Joint Task Force Cross Border Redispatch Flow Definitions

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Terminology

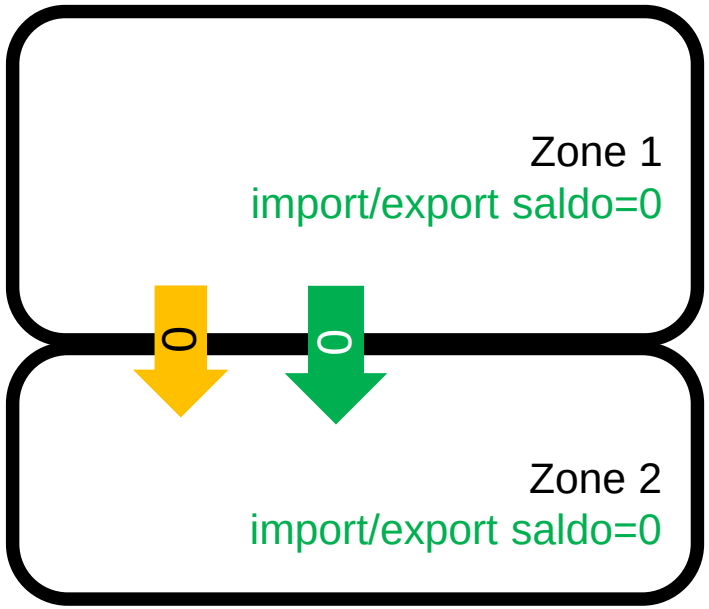
- Schedule means a reference set of values representing the Generation, consumption or exchange of electricity between actors for a given time period. *From NC OPS*

- Internal Commercial Trade **(ICT)** Schedule means a Schedule representing the commercial exchange of electricity within a Scheduling Area between different Market Participants or between Nominated Electricity Market Operators and Market Coupling Operators.

- Aggregated Netted External **(ANE)** Schedule means a Schedule representing the netted aggregation of all External TSO Schedules and External Commercial Trade Schedules between two Scheduling Areas or between a Scheduling Area and a group of other Scheduling Areas. *From NC OPS*

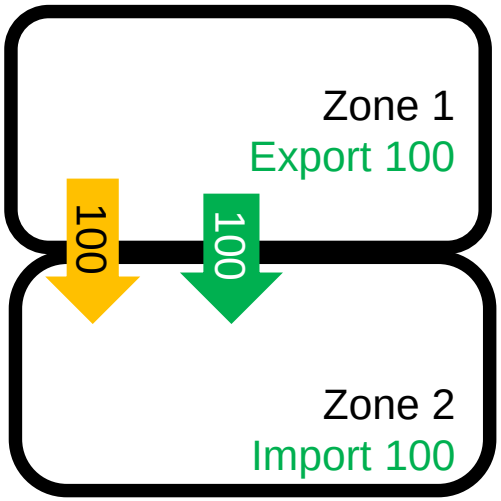
Assumptions

- AC interconnections
- Set of definitions valid for NTC and FB
- Diagrams are simplified to single tie-lines between two zones regardless of number of physical tie lines, nevertheless the defintions are valid for real networks
- Power flows due to zonal imbalance are neglected (i.e. ACE = 0)
- Zone can be any applicable geographical area according to purpose e.g. control area, bidding zones, countries



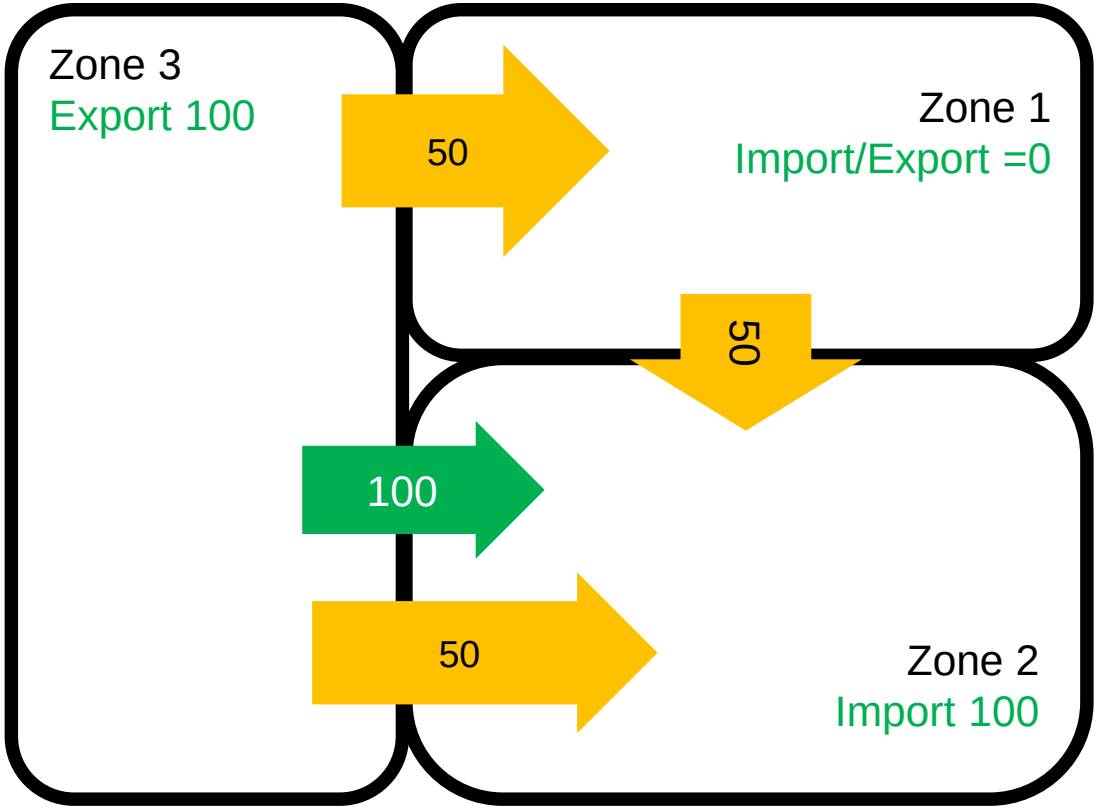
Simple Unmeshed Network

- For a single AC network (two zones) physical flow is always equal to schedule
- The above is not the case in a meshed AC network of at least three zones. Flows come from natural laws of physics as the electrical current follows the lowest impedance regardless of any borders



Simple Meshed Network

- Example of simple AC network composed of three zones with an ANE Schedule
- Deviations between physical flows and ICT/ANE Schedules currently observed in operation
- Due to uncertainties in grid models and forecast errors, the physical flows never match 100% with the planned commercial exchanges.



ANE Schedule

Physical flow

Basic flows

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Definition of Physical Flow

Physical Flow

=Flow on a grid element (for a given time unit)

- **Expected or Forecast = physical flows calculated from forecasting processes**
- **Measured = actual physical power flows measured in real-time**

Basic Physical Flow Definitions

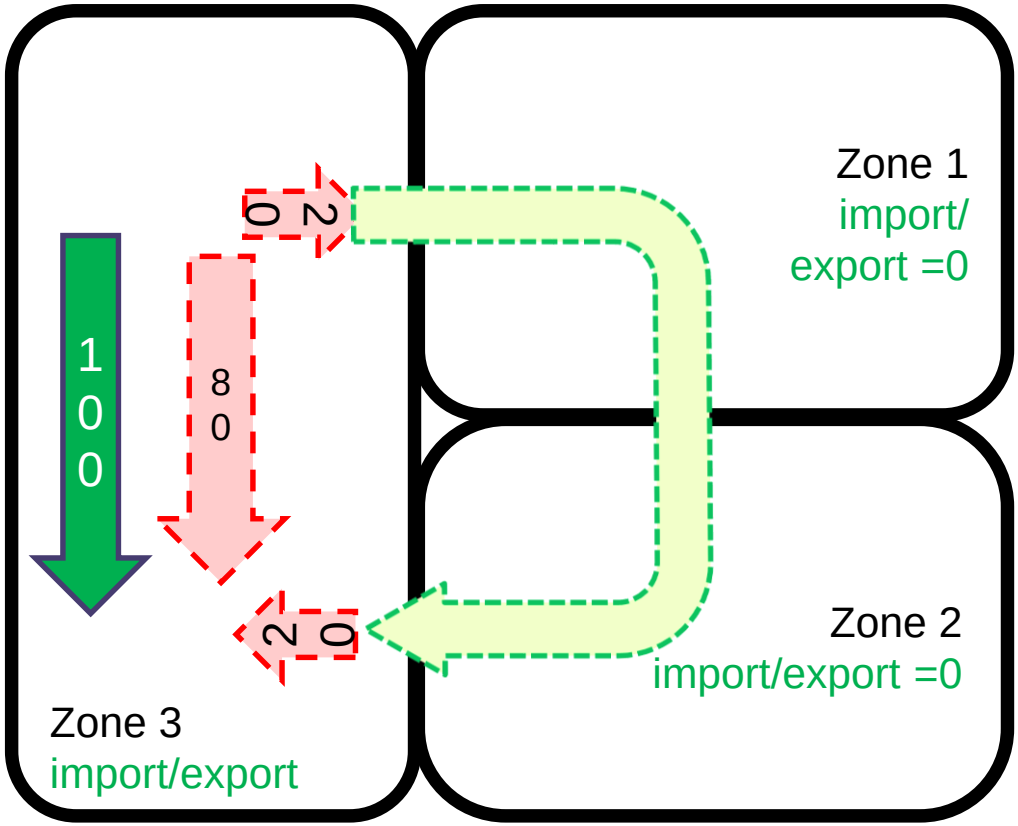
Physical power flow types can easily be classified according to zonal (A, B, C) allocation of source, sink and line

Source	Sink	Line	Flow Type
A	A	A	Internal Flow
A	B	A or B	Import/Export flow
A	A	B or C	Loop Flow
A	B	C	Transit Flow

Physical Flow= (Loop Flow)+(Internal Flow)+(Transit Flow)+(Import /Export Flow)

Internal Flows & Loop Flows

- Internal Commercial Trade (ICT) Schedules create Internal Flows and potentially Loop Flows in a meshed AC network, depending on the electrical distance between source and sink.
- An **Internal Flow** is defined as the physical flow on a line where the source and sink and the complete line are located in the same zone.
- A **Loop Flow** is defined as the physical flow on a line where the source and sink are located in the same zone and the line or even part of the tie-line is located in a different zone.

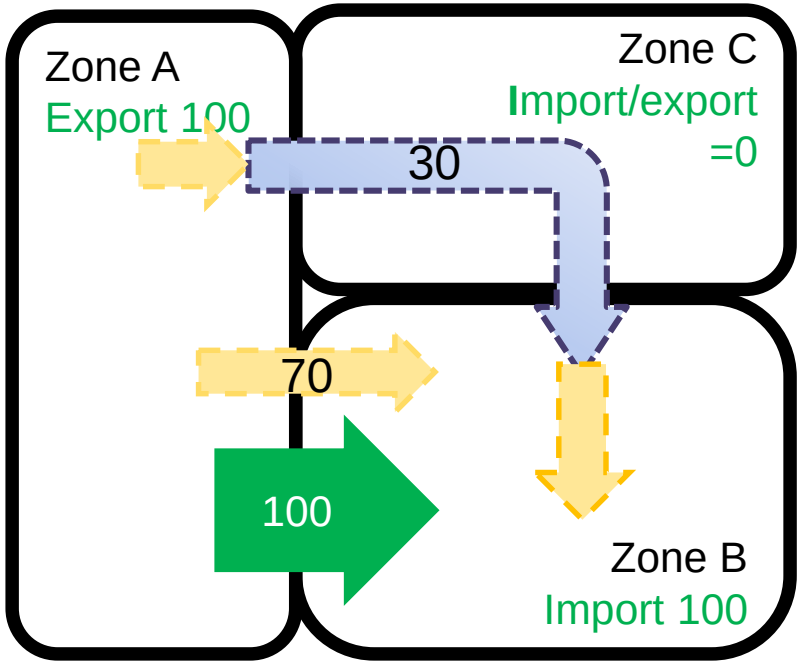


In this simplified example these flows are visible as there is no source or sink in Zones 1 and 2

ICT Schedule Loop Flow Internal Flow

Import/Export Flow & Transit Flows

- Aggregated Netted External (ANE) Schedules create Transit Flows and/or export/import flows in a meshed AC interconnection. The sum of these flows on a border are **the Allocated flows.**
- An **Import/Export Flow** is defined as the physical flow on a line that belongs completely either to the zone with the source and/or the sink.
- A **Transit Flow** is defined as the physical flow on a line where the source, sink and the line or even part of the tie line are all located in different zones
- Transit and Import/Export flows depend on actual generation & load pattern as well as network and zone configuration.



In this simplified example these flows are visible as there is only source in A and a sink in B

Import/Export Flow Transit Flow ANE Schedule

Summary Physical Flows

A flow has it´s source at a power plant and it´s sink at a point of consumption.
A physical flow uses lines as medium of transport.
A line could carry different kinds of flows at the same time , which summate to the measurable physical flow.
In a meshed AC interconnection
- Internal Commercial Trade Schedules create internal flows and potentially loop flows
- Aggregated Netted External Trade Schedules create transit flows and/or export/import flows.

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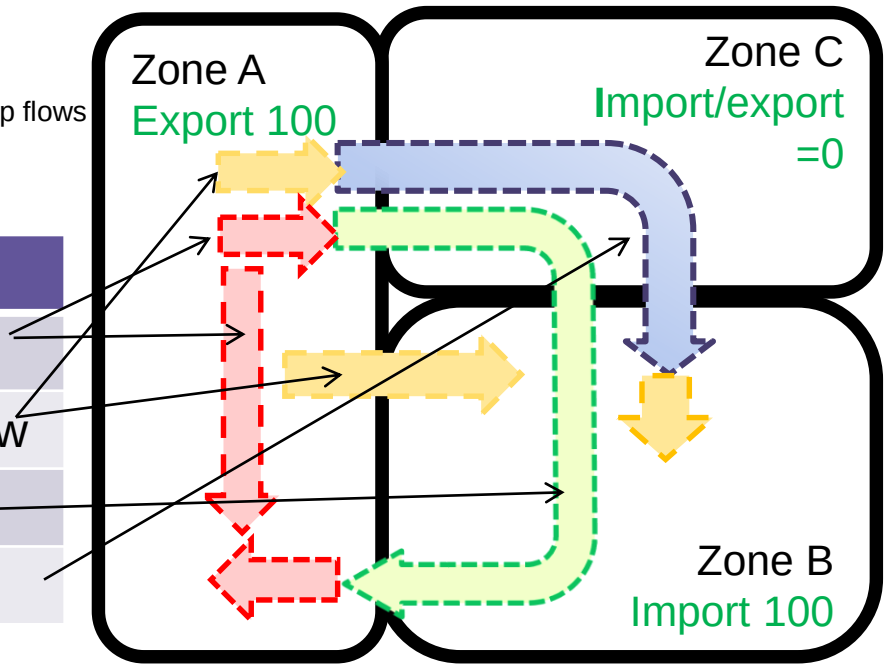

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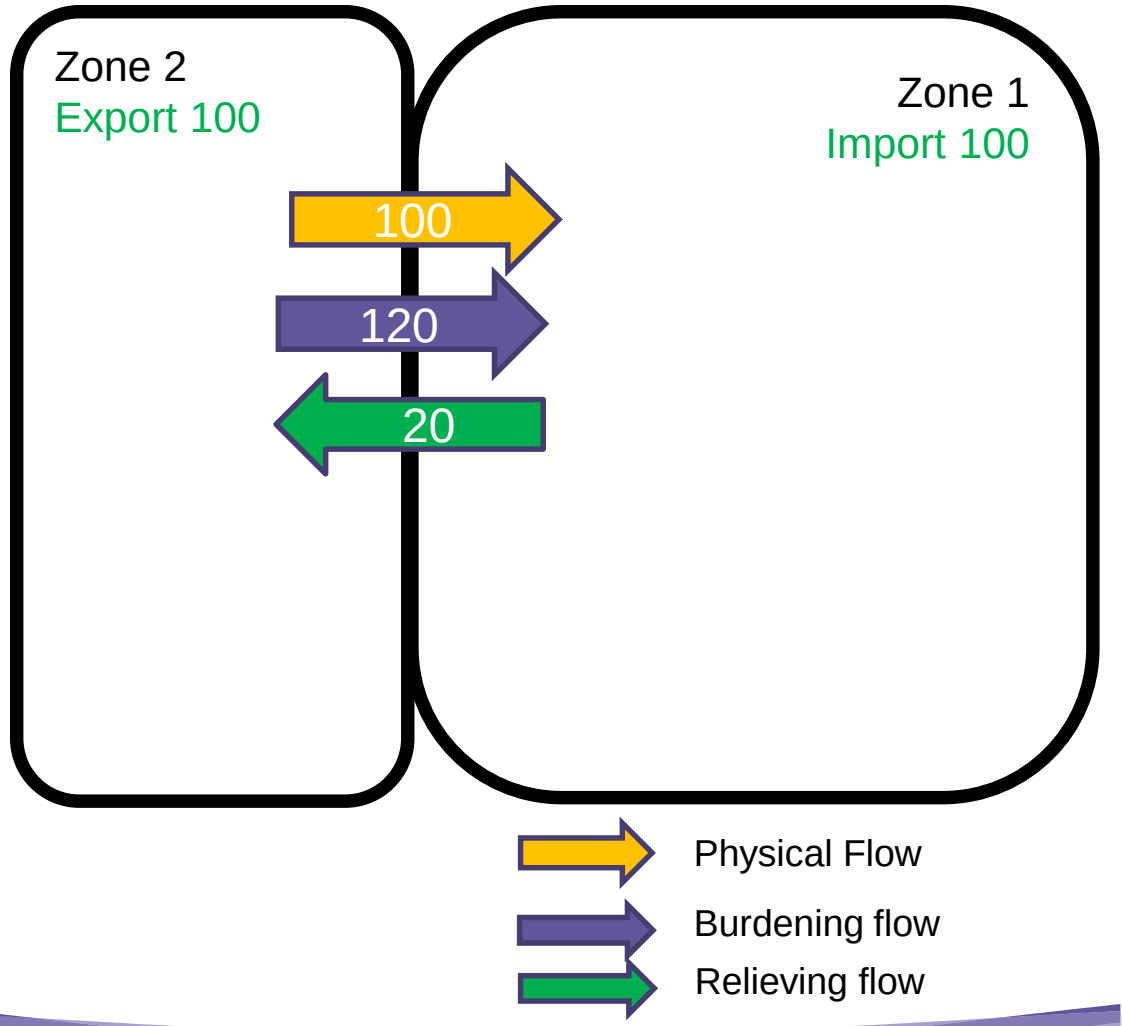
Burdening / Relieving Flows

- A burdening flow is a component of the physical flow on a specific line which flows in the same direction as the Measured/forecasted physical flow.
- A relieving flow is a component of the physical flow on a specific line which flows in the opposite direction as the measured/forecasted physical flow.
- All basic and derived flows can be classified as either burdening or relieving.



Derived flows

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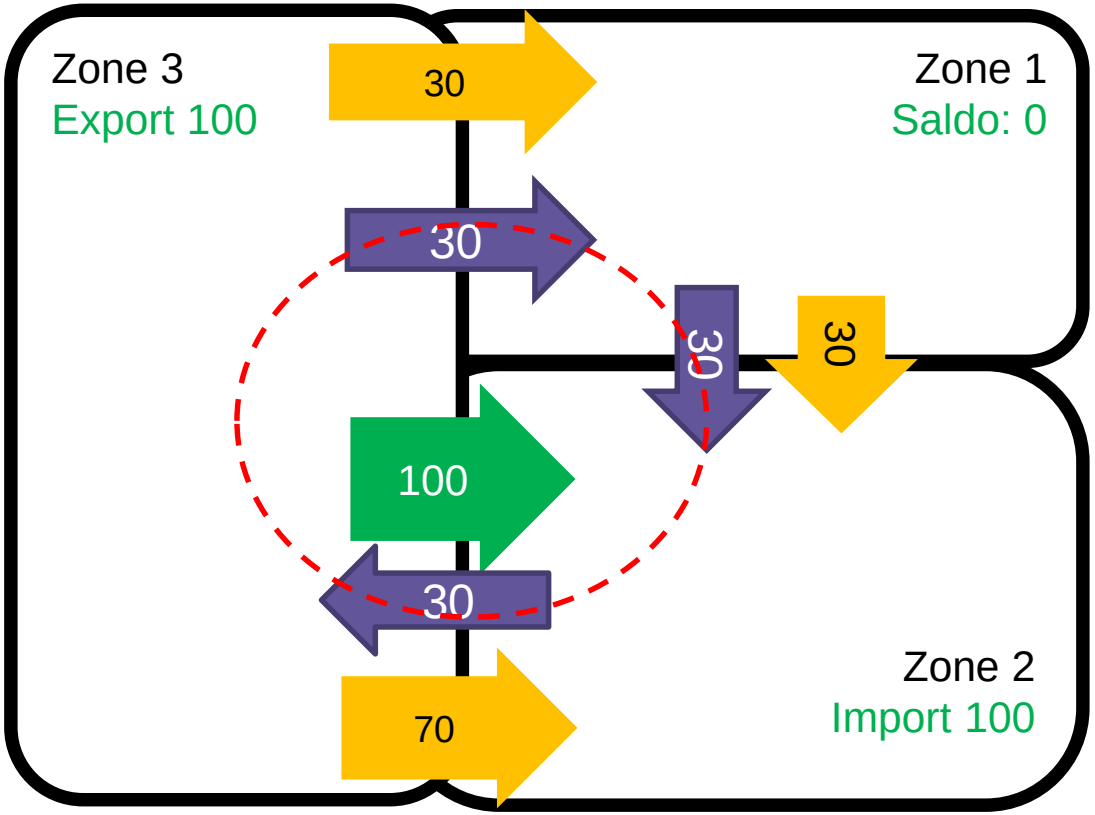
Unscheduled Flows

- Unscheduled flows are defined as the difference between Physical Flows and the ANE Schedule on a border between two Zones
- Unscheduled flows as a result of an ICT/ANE are always close up in a loop

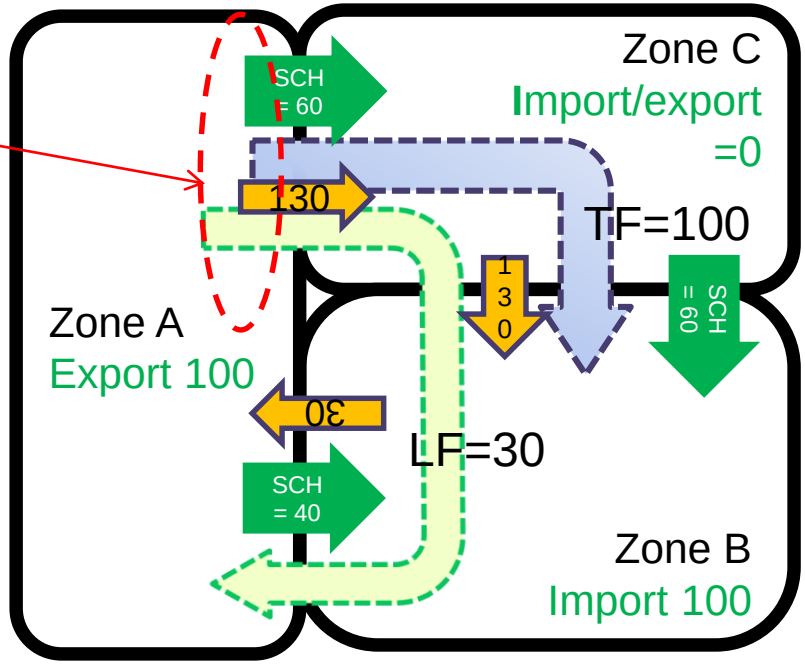


Transit flow | ANE Schedule | Physical flow | Unscheduled Flow

Example for unscheduled flows

- Unscheduled flows (UF) are defined as the difference between Physical Flows (PF) and the ANE Schedule (SCH)
  UF = PF – SCH = 70

- Unscheduled flows consist of
  Loop flows = 30
  and
  the difference between Import/Export/Transit flows and ANE schedule = 40



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Loop Flow

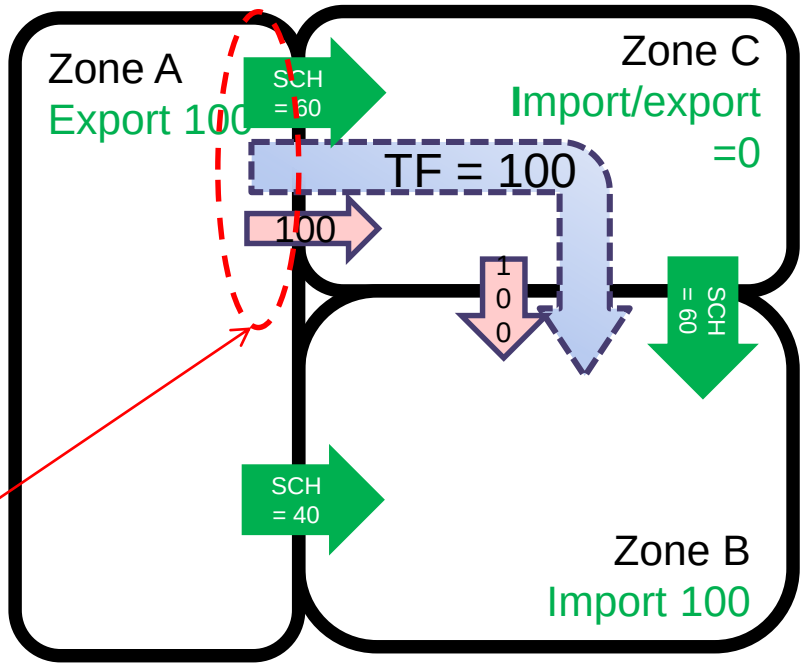
physical Flow

Transit Flow

ANE Schedule

Allocated flows / unscheduled allocated flows

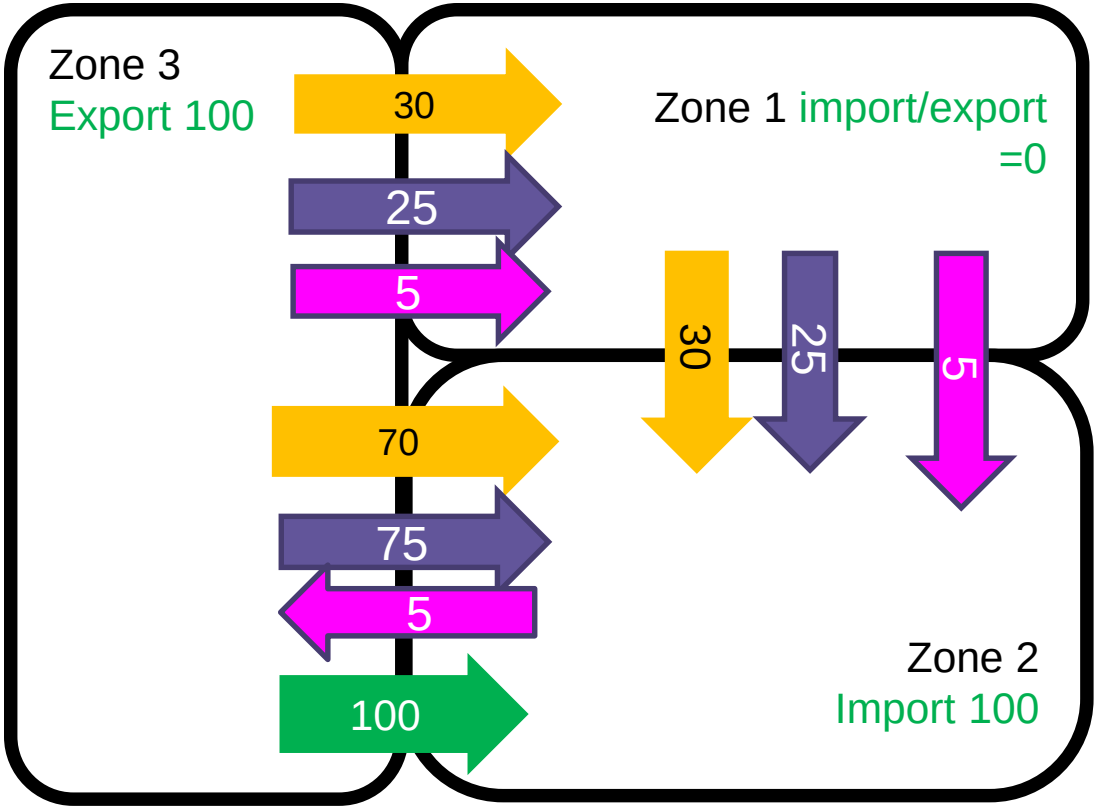
- Allocated Flow (AF) is the sum of the transit flow and import/export flow on a border or network element
- Allocated Flows are the physical flows without loop flows
- Unscheduled Allocated Flow (UAF) is the difference between the Allocated Flow and the ANE Schedules on a border
- UAF = UF – LF
  = AF –SCH = 40



allocatedFlow Transit Flow ANE Schedule

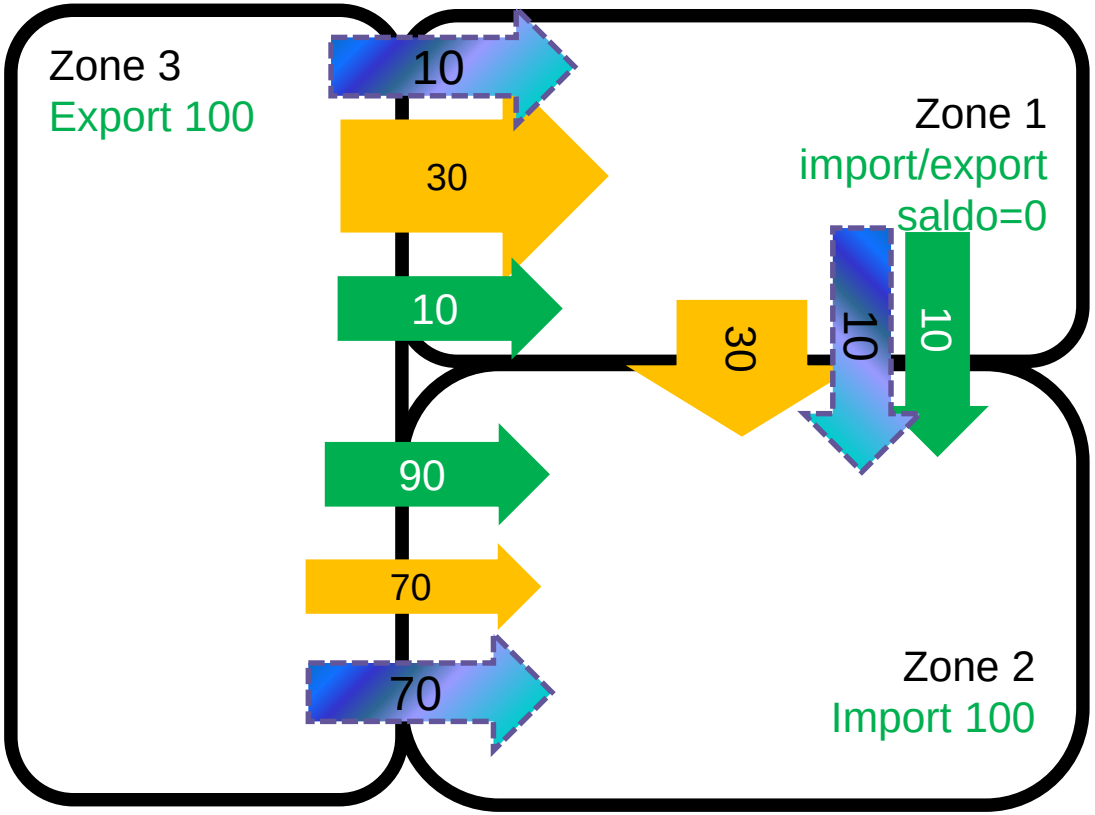
Unexpected Flows

- Unexpected flows are the difference between measured and expected physical flows



Direct Flows

- Direct flows are a subset of import/export flows.
- A direct flow is the flow going directly between two zones resulting from the ANE between those zones



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Direct Flow

ANE Schedule

physical flow