Adam Okuciejewski (CC BY-NC-ND)

Energy transition

... means more complex grids



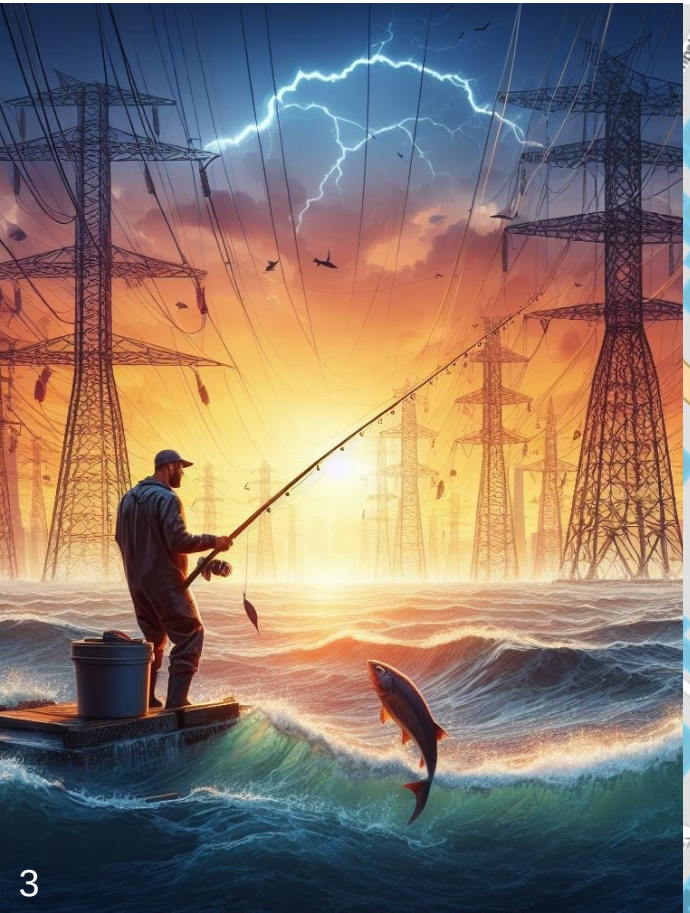
Yesterday



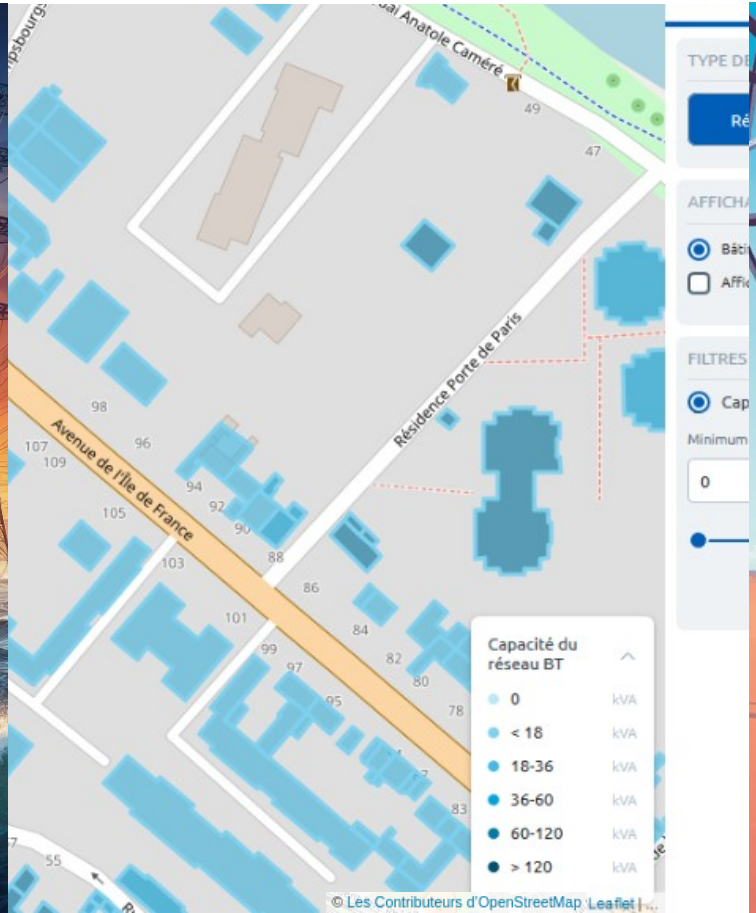
Juicy Studio LTD (copyright) - Iconshock

What key roles OSM can play here?

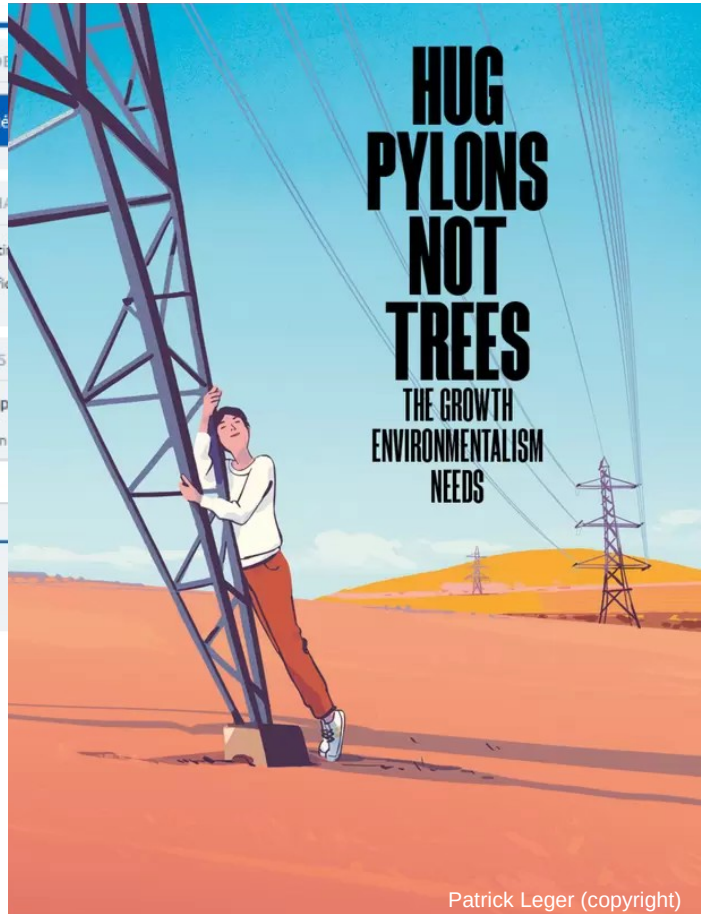
Third parties awareness



Contribute to network operators own knowledge



For the sake of it



Patrick Leger (copyright)

Some disclaimers

OpenStreetMap won't encourage to put yourself at risk while mapping, nor while using the data

Don't trespass on restricted perimeters

Power facilities are always dangerous places. Mapping guidelines won't ever expect you to get inside. **Stay safe and always obey local regulations.**

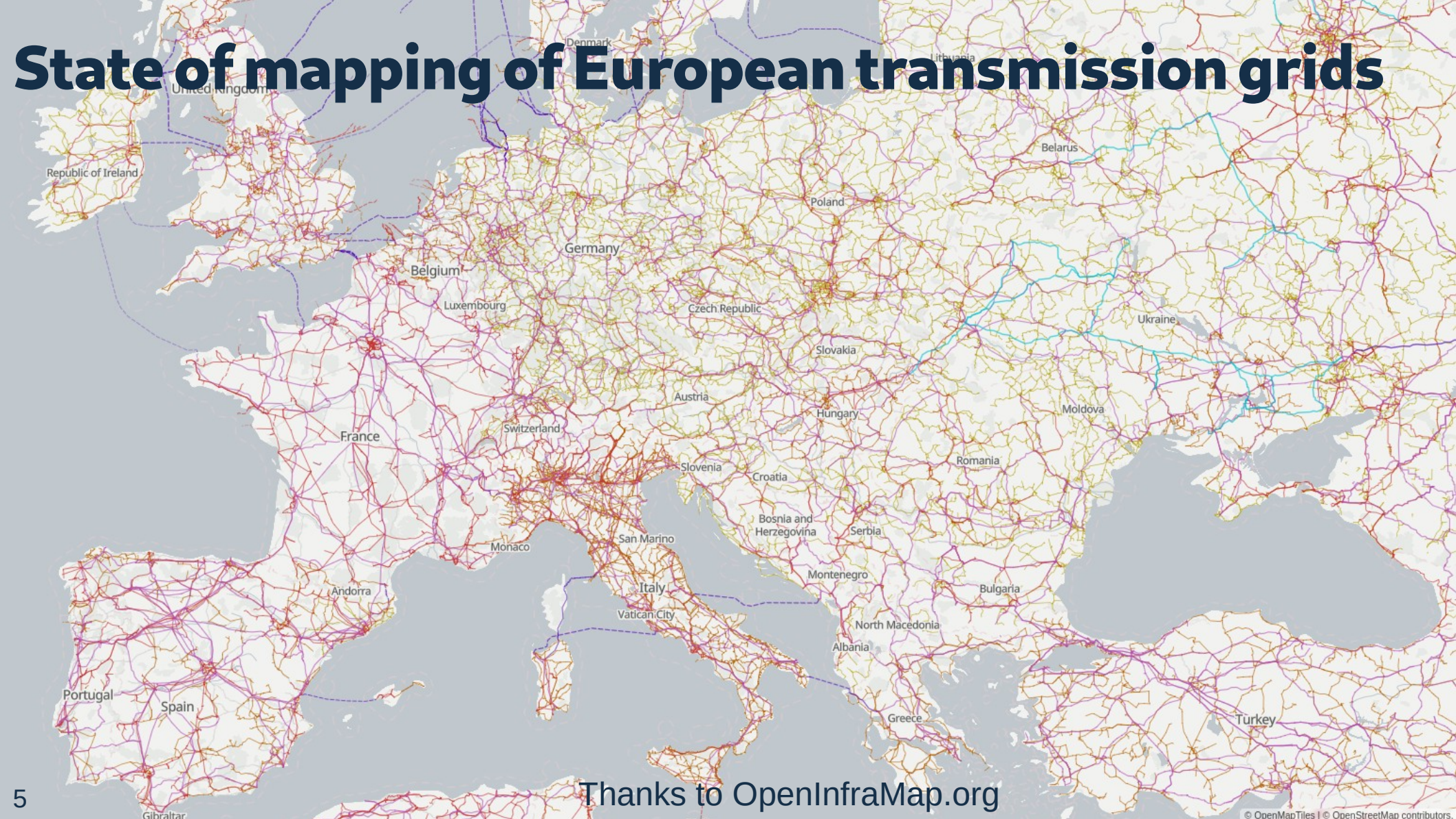
Dominique Fusina – Special grant

Call before you dig

Underground networks are often disrupted by poorly planned works. Many countries now provide official processes to get you informed on time. **OpenStreetMap data must not be used for works planning.**

Juicy Studio LTD (copyright)

State of mapping of European transmission grids



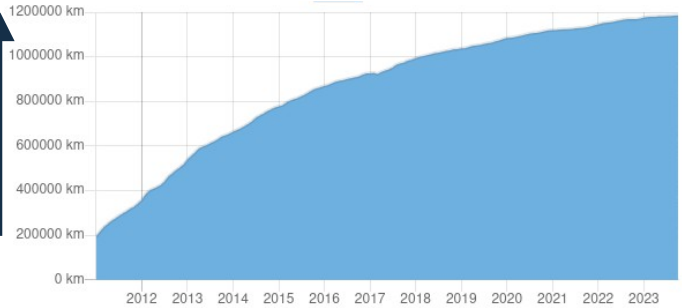
Thanks to OpenInfraMap.org

State of mapping of European transmission grids

Overhead power lines

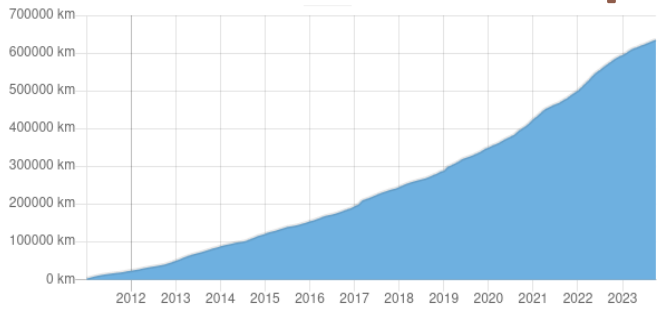
1,2M km

x5



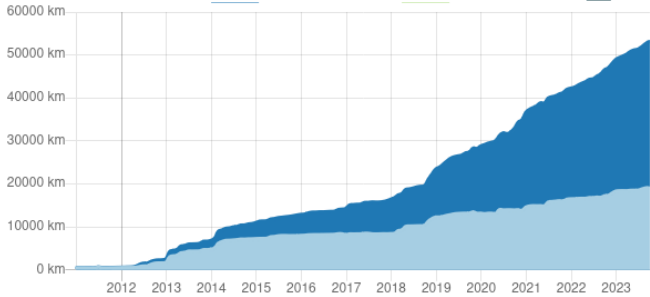
Overhead power minor lines

700k km



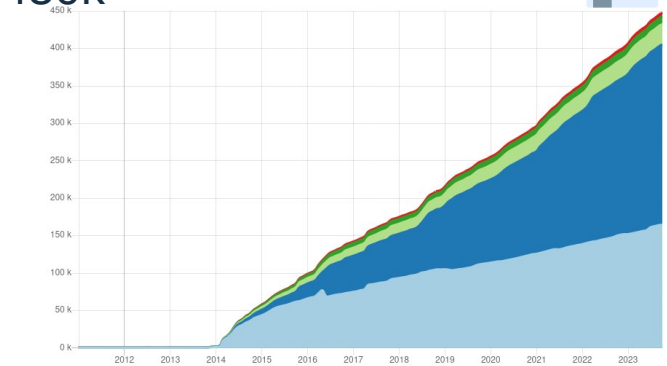
Insulated power cables

60k km



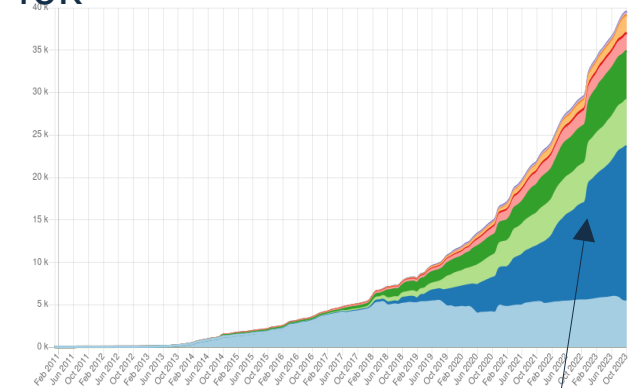
Substations

450k

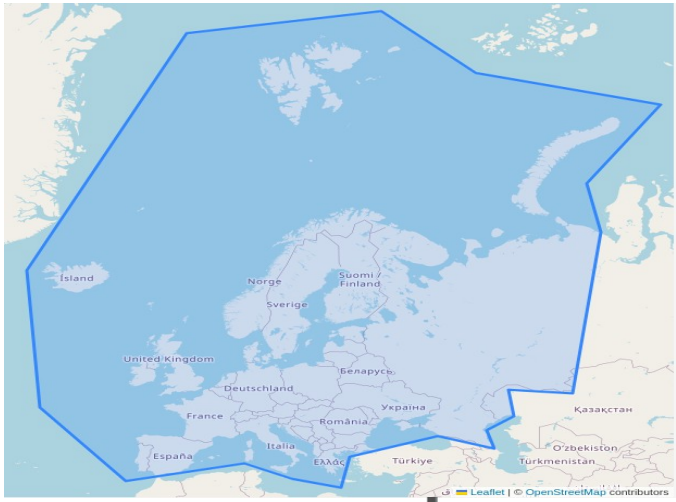


Power plants

40k



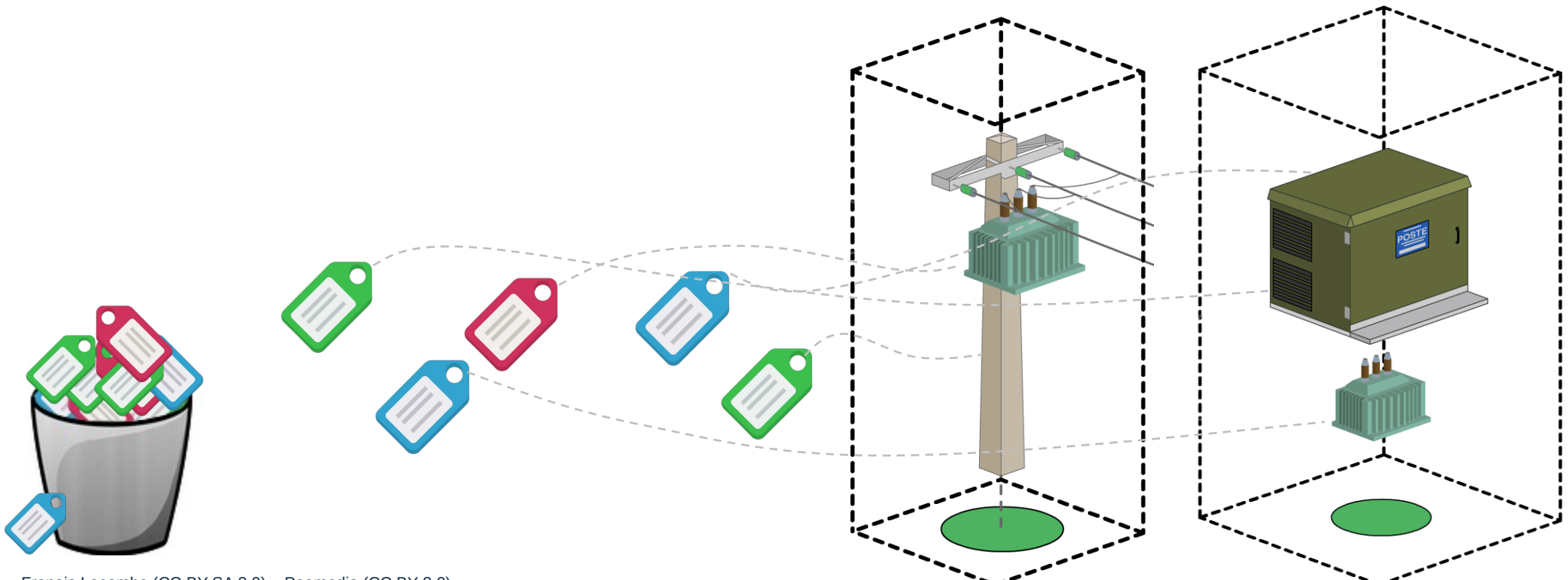
UK solar project-of-the-month



Baked with ohsome OSM History Analyzer

Juicy studio LTD (copyright)

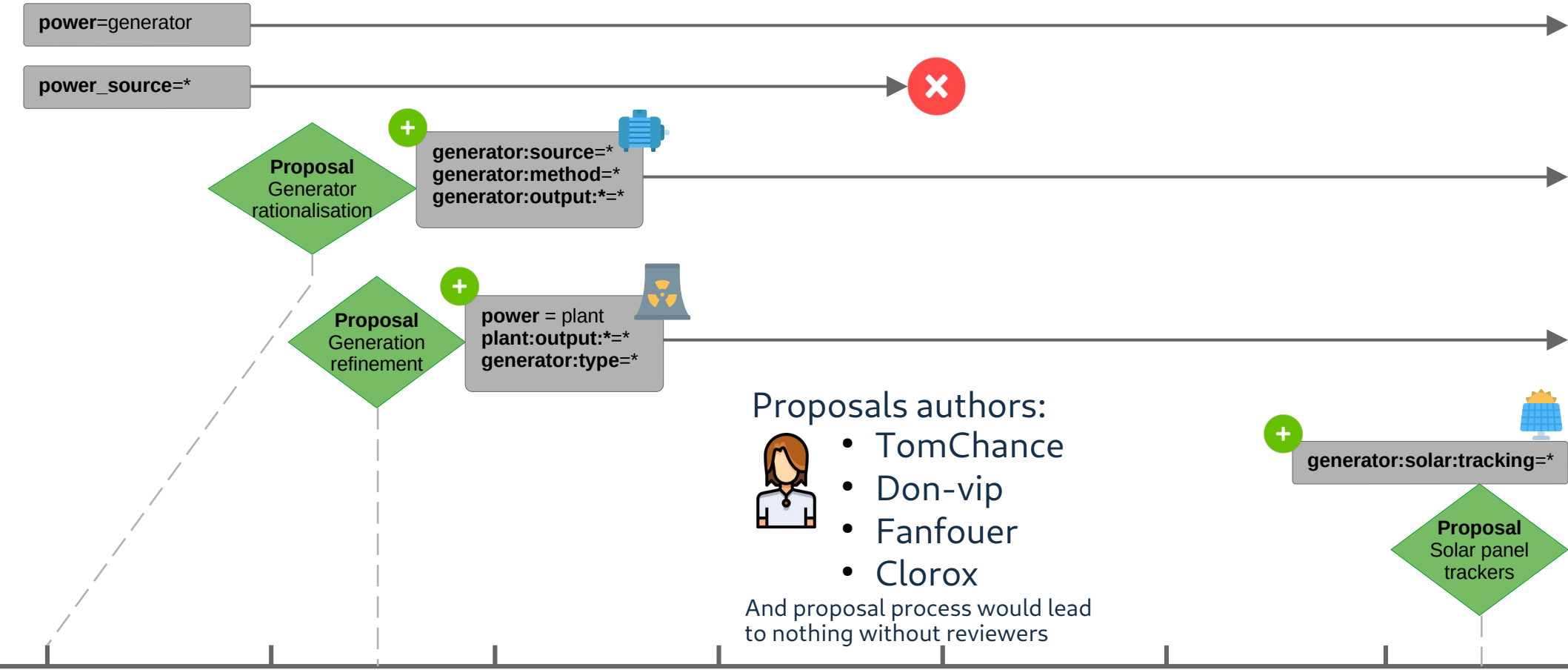
Tagging works



Franois Lacombe (CC BY-SA 3.0) – Paomedia (CC BY 3.0)

Power generation mapping

Early evolution – Most of what was defined between 2010 and 2013 is still in use



Juicy studio LTD (copyright) – Just icon (CC BY 3.0) – Robert Walsh

Power substations mapping

Continuous evolution and more and more details

power=station
power=sub_station

Proposal
Substation refinement

power=substation
power=transformer
power=converter
power=compensator
power=switchgear
transformer=*
converter=*
compensator=*
line=busbar

Proposal
Switching extension

switch=*

Proposal
Transformers extension

windings=*
windings:configuration=*
voltage:primary=*
voltage:secondary=*
voltage:tertiary=*
devices=*
transformer=auxiliary

transformer=traction
transformer=auto

Proposal
Transformers classification

transformer=main
windings:auto=yes

Proposal
Substations nodes

Proposals authors:

- Polderrunner
- Fanfouer

And proposal process would lead to nothing without reviewers

2010 2012 2014 2016 2018 2020 2022

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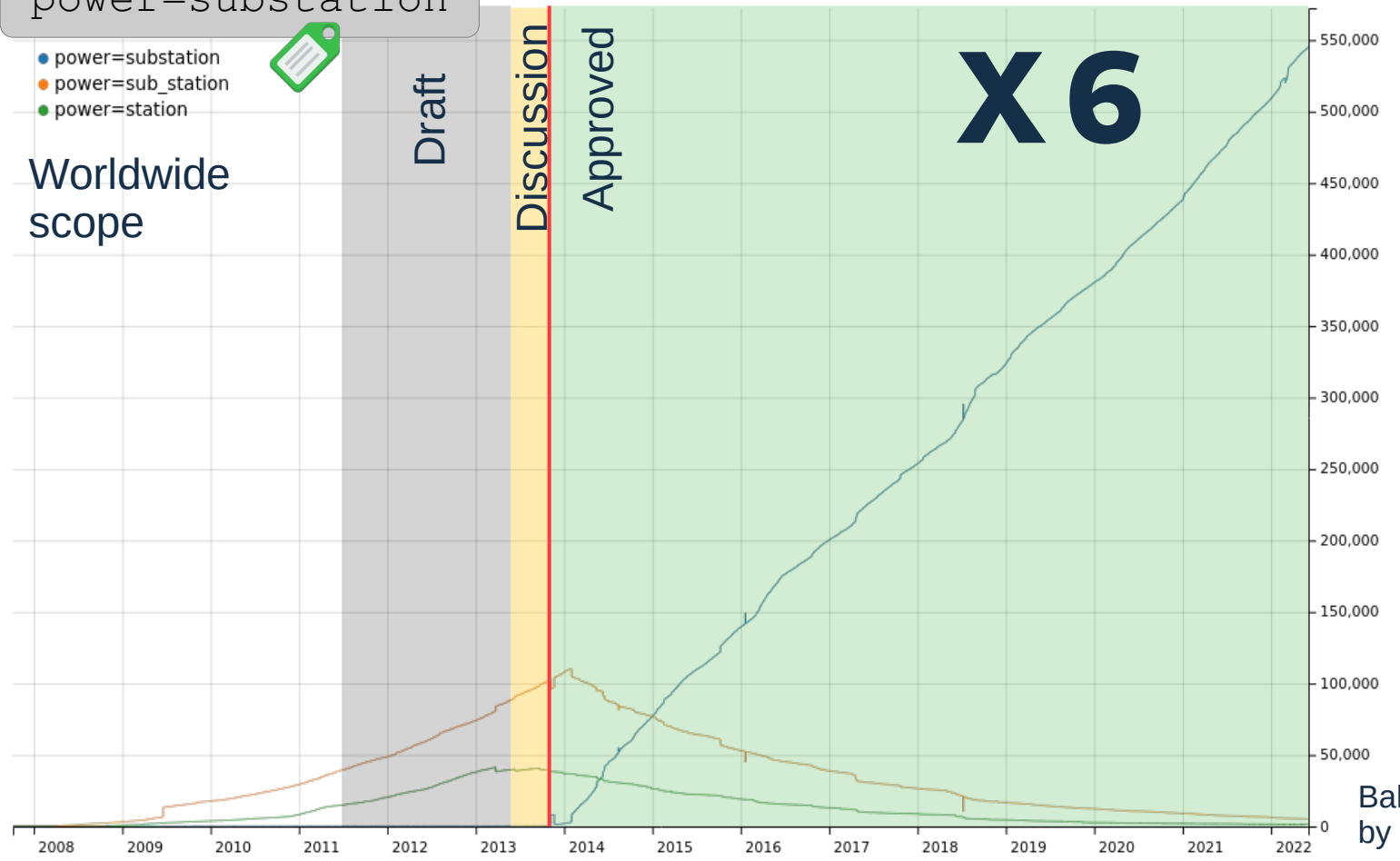
Power substation refinement outlook

It looks like a very successful refinement, despite 7-years long lasting

`power=substation`

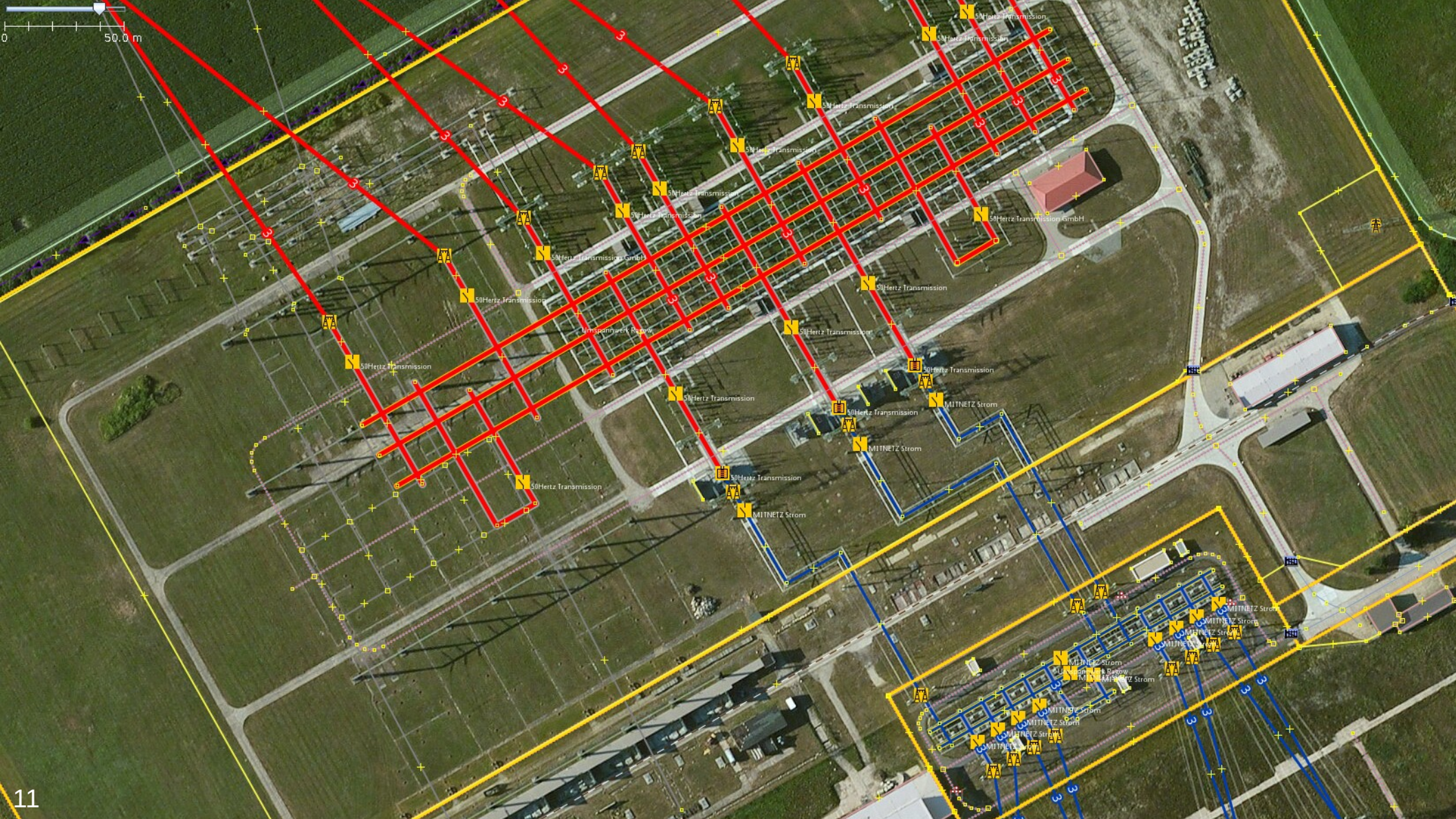
https://wiki.openstreetmap.org/wiki/Proposed_features/Substation_refinement



Replacement and clearer semantics

A more robust tag comes out of two with less meaning.
A constant effort in contribution is seen along years afterwards approval and **the relevancy to replace tags** with the appropriate method is no longer in doubt.

Baked with https://taghistory.raifer.tech by Martin Raifer


0
50.0 m
50Hertz Transmission
50Hertz Transmission GmbH
Umspannwerk Rerow
MITNETZ Strom

Lines mapping

A global framework to describe them all, not only power lines

tower:type=
- suspension
- anchor

pole:type=
- suspension
- anchor

Proposal Lines attachment

line_attachment=
- anchor
- suspension
- pin
- pulley

tower:type=
- branch
- termination
- transposing
- crossing

branch:type=*

pole:type=
- branch
- termination

Proposal Lines management

line_management=
- straight
- branch
- split
- transpose
- termination
- transition
- cross

line_arrangement=*

Proposal Lines arrangement

Proposals authors:

- Fanfouer

And proposal process would lead to nothing without reviewers

2016 2017 2018 2019 2020 2021 2022 2023

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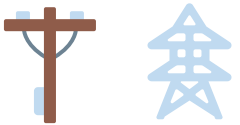
Lines mapping

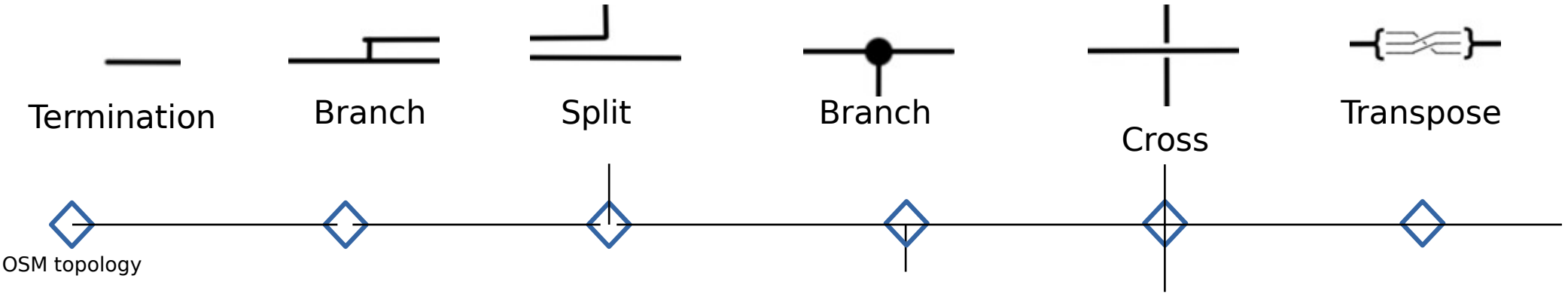
In a nutshell

François Lacombe (CC BY-SA 4.0)

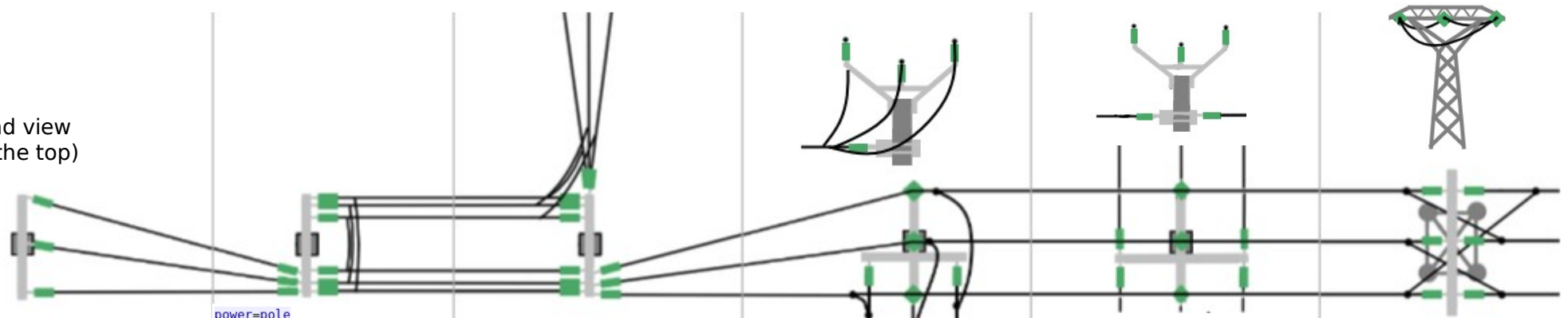
Lines mapping

A global framework to describe them all, not only power lines





Ground view
(from the top)



```
power=pole
line_attachment=anchor
line_management=termination
line_arrangement=horizontal
```

```
power=pole
line_attachment=anchor
line_management=branch
line_arrangement=semi_vertical
```

Y connection then it's a branch.

```
power=pole
line_attachment=anchor
line_management=split
line_arrangement=semi_vertical
```

```
power=pole
line_attachment=(pin)|(anchor)
line_management=branch
```

```
power=pole
line_attachment=(pin)|(anchor)
line_management=cross
```

```
power=tower
line_attachment=anchor
line_management=transpose
line_arrangement=horizontal
```


Juicy studio LTD (copyright) – François Lacombe (CC BY-SA 4.0)

Lines mapping

Sometimes, even most usable tagging fails

Robert Tiefenbach (CC BY-SA 3.0)

Utilities facilities

Power networks are part of a wider universe to document hosting of utilities activities

Previously

	Armoires de rue man_made=street_cabinet	Site industriel landuse=industrial	Bâtiment technique building=service	Poteau man_made=utility_pole	Borne marker=*
power	street_cabinet=power	industrial=power	inexistant	utility=power	utility=power
water	street_cabinet=water	industrial=water	inexistant		utility=water
telecom	street_cabinet=telecom		inexistant	utility=telecom	utility=telecom
gas	street_cabinet=gas	industrial=gas	inexistant		utility=gas
sewerage	street_cabinet=sewerage	inexistant	inexistant		utility=sewerage
street lighting	street_cabinet=street_lighting		inexistant	utility=street_lighting	

street_cabinet=
- power
- telecom
- gas
- sewerage
- street_lighting
- water

industrial=
- power
- water
- gas

Proposal
Utilities facilities

2023

utility=
- power
- telecom
- gas
- sewerage
- street_lighting
- water

As of 2023

Utility=* key is now a common concept to attribute which activity is hosted by a given building, marker, cabinet...

Armoires de rue man_made=street_cabinet	Site industriel landuse=industrial	Bâtiment technique building=service	Poteau man_made=utility_pole	Borne marker=*
utility=power	utility=power	utility=power	utility=power	utility=power
utility=water	utility=water	utility=water		utility=water
utility=telecom		utility=telecom	utility=telecom	utility=telecom
utility=gas	utility=gas	utility=gas		utility=gas
utility=sewerage	utility=sewerage	utility=sewerage		utility=sewerage
utility=street_lighting		utility=street_lighting	utility=street_lighting	

Juicy studio LTD (copyright) – Robert Walsh

Interoperability strategy

Tagging should be as consistent to several external norms and regulations as possible

Sustainable and used OSM tagging concepts

International norms

(pretty good)

IEC 60050
IEC 60038 ...

https://wiki.openstreetmap.org/wiki/Category:IEC60050

IT standards

(to be done)

FIWARE

LF ENERGY

National regulations

(to be done)

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

CNIG
Conseil national de l'information géolocalisée

Star-Elec
EclExt...

Paomedia (CC BY 3.0)

Enedis / OSM France partnership

OpenStreetMap France

OSMFoundation's French local chapter in France

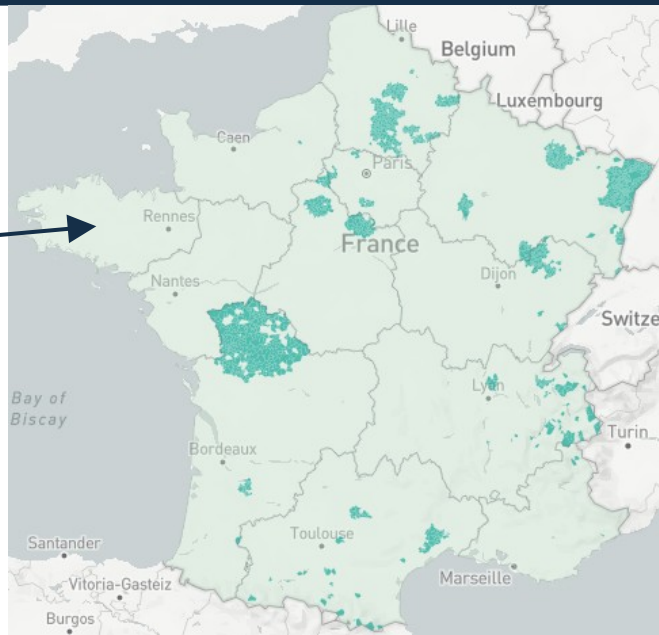
3-years partenership

2021-2023

Largest **distribution grid** operator in Europe serving 33,4M households in metropolitan France

~ Approx 1 200 people involved in **cartography activity**

Linemen and linewomen, mostly working on ground. Engineers and planners working in office.



François Lacombe (CC BY-SA 3.0)

Enedis / OSM France partnership

Encouraging crowdsourcing on chosen features, with:

~7 300 km² covered by **5cm aerial imagery** produced by Enedis by its own means, dedicated to OSM contribution

Additional **opendata** about overhead power infrastructure

Maintained and enriched **OSM documentation**, dediacted platform for engagement monitoring day by day.

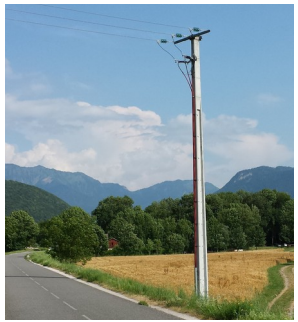
Share views and technical abilities

General knowledge about power networks operations

Planning and design about a possible comparision between OSM and internal GIS, with data feedback

Implementing business references as to make links between official opendata and OSM

Visible features :

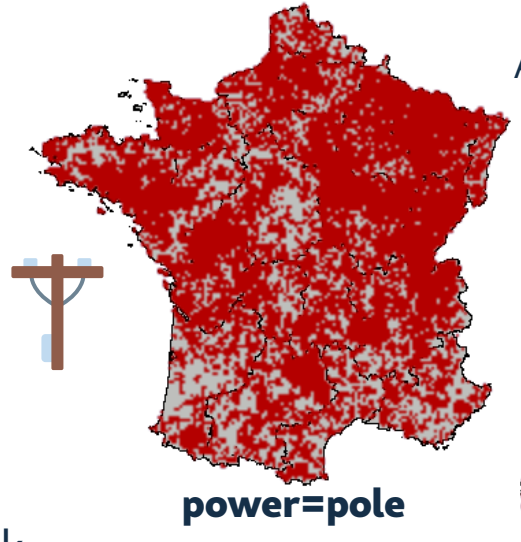


Find **12M** of poles

Cabinets

François Lacombe – Adam Okuciejewski – Barrymieny – CC BY SA

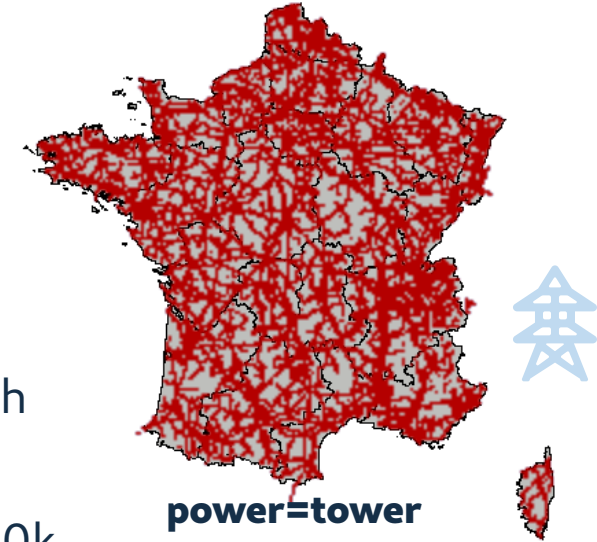
Enedis / OSM France partnership



power=pole

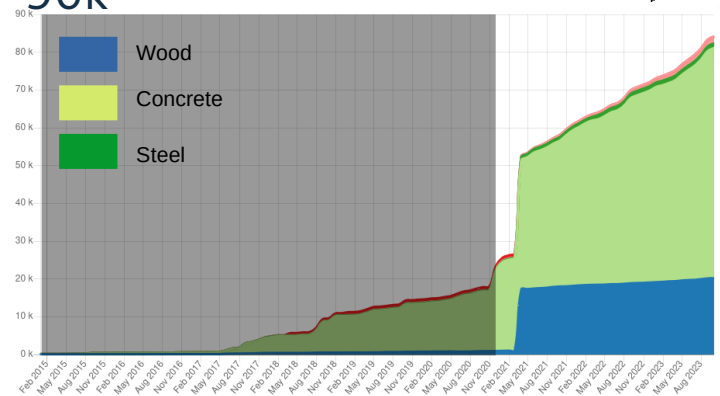
As of mid-October 2023, compared to begining 2022:

- **1 063 258** (+25%) poles and **254 699** (+0,3%) towers supporting power networks, all operators.
- **85 000** (+ 35 %) poles are tagged with a material (thanks StreetComplete)



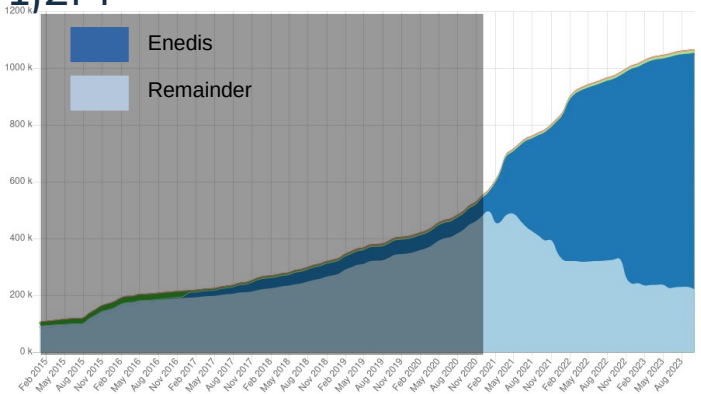
power=tower

90k



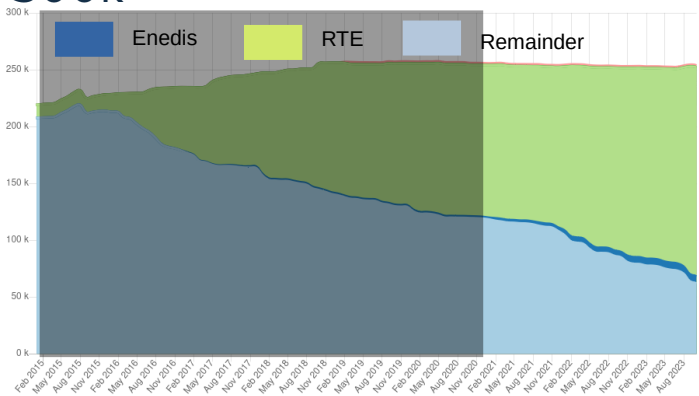
Poles material

1,2M



Poles operator (mostly distribution)

300k



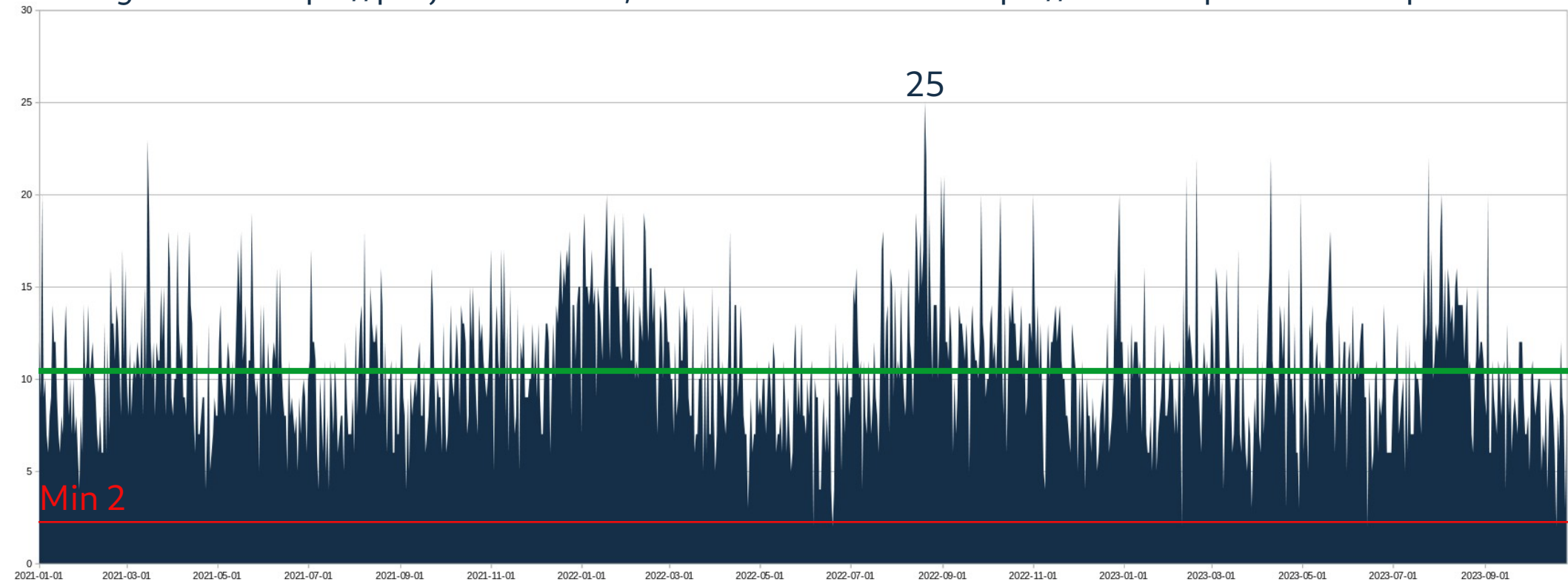
Towers operator (mostly transmission)

Juicy studio LTD (copyright)

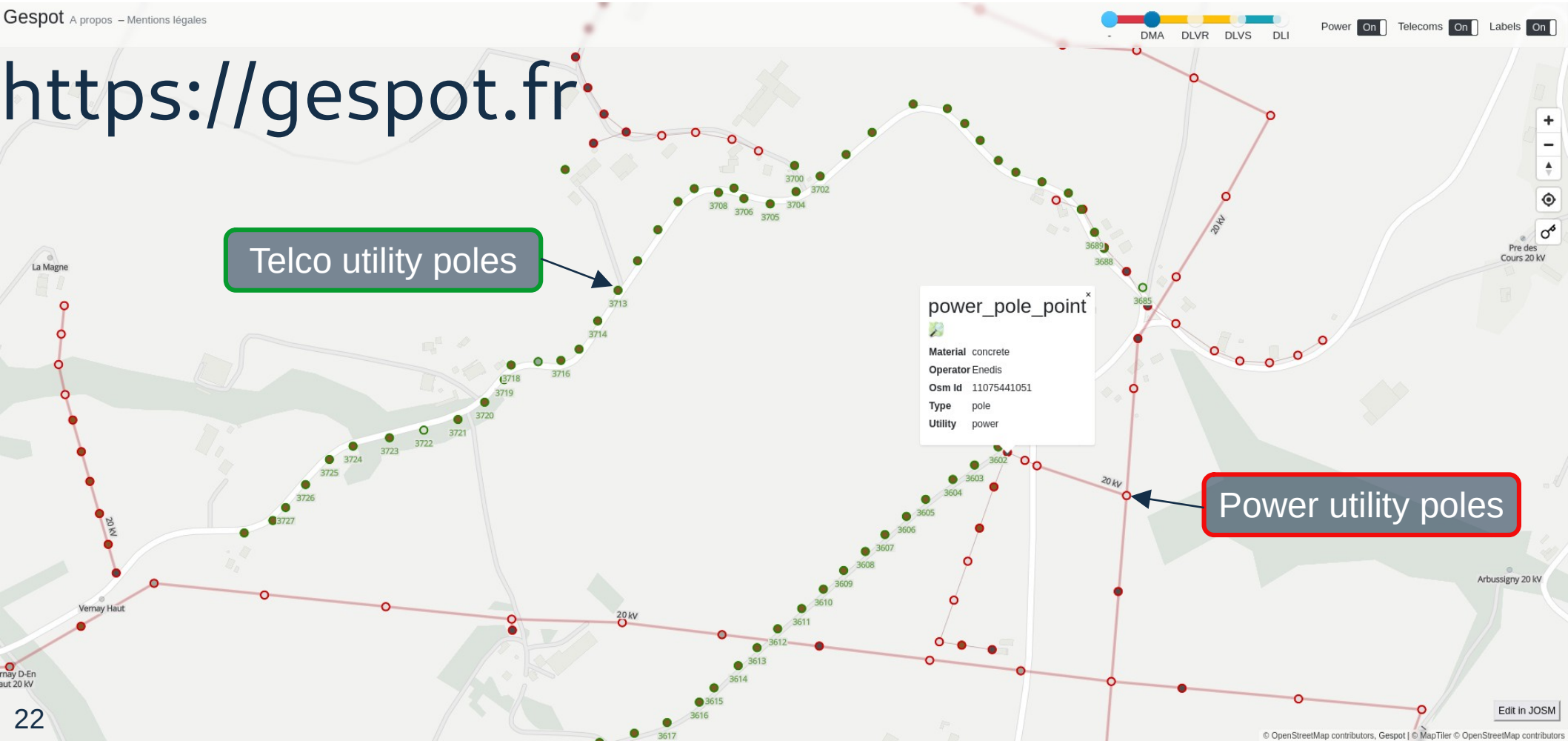
Enedis / OSM France partnership

A relentless involvement is seen over 3 years. **2 users each day** at least, among 1 476 contributors. Average stands at 10.5 people, no holidays, no weekends.

Managed with https://projetdumois.fr, dedicated instance: https://enedis.openstreetmap.fr

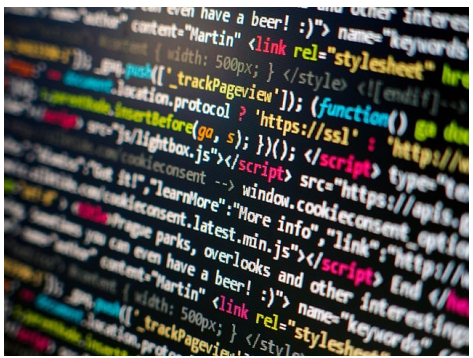


Enedis / OSM France partnership



What remains to be done

Tagging



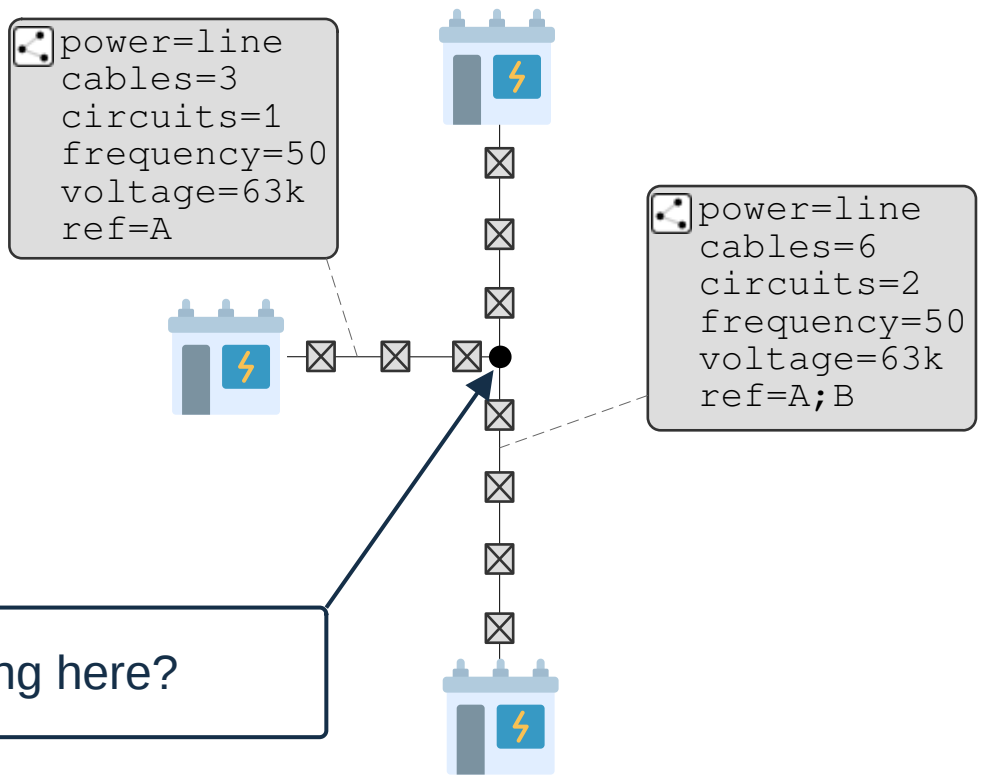
Software development

Connect with other communities

Paomedia (CC BY 3.0) – Martin Vorel (CC BY-SA 4.0) – Chanut is Industries (CC BY 3.0)

Finalise routing over networks

What most power contributors are used to (and will continue to map)



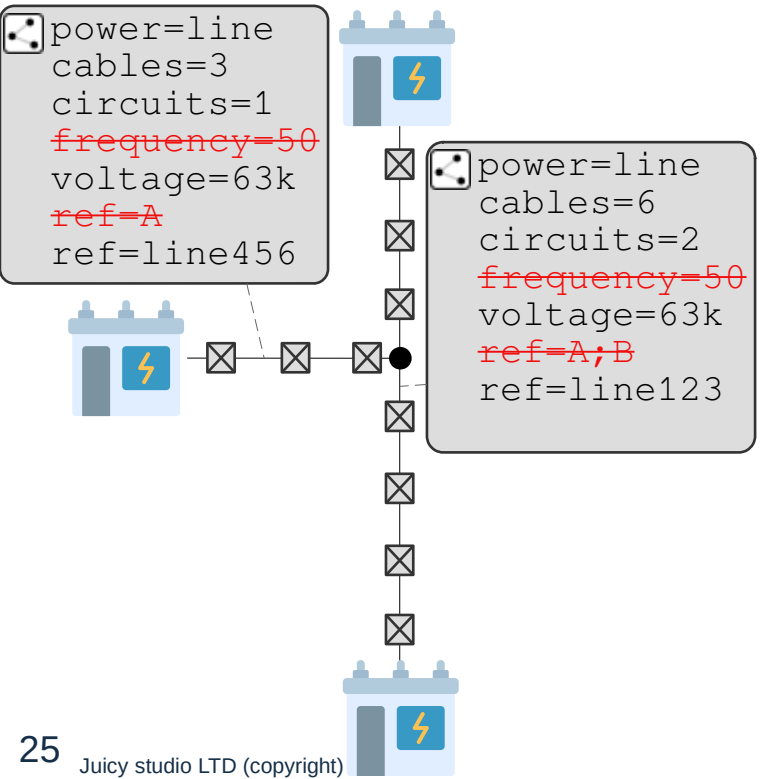
What is happening here?

Juicy studio LTD (copyright) - T99 (Public domain) – Polderrunner (Public domain)

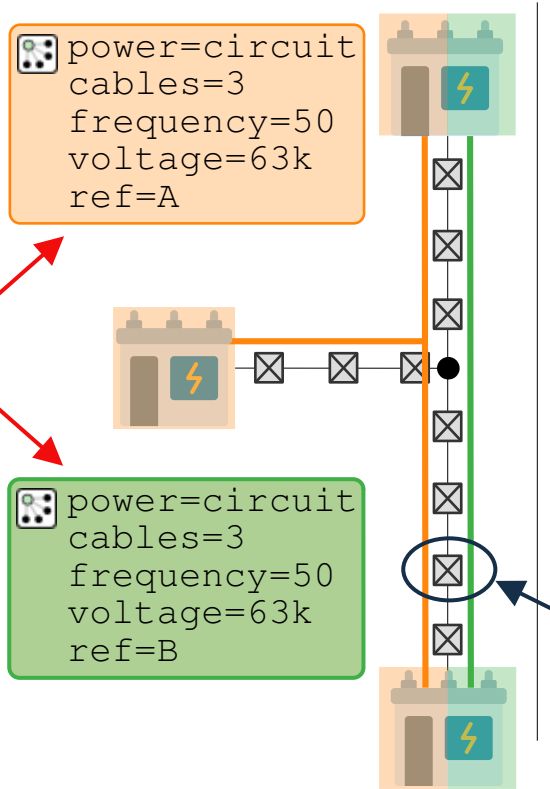
Finalise routing over networks

A 10-years-old proposal is still under RFC (by Surly)
https://wiki.openstreetmap.org/wiki/Proposal:Power_routing_proposal

What most power contributors are used to (and will continue to map)



What routing allows



Creating circuits relations has been a thing on OSM for years yet. **Several approaches** coexist.

It's not different from public transport relations over physical roads. We get **a better balance between physical and logical** properties on dedicated features.

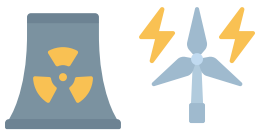
Two improvements are wished:

- Relation's members tagging
- Downstream graph processing

Juicy studio LTD (copyright)

Continuous improvement for tagging

Most of opened tracks in OSM tagging are still to be improved.
Here are some short-terms points :



Bring consistency into **power generation framework**, finalise heating generation and more detail splitting in thermal power plants

Complete **power storage** description (batteries, flywheels, potential storage…)
Anticipate related LVDC grids that could appear with appropriate compensators and converters.

Localise **designs of power supports** with `design:ref` help
Handle complex combinations of `line_attchment`, `line_management` and `line_arrangement`

Obviously, many **wiki pages remains to be refreshed**.
New /Power and /Power_lines to come

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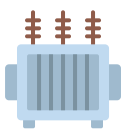
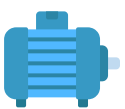
Quality assurance

Quality assurance is continuously improving as well, usually following tagging.
Power contributions rely on common QA tools : **editors validators** and **Osmose**.

Advice contributors on possible add of `line_management` by **topology analysis**, including upcoming route relations coming for routing

Measure conflation distances between OSM and opendata and observe how it evolves along years.





Implement advanced analysis in every editors as to ensure of proper validation prior to contribute (some tagging are dedicated to certain kind of geometries, and so on...)

Give a try to recently presented Clearence!

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Connect with other communities

We could (or already) share practices and data with several partners:

LF ENERGY

openmod open energy modelling initiative

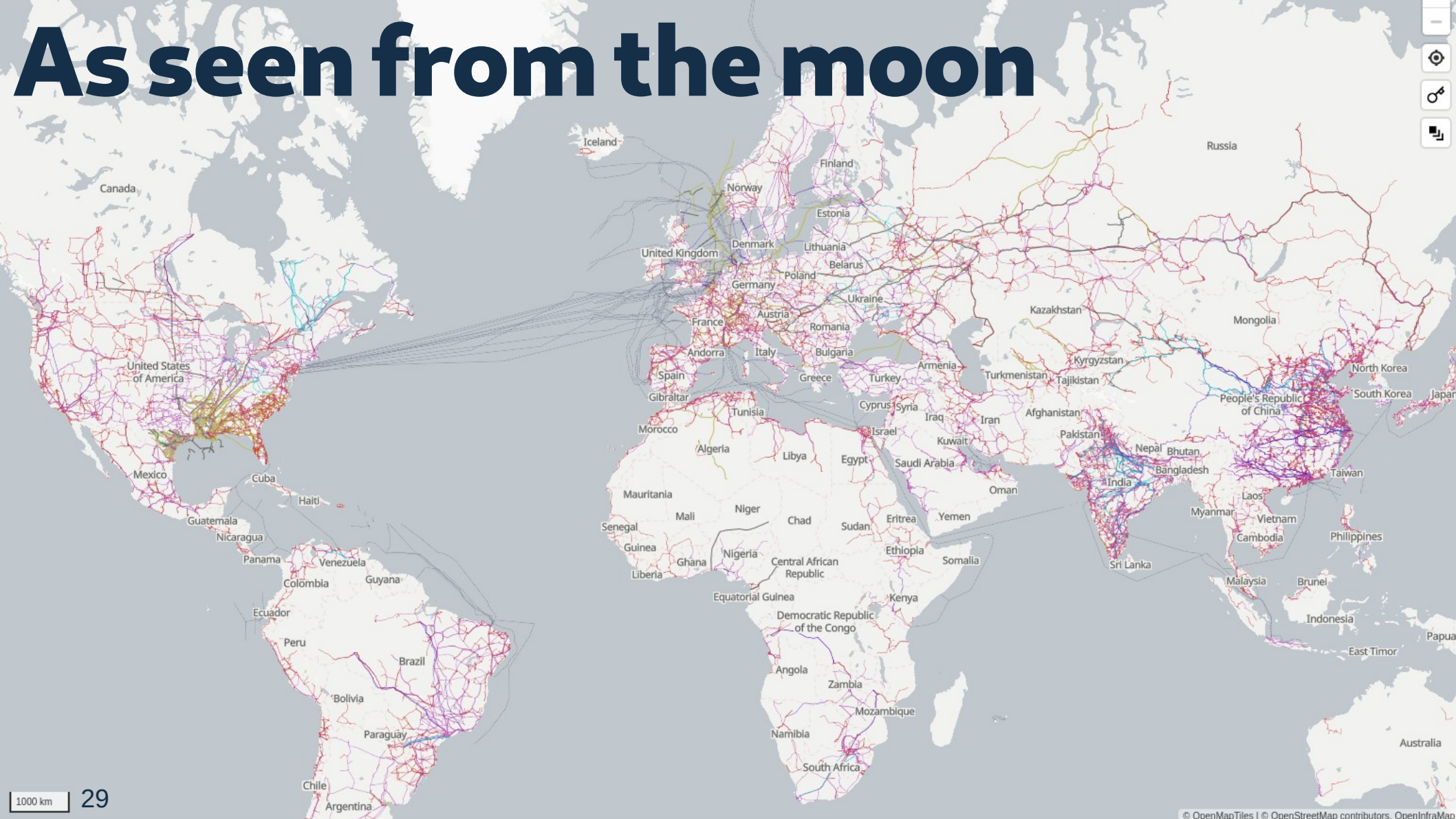
Semantics BIM

FIWARE

Key points that matters:

- Share data models
- Licence enforcement
- Feedback from OSM
- Partners contributing to code **and data**

As seen from the moon



Thank you

See you at SOTM-EU 2033

https://www.openstreetmap.fr

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lacombef