

Logistics and testing of APAs

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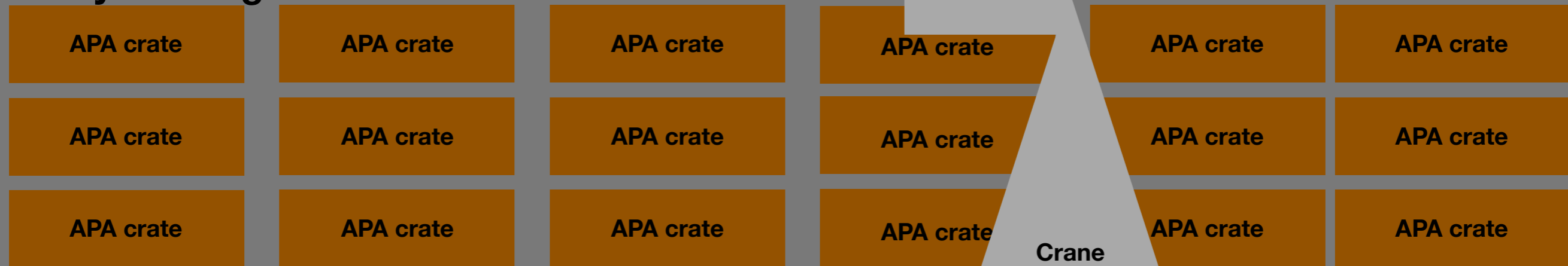
Assumptions for schedule

- APA construction:
 - ◆ Base: 50 shifts per APA, 4 sites, 2 shifts/day, 2 teams of 2 winders per site)
 - ◆ => **16 APAs in 2.5 months**
 - ◆ Start **January 2021**
- APA integration and testing:
 - ◆ Base: 1 week for integration (PD, CE) + 1 week cold box test (incl. thermal cycle) + 1 week buffer (for issues occurring) = 3 weeks per APA
 - ◆ 4 Integration stations and Cold boxes => **4 APAs in 3 weeks**
 - ◆ Start **July 2021** (assumes necessary PD and CE are ready)
- Storage space needs:
 - ◆ APA dirty crates (with 2 APAs) dimensions: ~7m x 2.9m x 3.0m (**foot print: 7m x 3.0m**)
 - ◆ Horizontally hanging APA space: 7m x 0.5m foot print

Rough layout

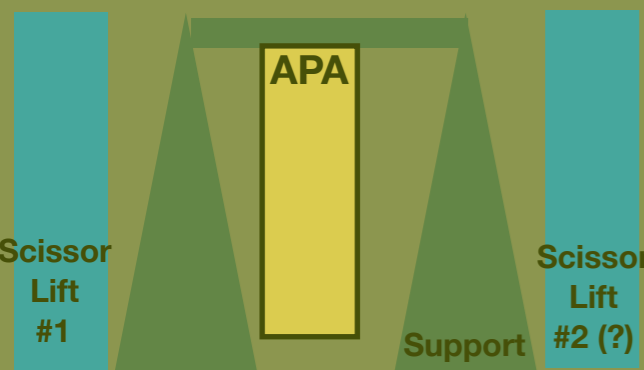


“Dirty” Storage

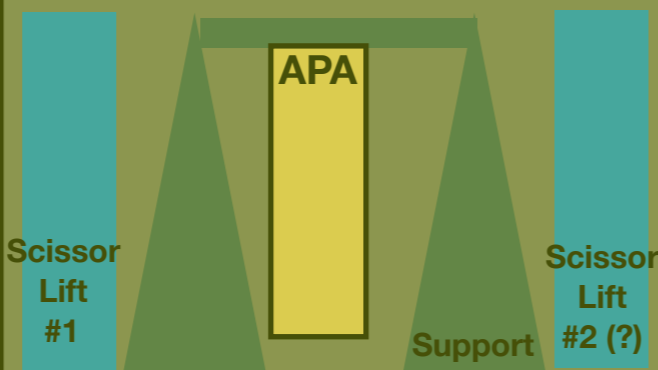


Crane
(Similar a in TCO)

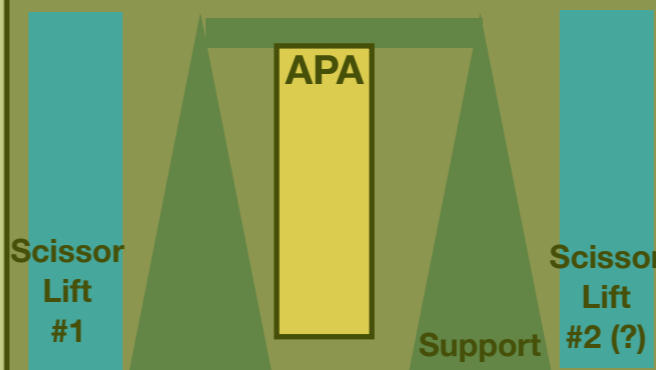
(PD)/CE Integration and Testing



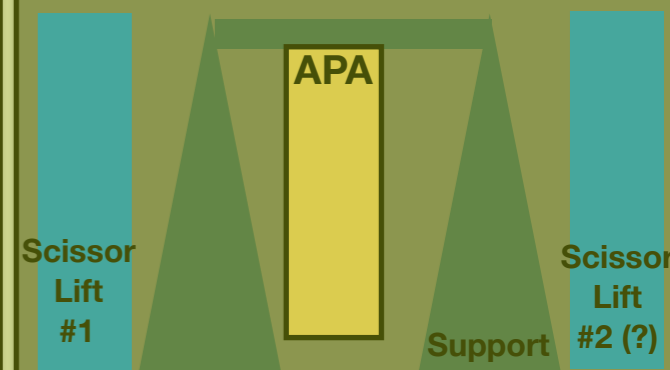
(PD)/CE Integration and Testing



(PD)/CE Integration and Testing



(PD)/CE Integration and Testing



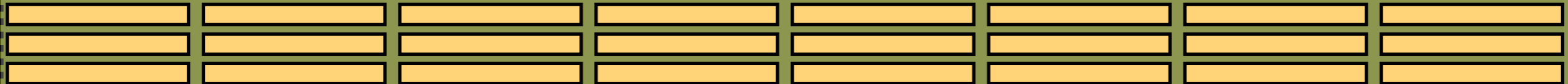
Cold Box

Cold Box

Cold Box

Cold Box

Final Storage



APA crate

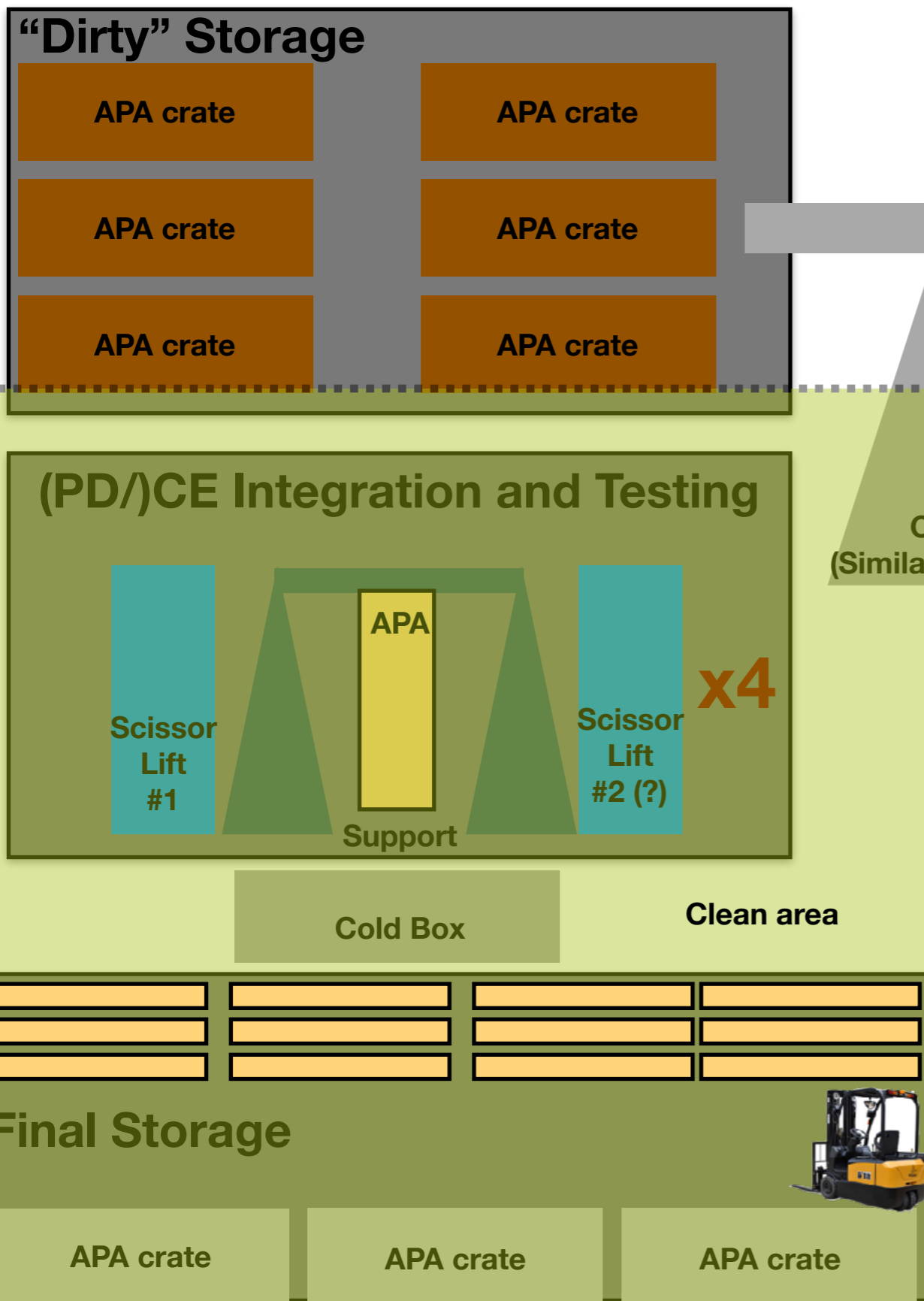
APA crate

APA crate



Space to pack and load the APA crates for underground transport

APA Integration and testing area

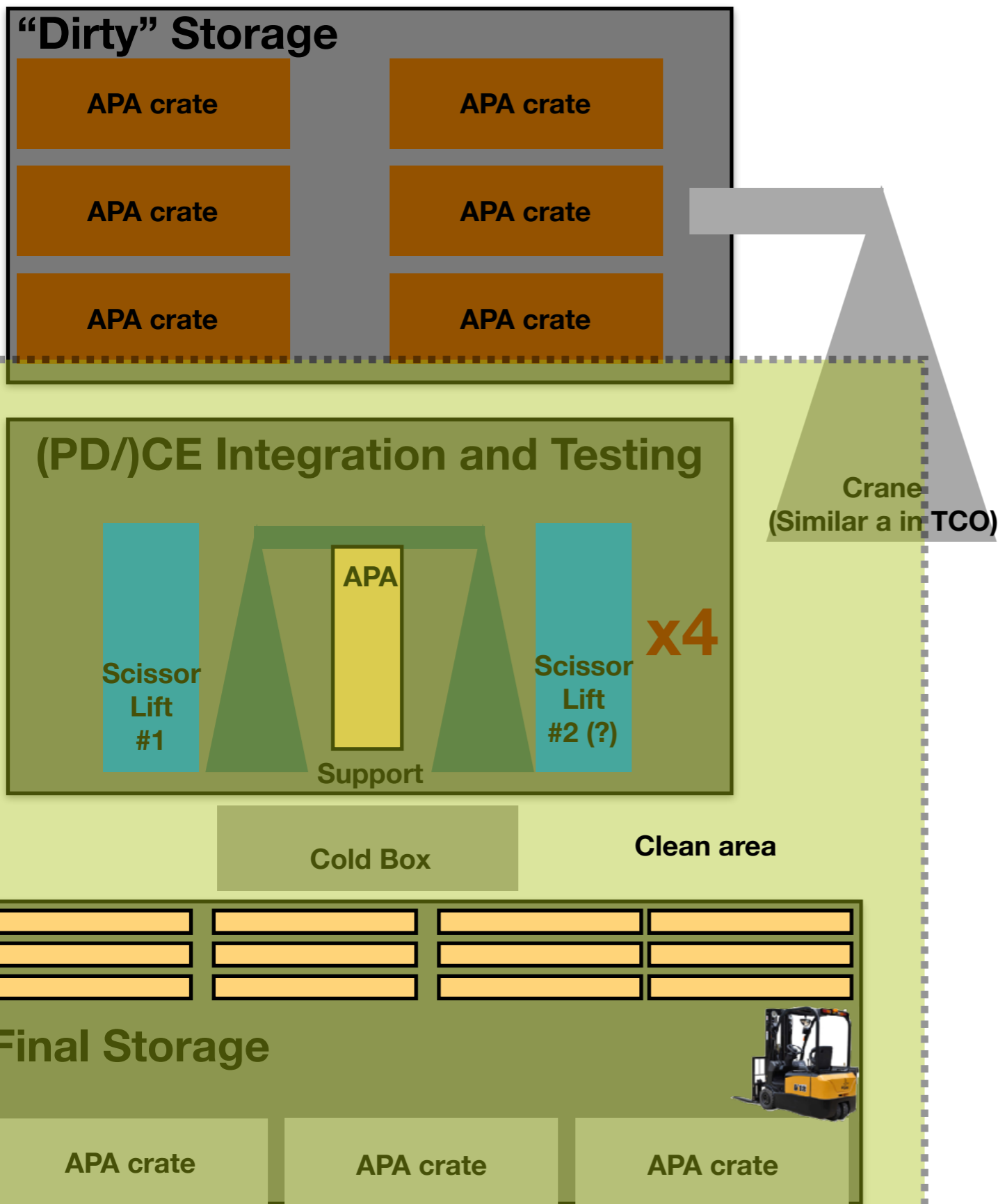


Needs:

- Store APAs in dirty area. **Up to 32 crates** ~ **672 m²**
- Extract APAs from the transport crates (need similar lifting crane as underground in the TCO).
- Possible rotation required (to ensure testing of tension in up-right position).
- Unpacked APA area needs same cleanliness requirements as underground.
- Support structure for integration/testing + scissor lift (**need 4 stations**) ~**200 m²**
- 4 Cold boxes for fully integrated APA (+ 1 spare)
- Hanging APA space. **Up to 105 APAs.** ~ **368 m²**
- Repackage APA in underground transport crates ~ **60 m²**

APA Integration and testing area

Steps:



1. Store up to 64 APAs (in 32 crates) to allow for early testing/integration/readiness
2. Extract (**and rotate**) APAs to install in the support structure
3. Visual inspection + APA tests (**wire tension, continuity, current leakage, flatness surveys**)
4. PD integration
5. CE integration and testing
6. Cold box tests
7. Storage of integrated APAs hanging horizontally
8. Repackaging for transport underground and temporary storage

Equipment required

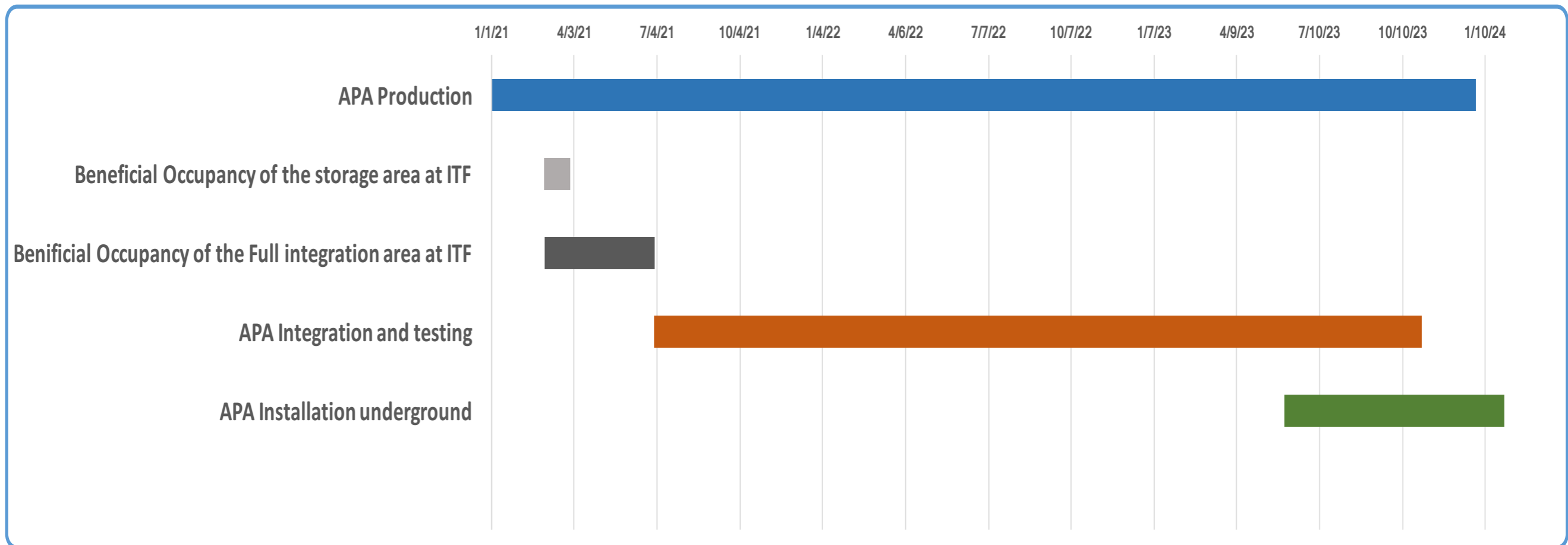
From APA Consortium:

- APAs arrive in transport crates
- Handling fixtures for APA
- Testing “station” with all the necessary equipment (power supplies, wave generators, readout scopes, computers, wire tension devices, electronics racks)
- Repair equipment
- Clean crates for underground transport ??

From Installation Facility:

- Handling device for APA crates (fork lift?)
- Crane to extract the APA from the crates and to rotate them if needed
- Support structure to hold APA in place during integration and testing
- One or two scissors lift(s) per station for APA integration and testing
- Electrical power sockets for testing station
- Tables
- Clean area (same requirement as underground)
- Hanging scheme for the 105 integrated APAs

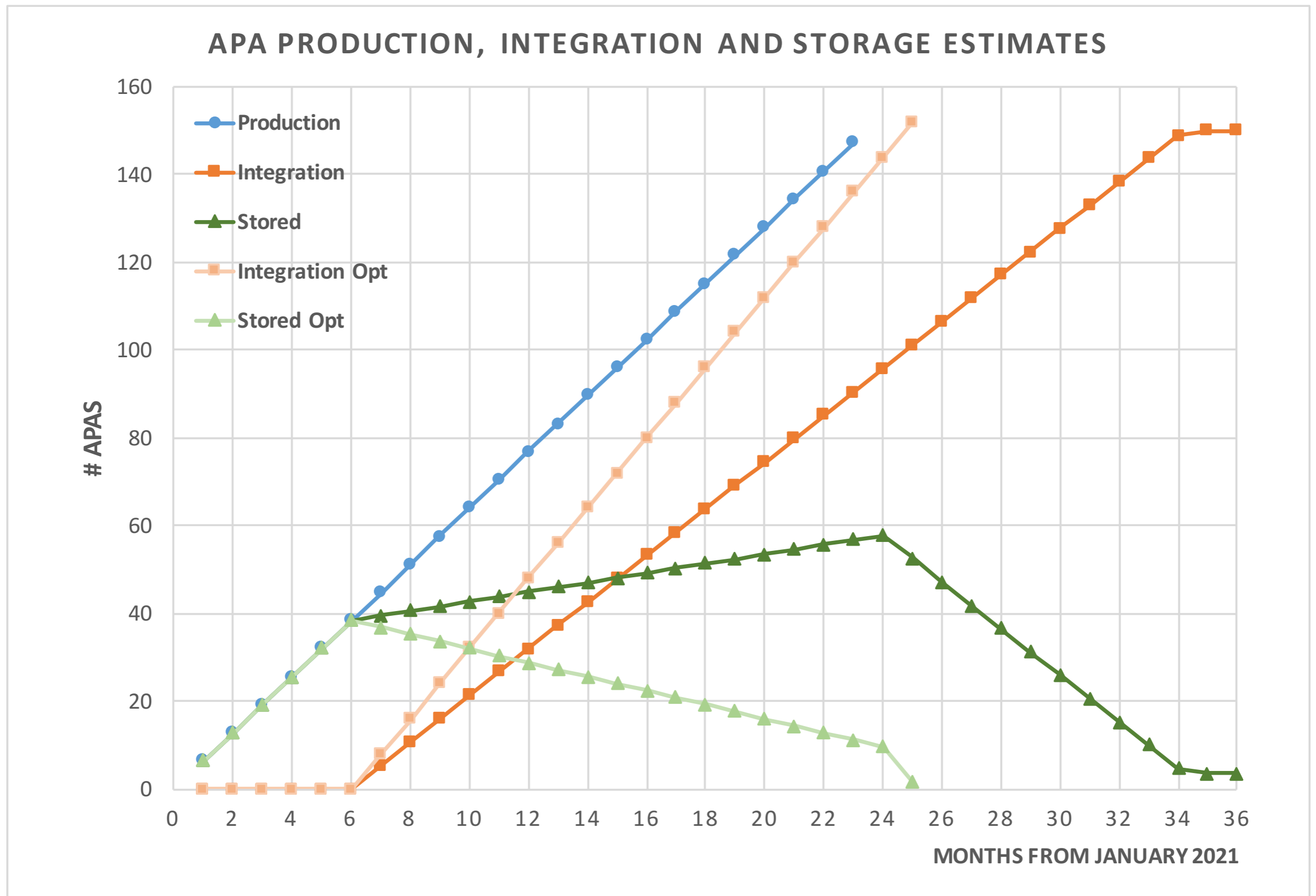
Schedule at a glance



- **APA production: 1 Jan. 2021 to 1 Jan. 2023** (2 years for 150 APAs)
- **APA Integration & Testing: 1 July 2021 to 1 Nov. 2023** (2.25 years for 150 APAs)
- **APA underground installation: 1 June 2023 to 1 Jan. 2024**

Backup

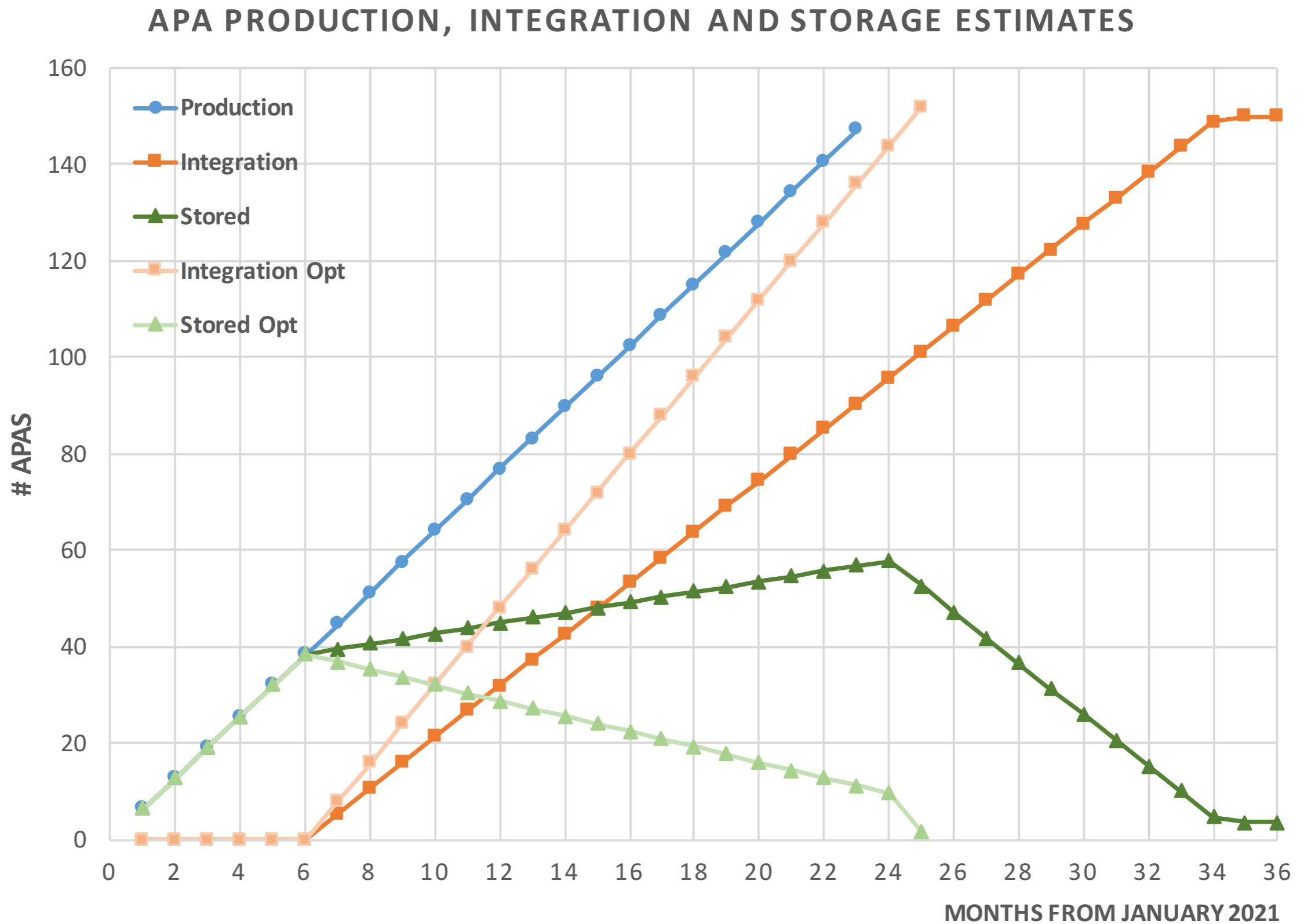
Time for APA production, integration, storage



Storage foot print estimates

- Dirty storage: 32 APAs x (7m x 1.5m) = **336m²**
- APA integration station: 4 stations x (7m x 7m) = **200m²**
 - ➔ (Space to rotate APA from vertical to horizontal (7m) + space to have the station and the cold box (~7m))
- Hanging APA storage: 105 APAs x (7m x 0.5m) = 268m²
- Space to repack the APA for underground transport: 3 crates x (7m x 1.5m) + space for the left to move around and pick them (**double the space**) = 62m²

Additional optimistic scenarios for testing times



* assumes 2 weeks of Integration instead of 3