Interface TenneT and Offshore Windfarms

Sector Consultation

Den Haag, November 17, 2014

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Content

1. Compensation and Liabilities
2. Technical Design
3. Legal Framework Interface ato rea
4. Planning

Compensation and Liabilities

- Compensation delays
- Compensation interruptions
- Damages and lost income
- Liabilities TenneT

- Offshore Windfarm obligation to limit damages
- Incentive to coordinate maintenance
- Obligation to coordinate planning

- To be further detailed in ‘Algemene Maatregel van Bestuur’

Technical Design

- Connection interface
- Voltage levels
- Number of J-tubes
- Operation of switch-gear
- Voltage and frequency support
- Power Quality arrangements
- Overplanting
- Data links
- Platform functions

Legal Framework Interface (ATO and REA)

- Outside of the 12 miles zone: Connection and Transmission Agreement and Realization Agreement for offshore

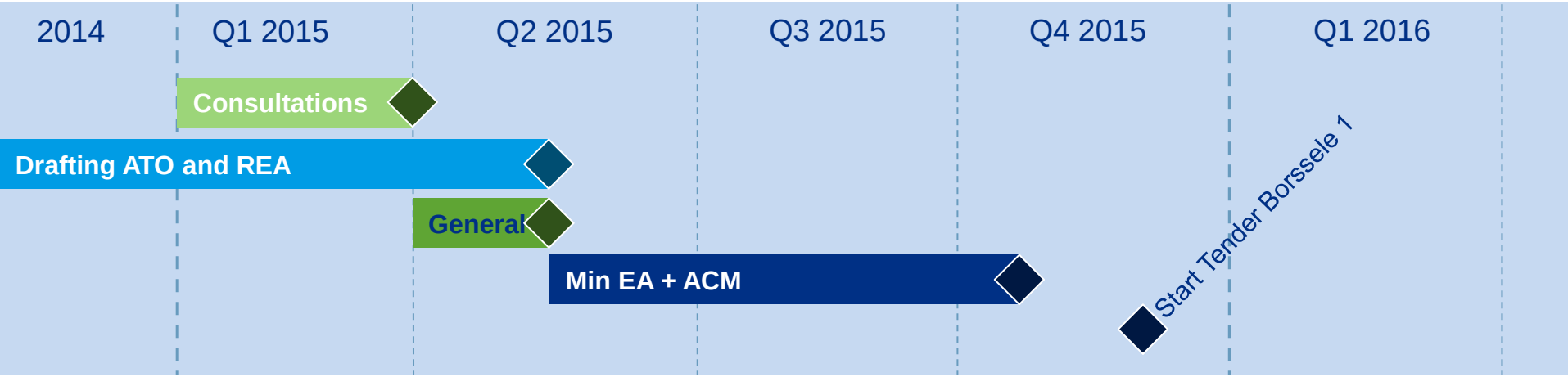
Elements of the ATO:

- General conditions
- Requirements specific to offshore (related to technical design)

Elements of the REA:

- Liabilities
- Technical requirements
- Commissioning arrangements

Planning Legal Framework Interface



Start	Subject
Q1/ 2015	Informal consultations draft ATO and REA
Q2/ 2015	General stakeholder consultation
Q4/ 2015	Formal approval ACM legal framework Offshore Connection Requirements

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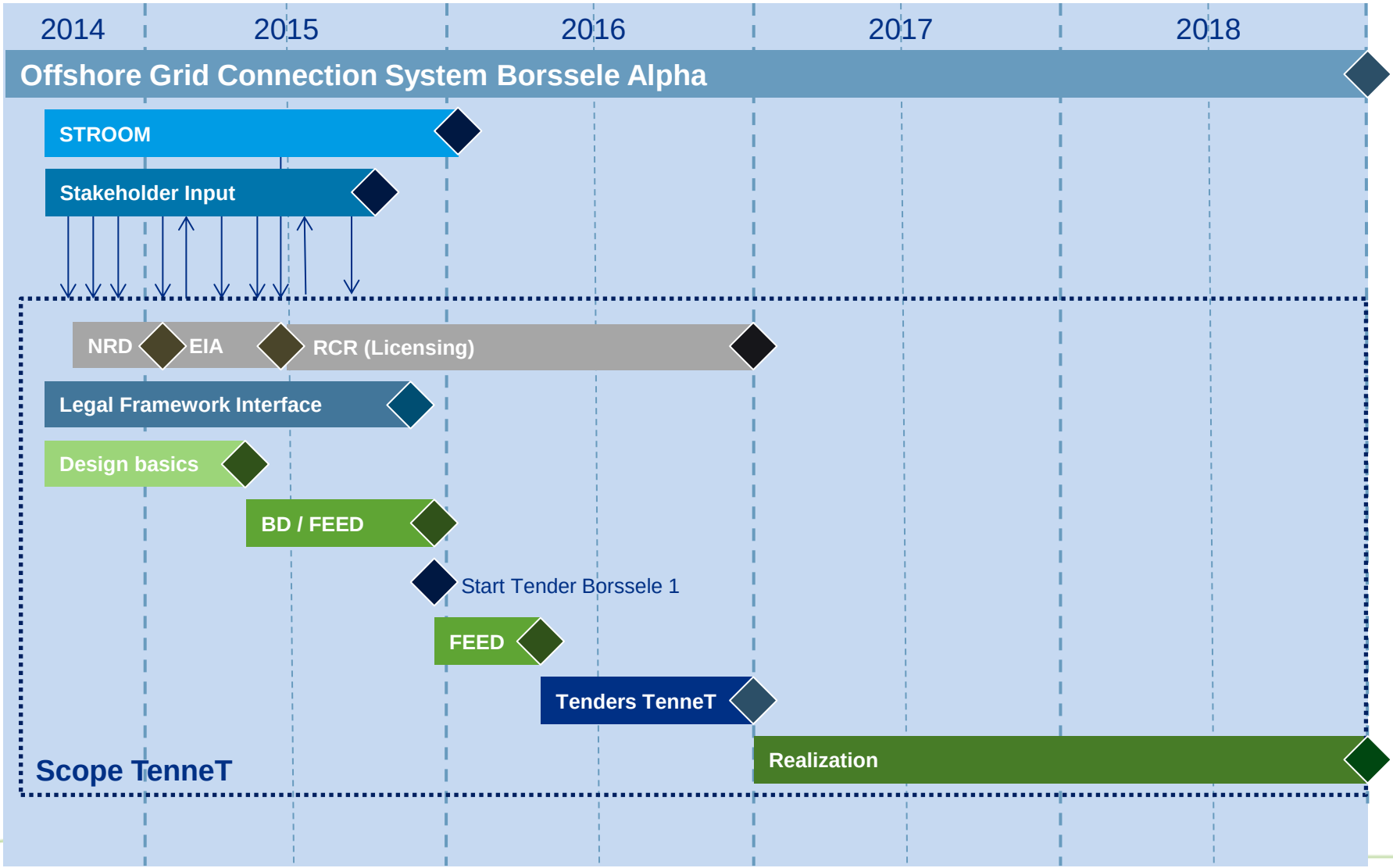
Preliminary Roll-out planning




STATNETT TRANSPORT
BORWIN BETA
BORWIN BETA
SIEMENS

Location of the platforms

Kavel I and Kavel II

Stefan Petersen
Den Haag, November 17, 2014

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Content

- Planning Principles
  - General Planning Principles
  - Spatial Planning Principles
- Platform location Borssele Alpha for Kavel I and Kavel II
- Estimations
  - Estimation of power generation
  - Estimation of infield cable lengths and amount
- Summary

General planning principles

Platform:

- Accessibility by helicopter
- Accessibility by boat
- Sufficient space for cable-routing and pull-in
- Transformer replacement needs to be possible
  - sufficient space for working-ships at platform
- Platform should be located „collision friendly“ (Not as an obstruction in shipping lanes)

General planning principles

Cables:

- Cables should be held as short as possible
- Crossings should be avoided
- Cables should be bundled with other cables/infrastructure
- Known obstructions should be avoided (e.g. UXO-areas, dumping grounds, mining grounds, military practice areas, wreck-positions etc.)
- Cable-lengths in environmental-protection areas should be held as short as possible
- Crossings of shipping-lanes should be as short as possible (if possible perpendicular crossing)

Spatial Planning Principles: platform

- Accessibility by helicopter:
  - Flightcorridor ideally along main wind direction
  - Width of corridor: 200 m + 3 * turbinediameter
  - length of corridor=(turbineheight + 200 ft - height helideck)/4,5*100
  - Max.150° between corridors/180° Drop Sector must be obstacle-free
- Estimated height of helideck: 40 m
- Estimated turbine dimensions in the kavels:
  - Rotor diameter: 170 m, Hub height 113 m

  → Length of helicorridor: 4875 m; Width: 880 m
- Estimated size of platform: 46 m x 35 m x 16 m

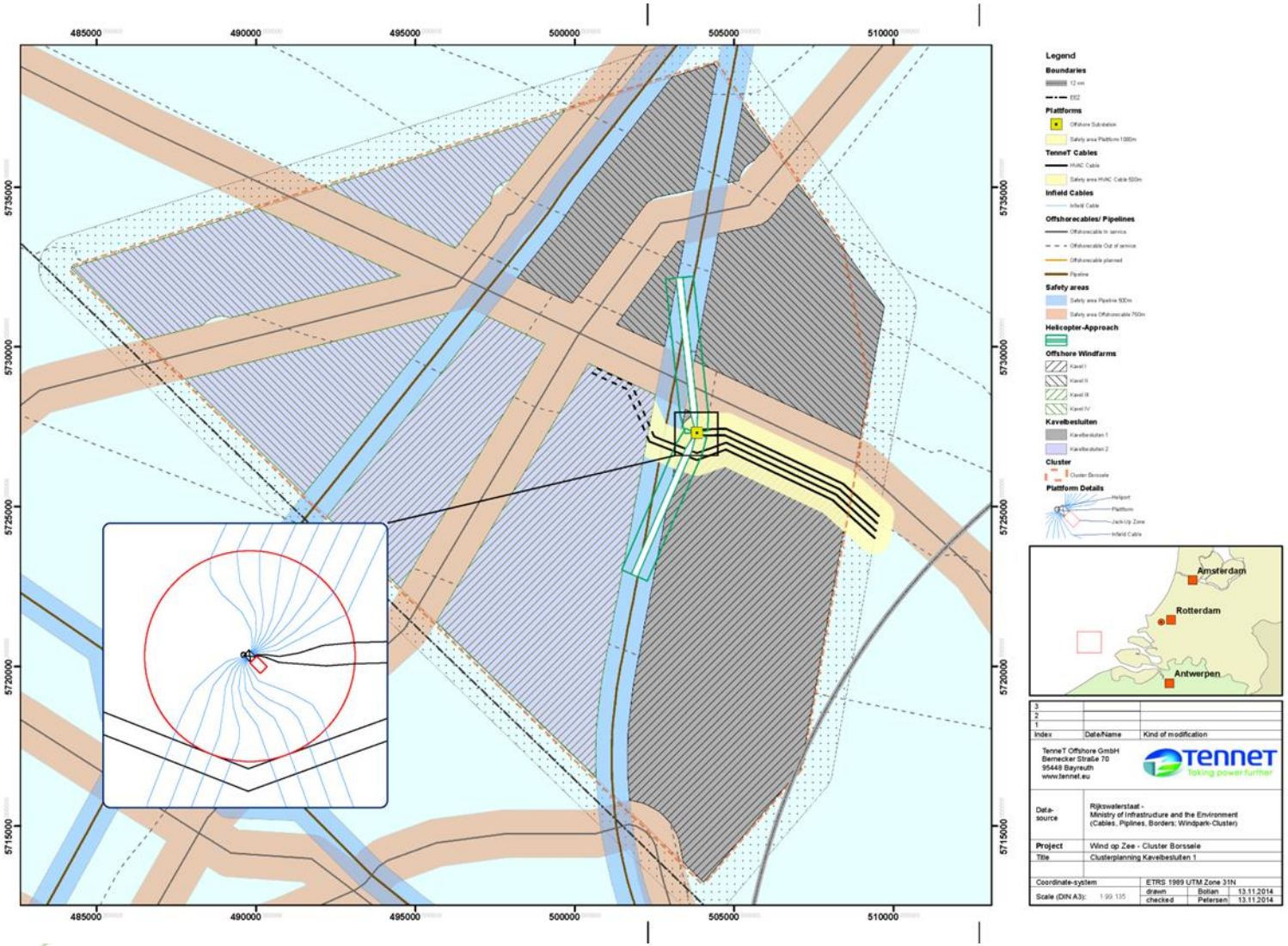
Spatial Planning Principles: platform

- Accessibility by ship needs to be given
- Obstacle-free zone of **1000 m** around platform for cablerouting and pull in
- Cable-free space at platform for Jack-up barge (Preferably on lee side or opposite prevailing wave direction)
  - Accessibility of transformers from Jack-up zone needs to be given
- No routing of Infield cables of one Kavel through neighbouring Kavels is allowed

Spatial Planning Principles: cables

- Cables need to be bundled
  - The distance between the cables is 200 m
- Cables need to be bundled as much as possible with existing cables and pipelines (e.g. through sand mining areas)
- Cable distance to third party infrastructure: min. 500 m
- Cable crossings should be held close to perpendicular (minimum 45°)
- Pipeline crossings should be held close to perpendicular (minimum 80°)
- Cable bending radius has to be considered (tightest radius: 45° turn every 150 m (absolute minimum, better larger distance))
- No cable bundling necessary within 1000 m zone around platform

Result: location of platform Borssele Alpha



Estimation of Infield Cable lenghts and amount

Power Generation per Kavel

The power generation per kavel is needed to estimate how many infield cables will be needed to connect the turbines to the platform

The power generation per kavel-subarea was calculated as follows:

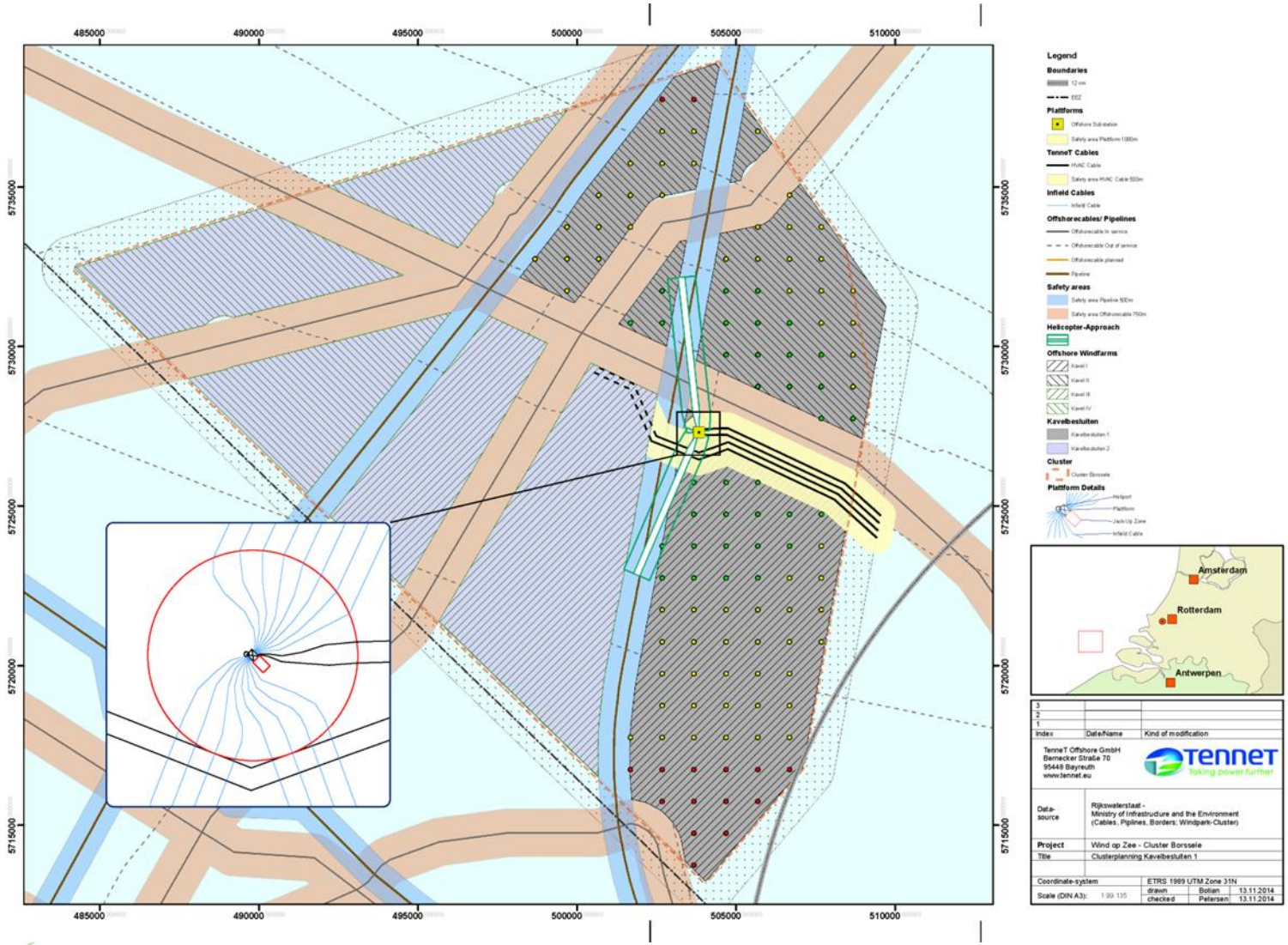
*POW(Kavel)=Area(Kavel)/ Area(Kavel I and II) *700 MW*

Amount of Infield Cables

The estimation is based on 66 kV Infield cables capable of max. 55 MW transmission capacity

$SUM_{(Infield\text{-}cables)} = POW_{(Kavel)} / 55\ MW$

Estimation of Infield Cable lenghts and amount



Summary

- 2 HVAC-cables to connect the platform Borssele Alpha to shore
- 2 HVAC-cables to connect the platform Borssele Beta to shore
- Platform location in the southeastern corner of the crossing of „Farland North“ and „PL 186“
- 8 Infield Cables / Kavel [assumption 66 kV]

  → Total of max. 16 Infield Cables for the Platform

Kavel	Lengths of infield cables (km) [Longest Infield Cable]	Area left for development (sqkm)
Kavel I	87,8 [17,7]	59,5
Kavel II	73,8 [13,7]	49,7

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