Sweden and the final percents of broadband rollout

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Claes Palmgren, Department of Digitalisation,
Swedish Post and Telecom Authority (PTS)

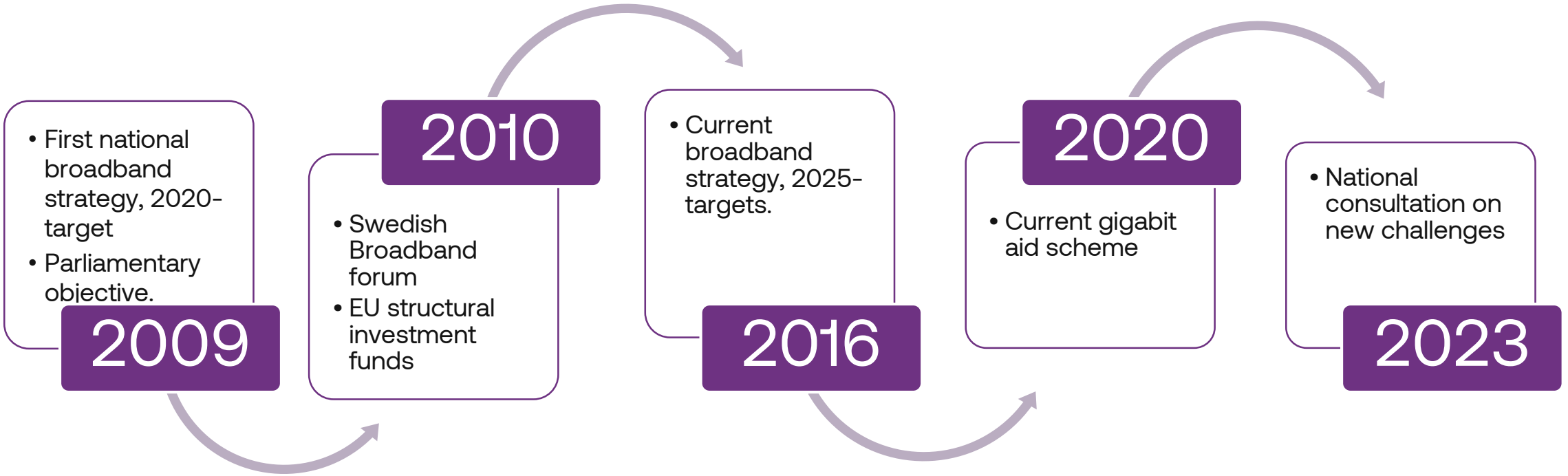
Three written reports on the final “two percent”

1. **”Satellite: an opportunity for high speed broadband 2025”**
   - *Satellit: en möjlighet till snabbt bredband 2025* (PTS-ER-2022-18)
2. **”Broadband to everything – Actions for a completely connected Sweden”**
   - *Bredband till allt – Åtgärder för ett helt uppkopplat Sverige* (PTS-ER-2022-33)
3. **”Aid to hasten broadband rollout in rural areas”**
   - *Stöd för att påskynda utbyggnad av bredband i glesbefolkade områden* (PTS-ER-2023-22)

Overview

1. Broadband in Sweden
   - The current Swedish strategy
   - Current national aid scheme
   - Household coverage and rollout costs
2. Conclusions of past reports on the final (two) percent
   - Technological options: fiber, ground based radio, satellite,
   - Proposal for an alternative aid scheme to hasten rollout in rural areas
3. Final remarks
   - OPEX
   - Conclusion

Broadband in Sweden, the road so far



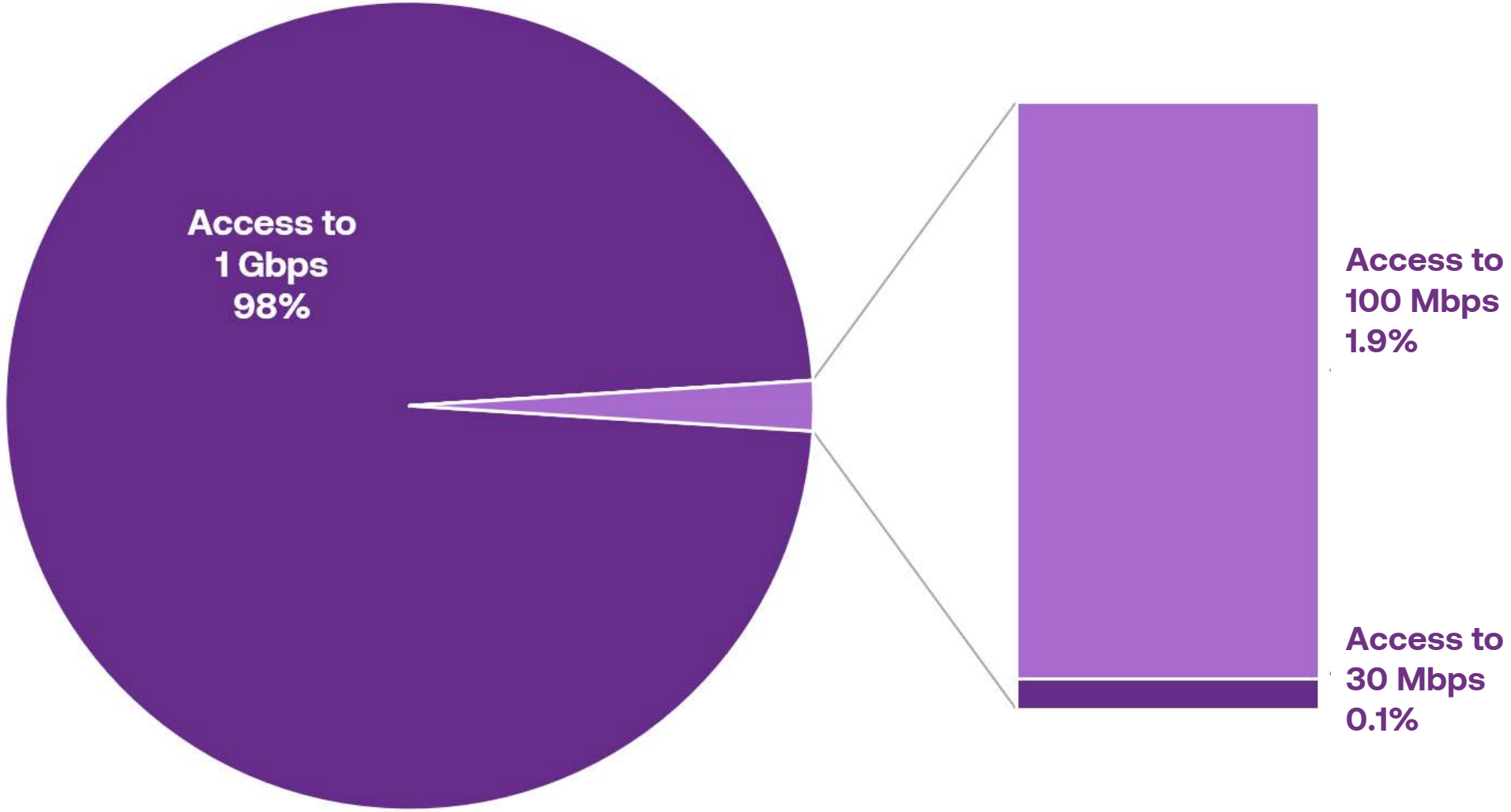
Current Swedish broadband objectives and targets

In **2020**, 95% of all households and businesses should be connected to a broadband infrastructure that provides a minimum speed of 100 Mbps

In **2023**, the entire country should have access to stable mobile services of good quality

In **2025**, the entire country should have access to high-speed broadband

2025 national broadband sub-targets



National state aid scheme in Sweden

Funded by the European Union
NextGenerationEU

Funding is allocated annually to projects building gigabit infrastructure in **rural areas and selected towns**, in accordance to GBER.

- National and EU-funding is spread out in three macro regions.
- Eligible projects are ranked and approved in turn, based on lowest amount of aid per household/socio-economic driver.
- Mapping is done per building. All 21 regions assist in identifying prioritized buildings.
- Costs for passive infrastructure are approved.
- Approx. 120 000 buildings funded with €420 mEUR since 2020.
- New calls are budgeted up to 2027

Rural from a Swedish perspective

- Statistically, an “**urban area**” is a contiguous settlement with at least 200 inhabitants.
  - A “**small town**” village area is a contiguous settlement with 50-199 inhabitants
  - Rural ”**Sparsely populated areas**” are every built area below that.

- Almost 70% of Sweden is forest, 7% agriculture. Less than 3% is built areas.
  - Over 9 million inhabitants (88%) lives in urban areas.

Source: SCB.se

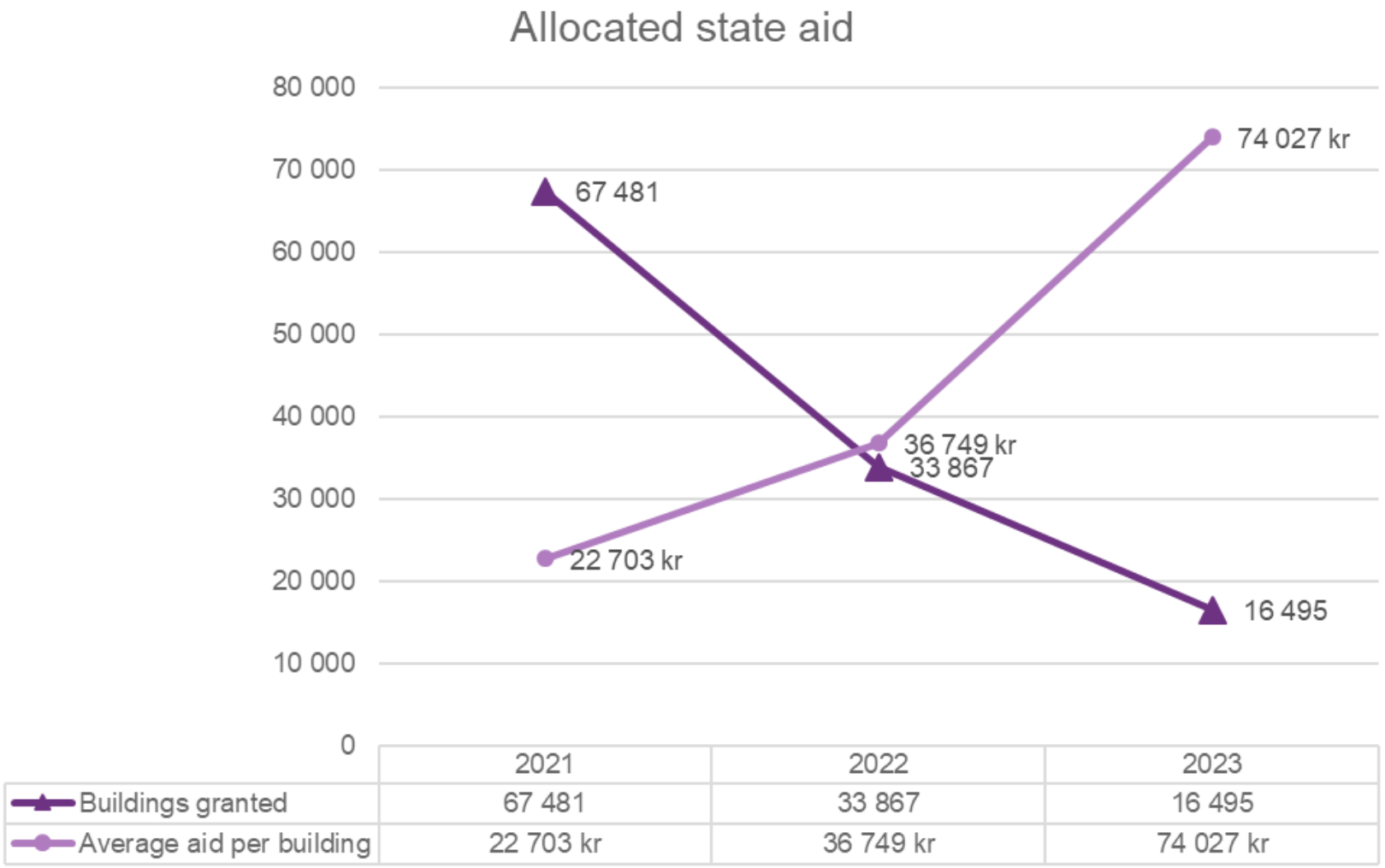
Official broadband coverage (households)

	1 Gbit/s	100 Mbit/s	30 Mbit/s
Homes passed (2025-target)	**97%** (80% rural)	**97.8%** (82%)	**99.5%** (95.7%)
Homes connected	83% (65%)	90.6% (66%)	99.3% (94.5%)

5G
57% (29%)

As of October 1st 2022.
Source: PTS-ER-2023:13

Rural rollout is getting expensive, fast



	2021	2022	2023
Buildings granted	67 481	33 867	16 495
Average aid per building	22 703 kr	36 749 kr	74 027 kr

Reaching the final “two percent”

What about optical fibre?

- The national 98% gigabit target will most likely be reached through commercial rollout and currently allocated funds up to 2025.
- Regions and municipalities desire a continued fibre rollout past the 98% target.
- Connecting households cannot be taken for granted
  - State aid funded projects are required to offer customers a connection on demand, up to two years from completion.
  - Commercial after market strategies to connect homes are more opaque and sensitive to economies of scale.

What about ground based radio?

- The mobile market is reluctant to roll out high or mid-band mobile broadband in rural areas, or use shared infrastructure, due to OPEX.
  - Focus is on upgrading existing infrastructure to 5G, replacing 2G and 3G.
  - Coverage obligations only apply to the intended spectrum.
- 100 Mbps FWA during peak-time conditions strains available radio capacity, in particular as it is shared with mobile use.
  - Planning for “best effort” capacity is several times more cost-efficient
- 5G over 3.5 GHz spectrum is an option for 100 Mbps FWA in areas next to existing infrastructure.
- Fixed radio is an alternative in some local areas, by smaller operators.

What about satellite?

- As of 2023 Sweden has full LEO satellite coverage offering broadband services up to 100 Mbps downlink, from one player.
  - >1100 customers in mid 2023 (up from <200)
  - Customer experience reports positively exceeds expectations so far.

- PTS assess for now that limited capacity and line of sight obstacles stops LEO from reliably reaching the 100 Mbps target, nationwide and in particular during peak-time conditions.

”Aid to hasten broadband rollout in rural areas”

Stöd för att påskynda utbyggnad av bredband i glesbefolkade områden (PTS-ER-2023-22)

The mission

Investigate the possibility of support for broadband expansion in sparsely populated areas using wireless technology.

Within the scope of the assignment, PTS shall:

- Present a model for how funding for such rollout can be allocated. The infrastructure should be a one-off investment from the state and not a temporary solution.
- Assess how such a measure can be designed to supplement existing support for broadband expansion. Expansion from the outside in; a reverse logic from the current aid scheme.
- Emphasis is on that the infrastructure must meet society's long-term digitalization needs.
- Report whether the suggested aid should form a separate support scheme or be included in the existing scheme.
- Ensure that aid is primarily directed towards areas that are not expected to be reached by commercial expansion or with existing aid efforts.
- PTS must still relate the model to the 2025 sub-targets.

PTS proposition of a separate state aid scheme

PTS concludes that the final percent requires a different approach to planning than a large national fund, further emphasizing the understanding of local conditions.

- In the report, PTS describes a separate aid scheme that can function as a supplement to the current national broadband aid.
- In the new model, relevant development projects will be identified by PTS, in consultation with regional actors.
- Crucial difference – In PTS's existing scheme, the applicant defines the areas for which they seek aid. PTS assesses that the current model is effective in most cases, but that more control may be needed in some areas.

Infrastructure that meets society's long-term digitalization needs

PTS proposes that the infrastructure should at least provide 100 Mbit/s in download speeds under peak traffic conditions, corresponding to the lowest limit for granting support under the updated terms of the GBER.

- Lower requirements for transmission capacity than in the current gigabit scheme are deemed to enable solutions via fixed radio and fibre.
- Probably excludes solutions produced via mobile networks and satellite. Both are wide-area shared capacity technologies. Mobile network in particular needs to set aside capacity for mobile users.
- PTS therefore makes the assessment that broadband via mobile networks and satellite alone, in general are not considered to meet the long-term needs for fixed points. Especially in sparsely populated areas.
- PTS has previously concluded that broadband via mobile networks, under good conditions, might contribute to the broadband strategy's goal of 100 Mbps in 2025.

Fibre is still relevant

The new model may accelerate expansion in sparsely populated areas that are not reached by commercial expansion, or by the current aid scheme.

- The buildings deemed to be relevant for the new scheme will on average have an even higher deployment cost than in the existing scheme.
- The scheme delimitations will mean that fibre infrastructure in many cases might still remain as the most valid to receive aid.
- PTS' investigation shows that the financial sustainability of installing radio-based solutions is often worse over time in the most sparsely populated areas, compared to installing fibre-based solutions.

Conclusions and final remarks

What about operative expenses (OPEX)?

In the proposed scheme PTS suggested that costs for both active and passive equipment should be eligible for aid, but not OPEX.

- PTS' investigation shows that the financial sustainability of installing radio-based solutions is often worse over time in the most sparsely populated areas, compared to installing fibre-based solutions.
- An OPEX scheme would need to be budgeted over a long period of years, most likely longer than the political mandate.
- There is also the risk of infrastructure being decommissioned once the OPEX state funding stops.

Conclusions

- The most challenging areas requires more detailed planning and local coordination than is possible within the current national scheme.
- Without an OPEX aid scheme, fibre appears to remain the most reliable option for 1 Gbps and 100 Mbps, as long as it is politically valid to fund CAPEX to rural households.
- 5G FWA remains a commercial 100 Mbps option in urban areas.
- LEO Satellite appears the best alternative rural option, when all else fails, but lacks competition and long term guarantees.
    - Willingness to pay appears high, lowering the need for a general voucher.
- New state aid schemes would require new political targets, addressing advanced needs for connectivity, including mobile.